

**A Relationship Model for Cause and Effect of Claim in Roads
Construction Projects: A Case of Central Directorate of
Ethiopian Roads Administration**



Tahir Mohammed Defo

A Thesis Submitted to the Department of Civil Engineering

School of Civil Engineering and Architecture

**Presented in Partial Fulfillment of the Requirement for Degree of
Masters in Civil Engineering (Construction Engineering and
Management)**

Office of Graduate Studies

Adama Science and Technology University

June, 2023

Adama, Ethiopia

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APPROVAL SHEET

I, the advisor of the thesis entitled “**A Relationship Model for Cause and Effect of Claim in Road Construction Projects: A Case of Central Directorate of Ethiopian Road Administration**” and developed by Tahir Mohammed Defo, hereby certify that the recommendation and suggestions made by board of examiners are appropriately incorporated into final version of the thesis.

Advisor

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We, the undersigned, members of the Board of Examiners of the thesis by Tahir Mohammed Defo have read and evaluated the thesis entitled “**A Relationship Model for Cause and Effect of Claim in Road Construction Projects: A Case of Central Directorate of Ethiopian Roads Administration**” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master in Construction Engineering and Management.

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DECLARATION

I hereby declare that this thesis entitled “**A Relationship Model for Cause and Effect of Claim in Roads Construction Projects: A Case of Central Directorate of Ethiopian Roads Administration**” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

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RECOMMENDATION OF ADVISOR

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled “**A Relationship Model for Cause and Effect of Claim in Roads Construction Projects: A Case of Central Directorate of Ethiopian Roads Administration**” prepared under my guidance by Tahir Mohammed Defo submitted in partial fulfillment for the degree of Master’s of Science in Construction Engineering and Management. Therefore; I recommend the submission of revised version of the thesis to the department following the applicable procedures.

Name of Advisor

Signature

Date

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ABSTRACT

Road construction project is prone to claims due to complex nature of project, involvement of multiple stakeholders with competing interest, unforeseen ground condition, adverse weather condition, and technical challenges. Claims are inevitable in road construction and cause impacts of cost overrun, time overrun, disputes and stranded relation between contracting parties. Thus; this study was conducted with objectives to identify significant causes and effects of claim; and to establish relationships between causes and effects of claim by considering thirty road projects under central directorate of Ethiopian Road Administration as population of the study. Fifty causes of claim and sixteen effects of claim were identified for the study. The study was quantitative research of correlation explanatory type and the data were collected through close-ended questionnaire, and case study. Significant causes and effects of claims were determined using one sample t-test. To establish the relationships; the significant causes and effects of claim were correlated using Spearman's correlation coefficient. Consequently; nineteen causes having t-value greater than 2.003 and twelve effects having t-value greater than 2.003 were identified as significant causes and significant effects in the study. Among the top significant causes; delay in granting possession of site, variation order, disruption of work, delay in work progress, and inflation had significant positive relationship (r_s greater than 0.259) with ten to twelve other causes of claim. Besides; among top significant effects of claim, time overrun, cost overrun, disputes, and idling of resources had significant positive relationship (r_s greater than 0.259) with eight to eleven other effects of claim. Furthermore; among top significant effects of claim, time overrun, cost overrun, disputes, idling of resources and additional expenses in managerial and administrative activities had significant positive relationship (r_s greater than 0.259) with multiple causes of claim. The findings of this study were limited to significant causes and effects of claim; and correlations between causes and effects of claim. Thus; it did not cover regression analysis for causes and effects of claim. The findings of the study showed that causes of claim having multiple relationships; effects of claim having multiple relationships; and causes of claim resulting in multiple effects of claim as a result of linkage. Thus; the establishment of such linkage of relationships helps in devising proper claim management strategy.

Key Words: Road, Construction Project, Cause, Effect, Claim, relationship

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LISTS OF ACRONYMS

ADR	Alternative Dispute Resolution
AIA	American Institute of Architectures
BIM	Building Information Modeling
COVID-19	Corona Virus Disease 2019
DAB	Dispute Adjudication Board
DRE	Dispute Review Expert
EIC	Ethiopian Insurance Company
EJCDC	Engineers Joint Contract Documents Committee
ETB	Ethiopian Birr
ERA	Ethiopian Roads Administration
FIDIC	Federation International Des IngenieursConseils
GGM	Gaussian Graphical Model
ICT	Information Communication Technology
ISO	International Organization for Standardization
JCT	Joint Contract Tribunal
NEC	New Engineering Contract
PMI	Project Management Institute
PPA	Public Procurement Agency
ROW	Right of Way
SEM:	Standard Error of Mean
SPSS:	Statistical Package for the Social Science

LISTS OF ABBREVIATIONS

\$	American Dollar
&	And
et.al	And others
etc.	And the rest
b/n	between
Dr.	Doctor
$\leq$	Less than or equal to
%	Percent
Sig.	Significant
r_s	Spearman's correlation coefficient

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

Construction industry is an industry that involves in all economic sectors. It involves in primary economic sector in production of construction materials by extracting raw materials; in secondary sector by transforming inputs produced under primary sector in to products; and in tertiary sector by consulting and supervising of construction realm. The construction industry is an important sector of any economy, and it has direct or indirect linkages with other sectors. It contributes significantly to the socioeconomic development and employment opportunities of a country (Tripathi & Jha, 2018).

The basic features of construction industry are project orientation, uniqueness of project, and involvement of multiple stakeholders with competing interest, huge capital investment, dynamic environment, long production duration, and exposure to external environment (Siraj and Fayek, 2019).

Road construction projects are subset of construction industry that involves construction, maintenance and upgrading of new and existing roads and bridges. It is a horizontal construction that passes mostly through different terrains, different ground conditions, and different communities. Due to involvement of multiple stakeholders with competing interest, market volatility of construction inputs, adverse weather condition and technical challenges; construction industry in general and road construction projects in particular are prone to uncertainties and risks. Road construction projects are riskier than other construction projects because road projects are stretched over a wider geographical area and subjected to unforeseen underground conditions (Mishmish & El-Sayegh, 2018). The occurrences of these uncertainties and risks have detrimental effect on effectiveness and efficiency of the road project if they are not managed in a proper way. The main stakeholders in construction that has to face the fate of uncertainties and risks are client and contractor. Client is the initiator or owner of a construction project whose aim is to get better quality with minimum possible budget whereas contractor is the executor of a construction project whose aim is to get maximum profit from the project by exercising minimum possible cost for the construction. Due to these contrasting aims of the main stakeholders; when risks and uncertainties occur,

these stakeholders blame each other for the causes of uncertainties and risks. Consequently; conflict erupts between the stakeholders and subsequently; claim and dispute develops in the construction project. Conflict is the starting point for a claim or a dispute which is initiated wherever there is incompatibility of interests or when one party feels that the others have breached or broken their trust (Bashettiyavar, 2018). Several studies indicated that conflicts between the stakeholders in construction are inevitable (Barakat et al., 2019). A global construction dispute report reiterates that disputes are unavoidable on construction projects (Zhu & Cheung, 2020). Claims are becoming inevitable and unavoidable in modern projects involving new technology, specifications, and complexities (Manda et al., 2019). Claims have become a way of life in construction projects (Mishmish & El-Sayegh, 2018).

The impacts of claim and dispute on construction project are cost overrun and/or extension of time. The probability of construction-related claim and dispute occurrence is between 10 and 30% in all construction projects, and the money spent to resolve these claims and disputes ranges from \$4 to \$12 billion or more every year (M. S. Mehany et al., 2018). If not properly managed, disputes may lead to project delays, reduced team spirit, increased project costs, and damaged business relationships (Gad et al., 2011). There are different reasons due to which the disputes occur but ultimately all the disputes certainly result in time overrun, delay & subsequent cost overrun of the construction project (Joshi & Pimplikar, 2021). Cost overruns, which mainly attributed to claims, are common in road construction, with many projects experiencing overruns of 50 to 100% (M. S. Mehany et al., 2018). Therefore; unless due attention is given to conflict, claim and dispute administration in a construction project, substantial cost overrun and extension of completion time due to claim cause huge impact on success of the project.

In Ethiopia road is the dominant mode of transportation accounting for 90 to 95 % of the motorized interurban freight and passenger movements (Asratie et al., 2021) and the construction, administration and advisory of road infrastructures falls under mandate of Ethiopian Roads Administration. Ethiopian Roads Administration has been administering many ongoing road construction projects constructed by local and international contractors (Eshetu, 2021). In other research it was reviewed that international contractors have been the dominant in carrying out the road construction as they account for 55% of projects awarded while local contractors account for 45% for road construction projects awarded by Ethiopian Roads Authority from 1997 to 2015 (Asratie et al., 2021). Different contractual factors,

cultural backgrounds, legal and economic factors, languages, technical standards, procedures, currencies, and trade customs may make projects carried out by international contractors more vulnerable to disputes (Gad et al., 2011). It was also reviewed that the most significant effect of claim by international contractor in Ethiopia has been financial impact and it can reach up to 200-300% in some projects (Dinku & Kasshay, 2003).

Therefore; it imperative to assess the cause and effect relationship of claim and dispute on road construction projects for formulating a proper claim and dispute management mechanism for the success of construction projects. A claim management system helps parties to the contract and others involved in a construction project to respect and take claims seriously and it is created by being able to identify, document, and quantify a claim (Klee, 2018). Avoiding claim and dispute are one of the best ways to manage claim and disputes as their existence results in degraded project efficiency, adverse social effects and unproductive use of valuable resources (Zhu & Cheung, 2020). A claim and dispute management system involves identification, assessment and control of claim and dispute (Gad et al., 2011).

Hence; being claim and dispute having detrimental impact on success of project and causing stranded relationship among parties to the construction; identifying root cause of claim and knowing relationship between cause and effect of claim in construction is imperative to avoid or lessen the impact caused due to the occurrence of such eventualities.

1.2 Statement of the Problem

Claim and dispute may be unavoidable in road construction projects. The impact of claim and dispute on road construction projects are cost overrun and delay of scheduled time. Cost overrun of 50-100% are experienced in many road projects mainly due to claim that originate from diverse sources (Hashem M. Mehany & Grigg, 2015). The probability of construction-related claims and disputes occurrence is between 10 to 30% in all construction projects, and the money spent to resolve these claims and disputes ranges from \$4 to \$12 billion or more every year (M. S. Mehany et al., 2018). Contractual disputes are time consuming, expensive, and unpleasant. However, they do occur from time to time, and the importance of bringing the dispute to a conclusion as efficiently and cost effectively as possible cannot be overstated (Gad et al., 2011).

Road is the main mode of transportation in Ethiopia. As a result; the government of Ethiopia is giving more emphasis on the construction and maintenance of roads; and it was reviewed

that international contractors have been dominant in road construction market of Ethiopia (Asratie et al., 2021). Different contractual factors, cultural backgrounds, legal and economic factors, languages, technical standards, procedures, currencies, and trade customs may make international projects more vulnerable to disputes (Gad et al., 2011). It was also reviewed that the most significant effect of claim by international contractor in Ethiopia has been financial impact and it can reach up to 200-300% in some projects (Dinku & Kasshay, 2003). A study conducted on road construction projects in southern part of Ethiopia revealed a cost overrun of 21.5% due to claims related issues (Belachew et al., 2017). Another study conducted on road construction projects in North Shewa Zone of Ethiopia indicated a significant cost overrun of projects due to claims of error in design, right of way problem, additional works, lack of proper planning, and cash flow problem (Werkineh & Mite, 2020). Besides global pandemic of COVID-19 related claims has become significant claim in construction industry (ARCADIS, 2021).

Therefore; as some researchers concluded that claims are unavoidable in road construction project and their impact is huge on success of a road project (Bashettiyavar, 2018; Mishmish & El-Sayegh, 2018; Manda et al., 2019; Zhu & Cheung, 2020); it is vital to establish cause and effect relation of claim to assist proper management of claim and dispute in the road construction projects. In this regard; causes, effects, and relationship between causes and effects of claim for road projects in Ethiopian Roads Administration were assessed to establish a relationship model of cause and effect of claim in the road sector.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of the study is to establish the relationship between the causes and effects of claims in roads construction project in the case of roads construction projects under Ethiopian Roads Administration.

1.3.2 Specific objectives

Specific objectives of the study are:

- To assess the causes of claim in road construction projects
- To assess the effect of claim in road construction projects

- To establish graphical relationship models between causes and effects of claim in road construction projects

1.4 Research Questions

The research attempted to address the following questions:

- What are the causes for claim in road construction projects?
- What are the effects of claim in road construction projects?
- What are the relationships between causes and effects of claim in road construction projects?

1.5 Significance of the Study

Road construction projects are susceptible to uncertainties and risks due to complex nature of project, involvement of multiple stakeholders with competing interest, high fragmentation, unforeseen ground condition, and force majeure. Due to occurrence of a risk and tendency of contracting parties to blame each other for the causes of a risk; claim develops between parties to the contract. Unless the causes of claim are managed and resolved properly; it will have detrimental impact on the success of the construction project. Therefore; the study may significantly contribute to claim management in road construction sector by identifying root causes of claims that have a multiplier effects to road construction projects as a result of their linkage.

1.6 Scope and Limitation of the Study

The scope of this study was limited to drawback of claim in general, and to causes, effects and relationship of causes and effects of claims for road construction projects under central directorate of Ethiopian Roads Administration in particular. ERA administers road construction under contract administration directorate. The contract administration directorate divides in to five regions, namely, north region, south region, central region, east region, and west region. Among these five regions this research was conducted in the central region due to ease of getting information as projects are relatively near to ERA's head office. In this study; data collection instruments were limited to questionnaire survey and case study. Interview was used only for conducting pilot study for validity purpose of the study. The study was also limited to correlation analysis for establishment of relationships between causes of claim, effects of claim, causes and effects of claim for road projects under central directorate of ERA. Besides; the study was interested in studying the significant causes and

effects of claim in the road projects irrespective of who was defaulting party for the occurrence of the claim.

1.7 Organization of the Study

The research is organized in to four chapters, conclusion and recommendation sections. Chapter one is Introduction and it deals with background, statement of the problem, significance, objectives and scope of the study. Chapter two is Literature Review and it deals with review of scholarly literatures about the research subject. Chapter three is Research Methodology and it deals with study area, type of data for the research, methods of collection of data, methods of data analysis and methodology. Chapter four is Results and Discussions and it deals with elaboration and discussion of results obtained from data analysis. The last section is conclusion and recommendation, and it deals with conclusion and recommendation driven from results obtained from data analysis of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Overview of Claims in Road Construction Project

The main stakeholders in construction projects are client, contractor and consultant. The client owns and initiates a project; the contractor performs works of the project as per the wish of the client; and the consultant transfer the wish of the client into realizable form and makes the study, design and possibly the supervision of works of the project. The wish of the client, reward for the contractor in materializing client's wish, reward for consultant in transforming client's wish into realizable form are guaranteed and effected as per the contract agreement signed among parties to the project. The contract agreement signed between client and contractor for detailing the rights and obligations of both parties constitute construction work contract. Among the rights and obligations outlined in construction contracts; the right and obligation of parties to the contract to share risk as it happens are commonly stipulated in the contract.

A common aim of client appears to be to avoid risks as much as possible by allocating as many risks as possible to contractors in the contract (Zhu & Cheung, 2020). To attain this aim; the client prefers one project delivery method over others and even determines type of contracts during procurement stage to avoid or minimize its share of risk that results in claim and dispute. Procurement method, project delivery method and contract type are three basic features that governs project performance in terms of cost, schedule, conflicts, claims, and disputes (M. S. Mehany et al., 2018). Potential risks are usually indicated in the contract document with their potential impacts. When risk happens and unresolved it develops in to claim; and if the claim is not settled between the parties to the contract, it develops in to dispute.

Risk.-Risk is defined as 'the effect of uncertainty on objectives' (ISO 2018) cited in (Asratie et al., 2021). The other common definition of risk associated with project is the PMI definition, which says, 'risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives' (PMI 2013) cited in (Asratie et al., 2021). Risk and uncertainty are considered different terms by some literatures while other consider them synonymous. The International Organization for Standardization defines uncertainty as the 'state, even partial, of deficiency of information related to, understanding

or knowledge of, an event, its consequence, or likelihood’ (ISO 2009) cited in (Siraj & Fayek, 2019). Risk is also defined as ‘the possibility that the impacts and interactions of events may turn out differently than anticipated’ (Gad et al., 2011).

Risks in construction projects are difficult to eliminate; they can only be shared, distributed, or transferred from one party to another (Zhu & Cheung, 2020). Risk is characterized by three components: the risk event, what might happen to the detriment or in favor of the project; the uncertainty of the event, the chance of the event occurring; and the potential loss or gain, the consequence of the event happening (Siraj & Fayek, 2019).

Risks can be classified as internal and external risks based on initial sources of risks (El-Sayegh and Mansour, 2015) cited in (Siraj & Fayek, 2019) and (Asratie et al., 2021). Internal risks are risks that are project related and commonly fall under the control of project management team; whereas external risks are risks that are beyond the control of project management team. Furthermore; Gad et al (2011) suggested that risk is driven from project-oriented risk, and external risk. Project-specific risks are uncertainties existing in the project itself and may include the unexpected occurrences during the construction period that are inherent to the companies involved, or they may be determined by the nature of the project. These risks include client related risks, organizations’ relationships, technical risks, schedule delay risks, cost overrun risks; whereas external risks are factors relating to the national or regional market and derived from the viable macro environment that the project functions within. These risks include political risks, legal risks, economic and financial risks, environmental risks, and social risks.

Risks are inevitable in construction projects. Hence, success is evaluated in terms of the effectiveness of the risk management (Asratie et al., 2021). Risks and uncertainties are indeed inherent in every construction project from initiation through to completion and thus to obtain project objectives, risk management should be applied for successful delivery of the project in terms of known project constraints (Siraj & Fayek, 2019). Risk management is the process in which organizations methodically address the risks attaching to their activities to achieve sustained benefit within each activity and across the portfolio of all activities (Asratie et al., 2021). Risk management involves risk identification, risk assessment and risk response (Gad et al., 2011).

Conflict.-A conflict can be defined as the serious difference between two or more ideas, beliefs or interests that refuse to exist together (Bashettiyavar, 2018). A conflict arises in road construction when parties to the contract start to blame one other for cause of the conflict. The cause of the conflict is risk event. Risk is unavoidable in construction industry and so does conflict. This is asserted in research that there would not be conflict in a perfect construction, but a perfect construction does not exist (Acharya et al., 2006) cited in (Bashettiyavar, 2018).

Conflicts in construction industry are categorized based on activities of stakeholders and improper communication among the stakeholders (Bashettiyavar, 2018). Accordingly; conflicts are classified as client evoked conflicts, consultant evoked conflicts, contractor evoked conflicts, and third party evoked conflicts. Client evoked conflicts are ambiguous requirement of client, variation orders, supremacy of client/ consultant, unclear project scope, lack of adequate fund by client; Consultant evoked conflicts are defective design, design related errors, excessive extra work, varying site conditions, varying quantities; Contractor evoked conflicts are not keeping up with the schedule, financial failure of the contractor, incompetency, defective maintenance, poor quality of work; Third party evoked conflicts are strikes, adverse weather, third party delays, change in government laws and regulation, inflation.

Conflict management deals with reducing conflict and, when possible, avoiding conflict in the construction projects. Conflict management includes identification of root causes of conflict, and working on the root causes to settle it. Conflicts happen due to inequalities of power and reward among various parties involved in the construction project, the trait of competition in humans, unforeseen conditions, changing needs of clients, and change orders from various participants (M. S. Mehany et al., 2018). If conflicts are not well managed and resolved in their embryonic stage, it leads to claims and disputes, which are both time consuming and expensive (Bashettiyavar, 2018).

Claim.-Claim happens in the road construction projects when risk event in the project evolved in to conflict and the conflict remains unresolved among the stakeholders. Claim is an escalation of a conflict (M. S. Mehany et al., 2018). A dispute in construction projects originates when a claim made by a stakeholder has been opposed, discredited, or rejected by another stakeholder (M. S. Mehany et al., 2018). Thus; risk, conflict, claim and dispute are

sequential events that have predecessor- successor relationship. The successor event will happen if and only if the predecessor event happens and unsettled by contracting parties.

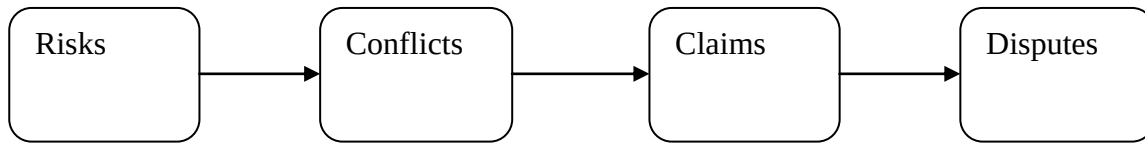


Figure2. 1 Occurrence of risks, conflicts, claims and disputes (Bashettiyavar, 2018)

The figure 2.1 shows the occurrence of risks, conflicts, claims and dispute in sequential pattern and they have cause and effect relationship. Risks are causes for conflict and conflicts are effects of unmanaged risks; conflicts are causes for claims and claims are effects of unresolved conflicts; claims are causes for disputes and disputes are effects of unresolved claims. Thus; unresolved risks and conflicts are causes for claim and consequently unresolved claims results in disputes.

Risks, conflicts, claims and disputes have cause and effect relationship. Preceding event is cause for subsequent event, and subsequent event is effect for preceding event (Iyer et al., 2008). Thus, it becomes chain as systematical shown in figure 2.2 below.

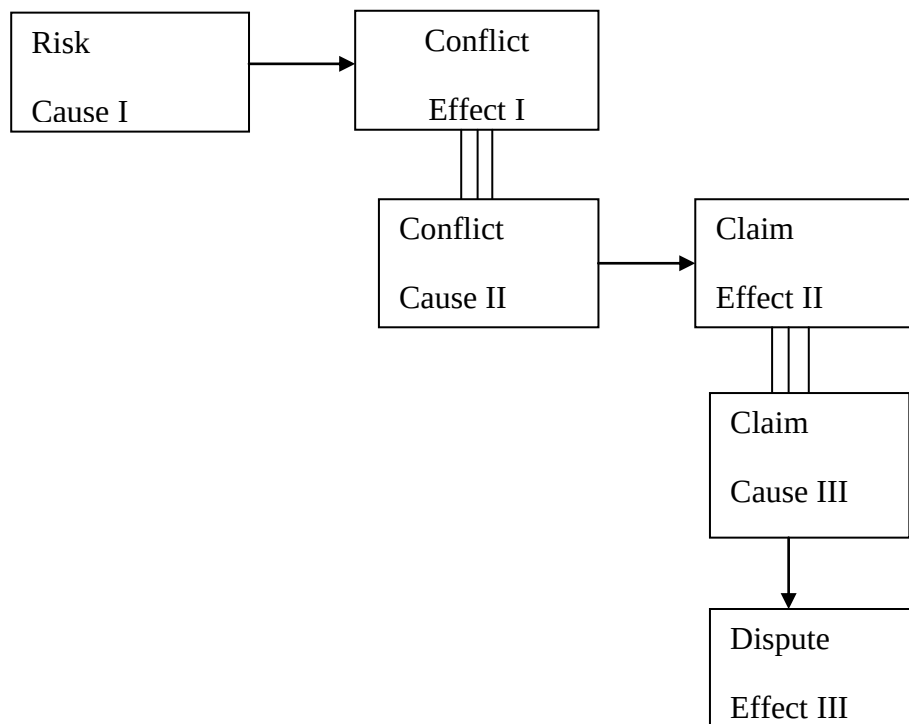


Figure2. 2 Causes and Effect Relationship of Claim (Iyer et al., 2008)

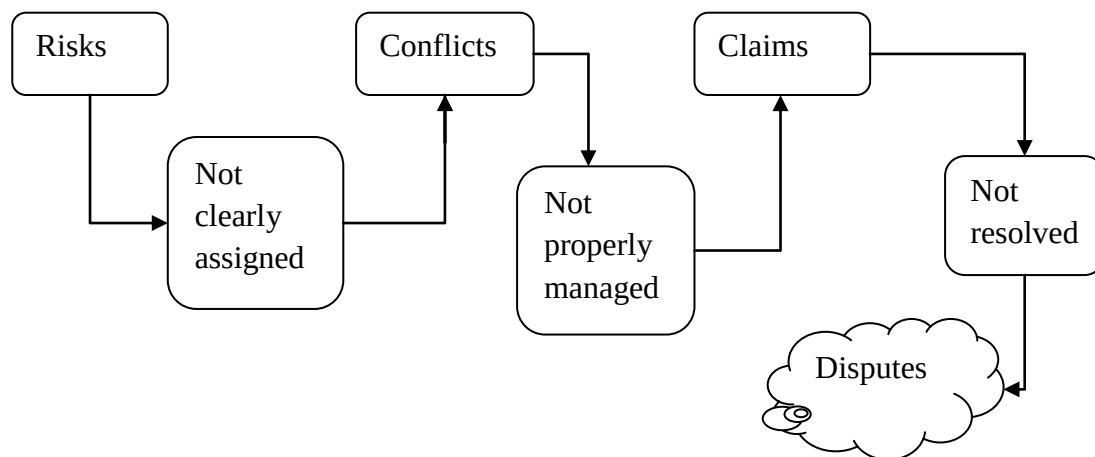


Figure2. 3 Risks, conflicts, claims and disputes continuum model (Tanriverd, 2019)

The figure 2.3 shows conflicts develops from risks not clearly assigned; claims arise from conflicts that are not clearly managed; and dispute as consequence of claims that are not clearly resolved. In this respect, the figure also clearly distinguishes between conflicts, claims, and disputes; and demonstrates that a dispute cannot exist until a claim is filed, submitted, and it is rejected by the recipient party.

2.2 Claim in Road Construction

A claim can be defined as an assertion of the right to property, money, remedy, lost time, and relief, or a compensation for the damages made by any party to the contract (M. S. Mehany et al., 2018). Claim is a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract (Levin, 2016). Claim is also defined in conditions of contract such as FIDIC, EJCDC, and AIA as a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract (Levin, 2016). In general claims in construction industry are defined as demands for compensation in terms of money or time extension or other or a combination of these that a party rightly or wrongly believes he is of these that a party rightly or wrongly believes he is entitled to (Dinku & Kasshay, 2003). Claim is also defined as a request for compensation for damages incurred by any party to the contract (Mishmish & El-Sayegh, 2018). Claim happens in the road construction projects when risk event in the project evolved in to conflict and the conflict remains unresolved among the stakeholders. Claim is an escalation of a conflict (M. S. Mehany et al., 2018).

Claims.-Claims may be made on the basis of many causes and contexts, some of which may be the claims in contract provision, claims in tort, quantum merit claims, and ex-gratia claims (Dinku & Kasshay, 2003). Claims in contract provision are those made within the provisions and stipulations of the contract document; claims in tort are those concerned with civil duties; quantum merit claims are those where work has been performed but no contract or price has been agreed, and may be claimed that the work should be valued and paid for what it worth; and ex-gratia claims are those claims with no foundation in the contract or law but only in sense of fairness of equity.

Though claims are inevitable in the construction industry, they can be avoided or mitigated by studying and understanding their primary causes (M. S. Mehany et al., 2018). In order to avoid or mitigate the claims effectively; parties to the contract should establish good construction claim management practice (Manda et al., 2019). Proper claims management begins with identification of a claim (Levin, 2016). Construction claim management deals with the entire journey of any claim resulting into a dispute. From the rise of claim, the factors those are responsible for the rise of claim along with their respective nature and impact or contribution. Reasons and situations due to which the claim remains unattended and gets triggered to become a dispute, ultimately causing negative impact on the project as a whole (Joshi & Pimplikar, 2021).

Dispute.-A dispute in construction projects originates when a claim made by a stakeholder has been opposed, discredited, or rejected by another stakeholder (M. S. Mehany et al., 2018). The causes for dispute are similar to the causes of claims as dispute is the outcome of rejected claim (M. S. Mehany et al., 2018). Disputes develop when all necessary precaution to avoid dispute and settlement of claims are unsuccessful (Zhu & Cheung, 2020).

Dispute in construction can be classified as design-related, contractor-related, owner-related, contract-related and external factors- related disputes (Getahun et al., 2016). Design-related disputes are design error, inadequate or incomplete specification, quality of design, availability of information; Contractor-related disputes are delay in work progress, time extension, financial failure of the contractor, tendering, technical inadequacy of contractor, quality of works; Owner-related disputes are payment delay, late giving of possession, variation initiated by the owner, unrealistic expectations, change of scope; Contract-related disputes are risk allocation, different interpretation of contract clauses, ambiguities in contract clauses; External factors-related disputes are weather, legal and economic factors,

security, fragmented nature of the sector (Getahun et al., 2016). Two types of disputes are identified after review of literatures and case studies (Zhu & Cheung, 2020). These are contractual and speculative disputes. Risks, uncertainties, and collaborative conflicts evoke contractual disputes due to contractual inadequacy, whereas opportunistic behavior and affective conflicts induce speculative disputes. According to (Zhu & Cheung, 2020); risks, uncertainties, and collaborative conflicts are categorized under task factor, where as opportunistic behavior, and affective conflict are categorized under people factor. Task factor and contractual inadequacy induce contractual dispute, while people factor and contractual inadequacy induce speculative dispute.

2.3 Causes of Claim in Road Construction

Improperly managed risk develops in to conflict; unresolved conflict results in claims. Hence; causes of conflicts, if not mitigated, are matured to causes of claims. A literature and research studies have identified several causes of claims, and some of these research studies were reviewed as follows.

Mehany et al (2018) identified design errors, differing site conditions, changes, weather, and strike, among others as causes of claims in construction. Manda et al (2019) pointed out increase in scope of work, inadequate bid information, faulty and late owner supplied material and equipment, inferior quality of drawing and specification insufficient time for bid preparation, disruption, work in congested areas and overcrowding, acceleration to regain schedule, unbalance bidding and underestimation as causes of claims in construction. Levin (2016) described additional work not specified in the contract documents; work different from that specified in the contract; work out of sequence; Owner furnishing equipment late, in poor condition, or not suitable for the intended use; accelerated performance; differing site furnishing equipment late, in poor condition, or not suitable for the intended use; accelerated performance; differing site condition; differences in contract interpretation; defective specifications; delays from the owner's acts or failure to act; unwarranted work rejection; increased inspection requirements, tests, or quality control program; owner's failure to disclose information; strikes; and forces of nature as causes of claims in construction. Mishmish & El-Sayegh (2018) identified poorly written contract, inadequate documentation, and inadequate site investigation before bidding, delay in granting possession of site, late issue of instruction/ clarification, variation, third party interference, measurement related issue, inconsistency in specification and drawings, payment related issues, defects in work,

different perceptions in assessment, delay caused by the contractor, termination/suspension of work, and acceleration as causes of claims in construction. Hashem M. Mehany & Grigg (2015) described delays in construction or materials delivery, weather, owner changes, poor site management, differing site conditions, insufficient plans and specification, failure to disclose important information in the construction phase, work acceleration, and schedule issues as causes of claim in construction. Rybka et al (2017) reviewed internal factors (faulty design documentation, other condition of execution than assumed, lack of access to construction site, change in primary requirement of client, additional requirement of client, prolonged approval or lack of acceptance of solution submitted by the contractor); and external factors (unforeseen physical conditions, collision or difficulty of site conditions, fossils, adverse activities of third party, change in legal regulation) as cause of construction contract.

Unresolved risk events develop into claims unless they are prevented or mitigated from proceeding to claim at early stages. Asratie et al (2021) identified inflation, poor or defective design, delay in payments, inadequate project duration, site safety, delay in delivery of material and equipment, poor workmanship, shortage of labor, cash flow problem, unforeseen ground conditions, delay inspection, inadequate planning, adverse climatic conditions, corruption, shortage of project managers and construction professionals, high interest rate, financial failure, low margin of profit due to high competition, poor communication among contracting parties, unfair decision on cost and time claim, change in legislation, delay in possession of site, variation, inaccurate contract quantities, labor dispute and strike, shortage of material, lack of access to foreign currency, supply of defective quality material, low labor productivity, low equipment productivity, shortage of equipment, frequent breakdown of equipment, professional turn over, high competition in bidding, vandalism, natural disasters, theft, high tax rate, and stoppage of work by local communities are risk factors contributing to claim.

Elhag et al (2020) reviewed that top causes of claims and disputes are variations as a result of clients-initiated change requests; contractors' selection on low bid only rather than including quality and performance considerations; and unfair risk allocation where majority of risks are transferred to contractors. Assaf et al (2019) reviewed that delay caused by the owner or delayed in payment as a major cause of claims and/or disputes reported in previous studies was not a significant cause in their study. Instead, it was determined that the top causes of

claims and disputes were attributed to all parties, including consultants, contractors and clients. Other causes revealed in previous studies include variations, contractor's delay and inadequate site investigation before bidding (Mishmish & El-Sayegh, 2018); variation orders, delay caused by owner, changes in material and labor costs and variations in quantities (Zaneldin, 2020); delay in handing over site, variation between actual and original quantities, excessive change orders by owner, delay of shop drawings approval by owner's representative and scope change of the project (Al-Qershi & Kishore, 2017); delay in decision-making, selection process and delay caused by poor planning, delay of payment, incomplete design, variation order, change order by owner, lack of communication and poor project management (Shaikh et al., 2020); change or variation orders due to new requirements from client, variations in quantities due to new requirements from client, delay caused by contractor, design errors or omissions and inconsistencies in the drawings and specifications (Assaf et al., 2019).

The following researchers also identified main causes of dispute. Causes of dispute are similar to the causes of claims as dispute is the outcome of rejected claim (M. S. Mehany et al., 2018). Disputes develop when all necessary precaution to avoid dispute and settlement of claims are unsuccessful (Zhu & Cheung, 2020). Getahun et al (2016) described disputes as design-related, contractor-related, owner-related, contract-related and external factors-related disputes based on causes of the dispute. Design-related disputes are design error, inadequate or incomplete specification, quality of design, availability of information; Contractor-related disputes are delay in work progress, time extension, financial failure of the contractor, tendering, technical inadequacy of contractor, quality of works; Owner-related disputes are payment delay, late giving of possession, variation initiated by the owner, unrealistic expectations, change of scope; Contract-related disputes are risk allocation, different interpretation of contract clauses, ambiguities in contract clauses; External factors-related disputes are weather, legal and economic factors, security, fragmented nature of the sector (Getahun et al., 2016).

2.4 Effects of Claim in Road Construction

Improperly managed claims may lead to project delays, reduced team spirit, increased project costs, and damaged business relationships (Gad et al., 2011). Project stakeholders lose huge amount of money due to conflicts, claim and dispute (M. S. Mehany et al., 2018). There are different reasons due to which the disputes occur but ultimately all the disputes certainly

result in time overrun, delay & subsequent cost overrun of the construction project (Joshi & Pimplikar, 2021). Cost overruns are common in road construction, with many projects experiencing overruns of 50 to 100% and many of these cost overruns can be attributed to claims that originate from diverse sources (Hashem M. Mehany & Grigg, 2015). The most major effect of claims in international projects in Ethiopia has been the cost overrun (Dinku & Kasshay, 2003). A study conducted on road construction projects in southern part of Ethiopia revealed a cost overrun of 21.5% due to claims related issues (Belachew et al., 2017). Another study conducted on road construction projects in North Shewa Zone of Ethiopia indicated a significant cost overrun of projects due to claims of error in design, right of way problem, additional works, lack of proper planning, and cash flow problem (Werkineh & Mite, 2020). Construction claims often tend to result in time and cost overruns; in case of a dispute arising from the claim, it may result in erosion of the brand value and the working relationship between the parties (Rai et al., 2021). The construction industry faces huge number of claims, as a result it gives origin to various troubles including additional cost and time to complete the project (Shaikh et al., 2020). Claims in the construction projects have direct impact on both time and quality, as the claim by the contractors to the owner lead to increase the duration of the projects and hence temporary suspension of the work (Naji, 2017). Other effects of claims in construction projects and the industry at large are delays, disputes and sometimes project abandonment (Sambasivan et al., 2017). Claim in construction disturbs the project progress, deteriorates relation between owners and contractors, leads to time and cost overrun and sends bad feelings to investors in the construction industry (G. J. Kikwasi, 2021). Claim due to delay and disruption results in cost overrun, time overrun, ideal resources, negative social impact, and disputes, delaying by the client to return the loans, poor quality of work due to hurry, delaying in getting profit by clients, bankruptcy, litigation, create stress on contractors, total abandonment, and acceleration losses (G. Kikwasi, 2013). Additional expense in managerial and administration; possibility of litigation cases; loss of company profile; loss of profitability and perhaps business viability; loss of productivity; time delays and cost overrun; extended and/or more complex award process; loss of professional reputation; breakdown in cooperation between parties; high tender prices; rework and relocation cost for men, equipment and materials and; cash flow are effects of claims (Malik & Ali, 2019).

2.5 Causes and Effects Relationship of Claims in Road Construction

Delay in decision making, incomplete design and estimate at the time of tender, improvement of standard drawings/design changes during construction stage and errors and omission in drawings and in the bill of quantity as the critical factors causing delays (Luvara et al., 2018) cited in (G. J. Kikwasi, 2021). Sambasivan et al. (2017) found that cost overrun can be explained by consultant-related and material-related factors; disputes can be explained by cost overrun; arbitration can be explained by consultant-related, cost overrun and dispute factors; litigation can be explained by client-related, disputes and arbitration factors; and abandonment can be explained by consultant-related, external-related, disputes, arbitration and litigation factors. Ametepey et al. (2018) reveal that vastness of the effects of delay of local government construction projects is triggered by client-related and contractor related causes. Similarly; a study cited by G. J. Kikwasi (2021) discusses on causes and effects relationship of disputes and figure out that the effect of one cause may prove to the cause of another effect. A study of Mbwake et.al (2015) cited in G. J. Kikwasi (2021) reveals that a strong positive relationship between claim and final construction cost of variation claims which accounts for 53.84%. Khair et al. (2016) found that cost overrun, time overrun, dispute, and total abandonment are top effects of as a result of delay claims. A study conducted by G. J. Kikwasi (2021) reveals that variation, change of scope of the work, and delay in completion of the projects are the significant causes of claim and at time effects other causes and delay in completion, delay in delivering of construction projects, poor contractual relationships among parties and extension of time have significant positive relationships with multiple causes of claim. Similarly; a study conducted by Malik & Ali (2019) concluded that priority of goal, change of site condition, personality conflicts, manpower resources, peoples interruptions, input or instruction from leader, outside people interruptions, architect and engineers dissatisfies the work progress of the main contractor, communication barriers, lack of continuous improvement, cost estimates, opening for inspection, late delivery of materials by employer, communication breakdown and mistrusting each other are primary causes of claim; and disputes, arbitration, time overrun, quality of work, wasted resources, lack of new idea, idling of resources, decreased productivity, poor quality of work due to hurry, negative social impact, poor decision making, cost overrun, dissatisfaction and stress, increased costs and litigation are effects of claim.

2.6 Claim Management in Road Construction

Claims are inevitable in the construction industry but they can be avoided or mitigated by studying and understanding their primary causes (M. S. Mehany et al., 2018). In order to avoid or mitigate the claims effectively; parties to the contract should establish good construction claim management practice (Manda et al., 2019). Proper claims management begins with identification of a claim (Levin, 2016). Construction claim management deals with the entire journey of any claim resulting into a dispute. From the rise of claim, the factors those are responsible for the rise of claim along with their respective nature and impact or contribution. Reasons and situations due to which the claim remains unattended and gets triggered to become a dispute, ultimately causing negative impact on the project as a whole (Joshi & Pimplikar, 2021). Causes of claims in construction have been found more or less similar as per reviews made by different researchers. These causes are identified and articulated mostly in conditions of contract as potential claims clauses so that parties to the contract become aware of them in advance. The claim clauses in condition of contract stipulate who will be responsible, what will be the impact of the claim, how the claim is assessed, and who will make determination, and time table for notification, presentation and determination of the claim. Parties to the contract are encouraged to have procedures in handling of claim with respect to notification, documentation, assessment of impact, and settlement. The basic procedures for claim management are contract knowledge, notification, systematic and accurate documentation, analysis of time and cost impacts, pricing, and settlement (Levin, 2016).

One of the most effective claims management techniques to avoid claims in the early phases of a project is eliminating the root causes of problems before they occur (ARCADIS, 2021). Claim management includes prevention, mitigation, pursuing claim and resolution (Parikh et al., 2019). Claim management is the process of engaging and coordinating various resources so as to manage a claim through its various phases, including identification, notification, documentation, presentation, analysis through examination, negotiation and settlement (Ali et al., 2020).

The Claim Prevention phase starts with the initial contract documentation. The most effective way to prevent claims is to create all contract documents, plans, and designs in the same line. During construction phase, it is not possible to avoid all the claims but it is possible to mitigate them. Well-defined responsibilities, good communication channels, effective risk

management and decision-making help project teams to take preventive actions (Abdul-Malak et al., 2020).

The Claim Pursuing phase includes claim identification and claim quantification. Claim identification is to identify the possible claims by analyzing the contract documents such as the scope of work, contract terms, extra work descriptions, etc. Claim quantification is to calculate the cost and time impact of the claim by analyzing the critical path of the schedule and cost estimation documents. Once the claim is identified and quantified, the claim resolution phase comes into action. Claim can be resolved either through negotiation or through expert determination (Ali et al., 2020). The claim pursuing phase requires strict adherence to timeline stipulated in conditions of contract document for notification, substantiation and submission of the claim for settlement (Barakat et al., 2019). Claim pursuing requires timely bounded phases of process and each phase has certain requirements for entry into and exit from the phase and the requirements are stipulated in conditions of contract (Abdul-Malak et al., 2020). Recognizable conditions of contract such as AIA, ConsensusDocS, EJCDC, FIDIC, JCT, and NEC adopts specified timeline for sequential progression of claim from notice of claim up to settlement of claim (Barakat et al., 2019).

Once the claim is identified; the claimant has to make notice to the other party his intention to claim. Provision of notice to claim increases the opportunity to facilitate the avoidance of adversarial situations and promotes early resolution of claim and, if properly understood and used, it provides positive contract mechanisms that are helpful to each of the contracting parties (Harris, 2021). The time line for giving notice of claim is very import procedure that has to be followed by the claimant and not abiding by it may result in invalidity of the claim (Harris, 2021). The defined time frame can vary considerable among conditions of contract, for instance, FIDIC condition of contract stipulates notice of claim shall be given by not later than 28 days after the claimant became aware or should have become aware of the circumstances giving rise to claim (EL-Ghrory et al., 2019); ConsensusDocs stipulates 14 days; AIA condition of contract gives 21 days; EJCDC condition of contract provides 30 days; and NEC conditions of contract sets 56 days to furnish a notice of claim from the start of events rising to claim (Barakat et al., 2019). Failure to issue notice to claim shall result in automatic rejection of claim in FIDIC; automatic rejection unless the matter was caused by owner's personnel in NEC; and the consequence of failure to issue notice of claim is not clearly stipulated in AIA, ConsensusDocs, EJCDC and JCT (Barakat et al., 2019).

Following the submission of the notice of a claim, the claimant shall submit fully detailed supporting document to justify the alleged demands (Barakat et al., 2019). A fully detailed claim shall contain the detailed description of the event, statement of contractual and/or other legal bases of the claim, all supported document and contemporary document, and full supporting detailed report of the claim showing event cause and effect, and impacted program. The fully detailed claim shall be presented in a logical pattern from contract particulars to claim event chronology to causes and effect of the claim (EL-Ghrory et al., 2019). Submission of supporting document is also time bounded and inability to substantiate claim in the time frame stipulated in condition of contract may result in rejection of claim (Abdul-Malak et al., 2020). The time frame for submission of detailed claim can vary considerable among conditions of contracts, for instance, FIDIC and NEC conditions of contract set 84 days; EJCDC permits 30 days; ConsensusDocs allows 35 days; AIA stipulates 41 days for submission of detail claim from the occurrence of relevant event causing the claim (Barakat et al., 2019).

Resolution of claim is initiated after claimant submitted detailed claim and it can be resolved either through negotiation between the parties or determination by the Engineer. It starts with negotiation and, if parties to the claim could not reach agreement, proceeds to Engineer's determination (Barakat et al., 2018).

The resolution of claim is also time bounded and the allotted time for negotiation and the determination of claim is clearly stipulated in conditions of contract of contract document, for instance, ConsensusDocs allows maximum of 15 days; FIDIC permits maximum of 42 days; EJCDC sets maximum of 90 days for negotiation (Barakat et al., 2019). The time bar for the Engineer's determination is maximum 14 days in ConsensusDocs and NEC; maximum of 90 days in EJCDC; and maximum of 42 days, time triggered after phasing out of negotiation phase, in FIDIC conditions of contract (Barakat et al., 2019).

The determination of claim can be final and binding to parties to the claim unless either of the parties issues notice of disagreement with engineer's determination in accordance of time bar stipulated in conditions of contract. FIDIC condition of contract allows 28 days reaction time for either parties on the determination and if notice of dissatisfaction is not issued; the determination becomes final and binding (Barakat et al., 2019).

The claim management procedures can be presented as follows:

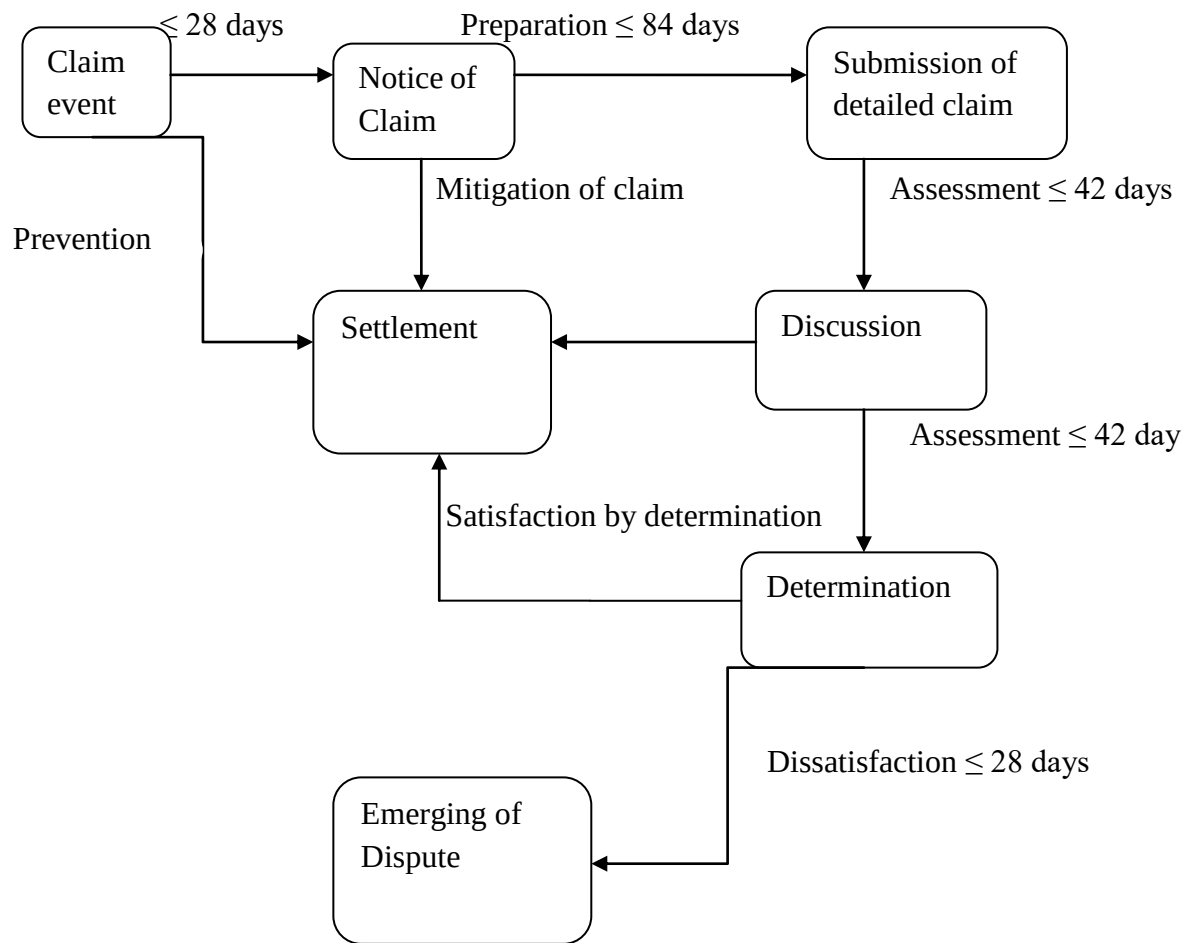


Figure2. 4 Claim Management Flow chart (FIDIC, 2017)

Figure 2.3 shows the flow chart of claim management. It starts with happening of events arising claim. once the event is occurred the claimant shall give notice to claim with in specified time limit and if the other part mitigate the problem causing the claim, then the claim is settled; otherwise the claimant submit detailed claim to the engineer within specified time limit. Then the Engineer starts making assessment and opens the door for discussion among parties to the claim to agree; if the parties do agree, the claim is settled otherwise the engineer continues with his assessment of claim and gives determination within specified time limit. After engineer's determination the parties to the claim has reaction time to the determination whether to be bided by the determination or not. If either of the parties or both of the parties do not give notice of dissatisfaction within the specified time limit; the determination becomes binding and final, and the claim is settled. If either or both parties give notice of dissatisfaction; the determination is not final and binding and the claim is deemed unresolved.

2.7 Disputed Claims Management in Road Construction

Disputes develop when all necessary precaution to avoid dispute and settlement of claims are unsuccessful. Dispute avoidance is preferred over deploying excessive resources to resolve dispute due to the fact that prevention is better than cure (Zhu & Cheung, 2020). Dispute may be avoided at inception of a project by establishing strategies such as partnering and trust in construction (M. S. Mehany et al., 2018); and by incentivization (Zhu & Cheung, 2020). Partnering is a process of creating an effective working relationship between project participants in order to avoid adversarial positions during the course of a project (M. S. Mehany et al., 2018). Increased communication, innovation, improved site and project coordination between projects participants, cost reduction, value engineering and improved schedule are considered to be some of the advantages of partnering during construction projects, and trust is considered to be the key element to achieve a successful partnership between the project participants (Mehany et al., 2018). Incorporating incentivization is seen as an effective way to realign unfair situations and facilitate relational contracting (Zhu & Cheung, 2020).

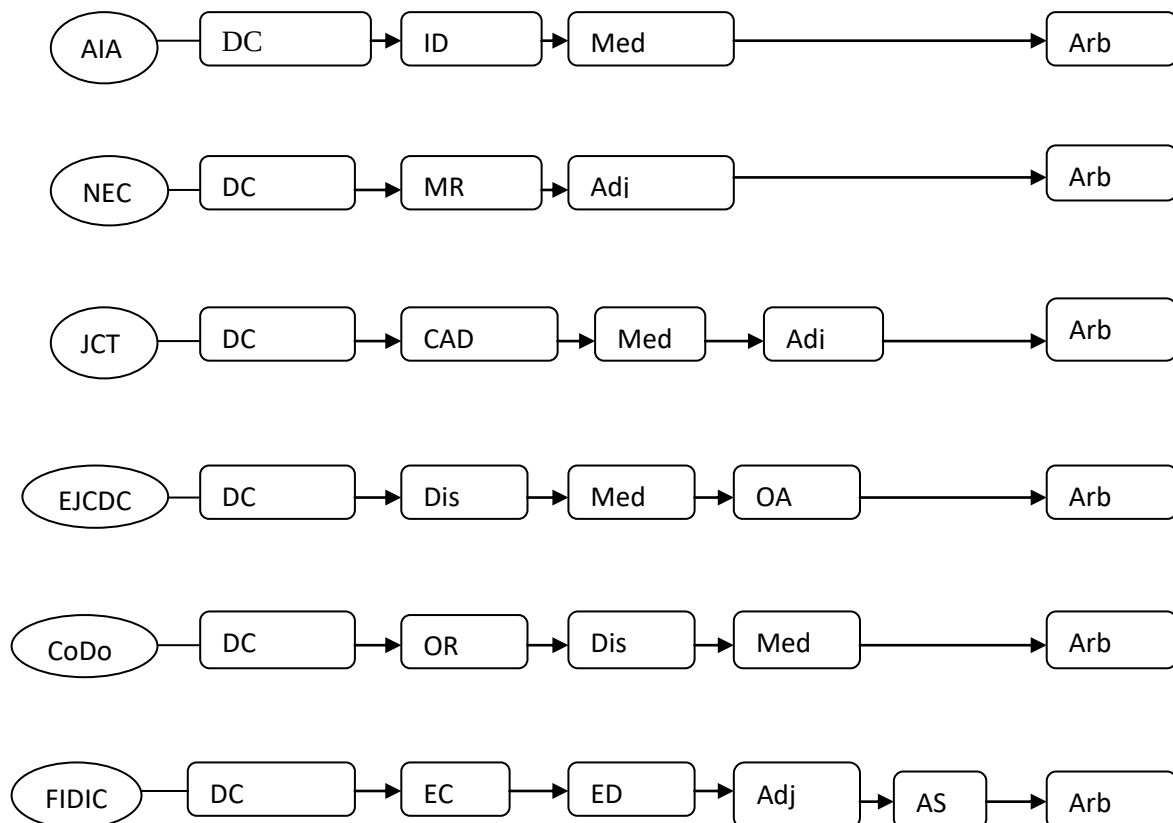
A study conducted by Gebken and Gibson (2006) cited in Gad et al. (2011) proposed a dispute management system following the concept of risk management process (risk identification, assessment, and control). The system comprises dispute identification, dispute assessment; and dispute control. A study conducted by Gad et al. (2011) established matrix for cause of dispute and selection of dispute resolution method. The study summarized the types of dispute resolution mechanism varied with type of dispute causes.

Dispute management comprises identification of causes, assessment of impact, and resolution of dispute. Dispute resolution procedures are usually outlined in conditions of contract and parties to the contract are aware of the procedure to be instituted in advance. The dispute resolution procedures entail resolution technique, notification of dispute, timeline for notice, submission, and reward. Dispute resolution requires preparations and processes to be created in order to effectively take gain benefit from opportunities present to the parties participating (Srouf, 2017).

Widely used sets of standard contract conditions are found to offer a spectrum of dispute resolution mechanisms and it is evident that all mechanisms are triggered through the disclosure of a dispute and eventually end when the resulting dispute is referred to arbitration (Barakat et al., 2019). The claim and dispute resolution mechanisms under all sets of standard

conditions implement at least one ADR technique like mediation, conciliation, adjudication, and amicable settlement as an endeavor to reach a resolution prior to referring the matters as disputes to arbitration (Abdul-Malak et al., 2020).

Dispute resolution techniques are amicable settlement, mediation, conciliation, adjudication, arbitration, and litigation. Triggering of one dispute resolution technique requires unsuccessfulness of the other in resolving the dispute and it has to pass through series of steps. These steps have to be followed thoroughly and any neglect of steps or time line of steps results in disqualification of the dispute. The orders of precedence of dispute resolution technique vary with respect of standard condition of contract of contract document (Barakat et al., 2019).



Where DC=disclosure of claim; ID=initial decision; Med=mediation; Arb=arbitration; MR=manager's replay; Adj=adjudication; Dis=discussion; OA=owner's action; OR=owner's replay; EC=engineer's consultation; ED=engineer's determination; AS=amicable settlement

Figure2. 5 Claim and Dispute Resolution Spectrum (Barakat et al., 2019)

The above figure shows the order of implementation of dispute resolution techniques in AIA, NEC, JCT, EJCOT, ConsensusDocs, and FIDIC starting from disclosure of claim up to arbitration in sequential manner. From disclosure of claim up to initial judgment, be it engineer's determination or owner's replay or project manager's replay as the terminology in the standards for conditions of contract though all entail same theme, is considered claim resolution spectrum. The dispute resolution spectrum starts after claim is unresolved through claim resolution spectrum.

The chronological orders of the steps for dispute starts with notice of dissatisfaction with Engineer's determination; followed by notice to dispute, submission of detail dispute; hearing of arguments, assessment of dispute and delivery of decision by external expert; then progress to notice of dissatisfaction with expert decision, notice for arbitration, hearing of dispute, assessment of dispute and award of dispute (Barakat et al., 2019).

Adjudication. -Adjudication, also known as DRE, DAB, is a panel of experts who helps parties to the dispute through giving recommendation or decision that could be final and binding to both parties (Srouf, 2017). Adjudication is alternative dispute resolution (ADR) that is adopted in some well known condition of contract such as FIDIC, JCT, NEC for dispute resolution (Barakat et al., 2019).

Under those conditions of contract which permits adjudication as one means of dispute resolution techniques; two steps notices are required to initiate adjudication. These are notice of adjudication and followed by notice of referral to adjudication and the notices are time bounded (Barakat et al., 2019). FIDIC condition of contract sets maximum of 28 days for issuing notice of dissatisfaction (notice of adjudication) from the date of issuance of initial judgment (engineer's determination) and maximum of 42 days for referring cases to dispute review expert. If the these time bars are not respected; parties will not be able to pursue adjudication techniques (Barakat et al., 2019). As per FIDIC conditions of contract the adjudicator shall deliver decision within 84 days and the decision is said to be final and binding unless notice of dissatisfaction is issued within stipulated time period. Failure to render decision by the adjudicator within 84 days; and issuing notice of dissatisfaction by either party within stipulated time promote the dispute to arbitration stage (Barakat et al., 2019).

Mediation.-Under mediation; a neutral third party is involved in formalized negotiations between the contractor and the employer in order to achieve agreement between the parties on an outcome that suits them both. The mediator doesn't have the same rights as the DRB or DAB in the sense that he/she is not allowed to have a judicial or quasi-judicial role (Srouf, 2017). Mediation describes the process of neutral and disinterested person helping disputing parties to negotiate a settlement to their dispute. The mediator helps parties to the dispute to understand the dispute in a way that will maximize their chance to reach mutually acceptable and lasting solution but the mediator does not propose a solution for the settlement of the dispute.

Well-known conditions of contract such as EJCDC, ConsensusDocs, AIA, FIDIC and JCT allow mediation as ADR techniques. Mediation is also time bounded and the time bar for mediation varies with respect of conditions of contract in use in the contract. ConsensusDocs allows a minimum duration of 15 days and a theoretical maximum duration of 44 days. On the other hand; the AIA and EJCDC conditions stipulate that the mediation process shall proceed for a minimum period of 60 days before being terminated by either party. On contrary; FIDIC does not stipulate any specific requirement regarding mediation but makes the allowance as part of amicable settlement phase, which is initiated in period between issuance of notice of dissatisfaction with DRE's decision and issuance of notice for arbitration (Barakat et al., 2019).

Conciliation.-Conciliation is a voluntary form of dispute resolution where a neutral party is appointed to facilitate negotiation between disputing parties and to act as a catalyst to reach a settlement to their dispute. Conciliation allows the conciliator to a more active role probing the strength and weakness of parties' case; making suggestion, giving advice; finding persuasive arguments for and against each of the parties' positions; and creating new ideas which might induce them settle their dispute.

Amicable settlement is adopted by the FIDIC conditions and sequenced to take place just prior to commencing arbitration. During this phase, the parties shall endeavor to resolve claims amicably, possibly using any ADR technique other than that of adjudication, given the fact that adjudication is the stage immediately preceding this amicable settlement stage under the FIDIC conditions. The parties' mutual agreement is necessary for the initiation of any ADR technique during this stage, taking into consideration that the specified period of 28 days may be extendible upon the parties' mutual agreement, which can serve to possibly

accommodate for the time needed to initiate, conduct, and conclude accommodate for the time needed to initiate, conduct, and conclude the adopted ADR proceedings (Barakat et al., 2019).

Arbitration.-Arbitration is a mirror image of a court trial in certain aspects. It consists of a panel of one or three members as stated by FIDIC 1999 and in theory should be able to result in more correct decisions in the matters of dispute. This idea is also backed by the fact that the arbitrators should be people whom have no interest whatsoever in the outcomes of the arbitration in regards to both parties (Srouf, 2017). Arbitration is a consensual process that involves the agreement of parties to the contract to settle their dispute by the arbitrator (Bailey, 2011).

Litigation.-Litigation is considered by many as preparation for the court's trial. The important difference that litigation offers is that the stronger party in terms of the facts and particulars prepared is more likely to succeed. Litigation also offers an extra window for parties to negotiate before reaching the final court trial (Srouf, 2017). Litigation takes place at the court of law having jurisdiction over the case.

2.8 Claim in Road Construction under Ethiopian Roads Administration

Research works of Eshetu (2021); Belachew et al. (2017); Werkinah & Mite (2020); and Road Research Center (2015) revealed the major causes of claim and subsequent effects of claim in road construction projects under ERA. Eshetu (2021) revealed that poor design, poor communication, poor project planning, poor contract documentation, delay in progress, and ROW issues are significant causes of claim in ERA's road construction projects that develops in to dispute. Belachew et al. (2017) pointed out that material price fluctuation, cost underestimation, delay in supply of raw materials, inadequate review of contract documents, lack of coordination at design phase, poor planning are significant causes of claim resulting in cost overrun for road construction projects under ERA. Werkinah & Mite (2020) pointed out that design error, ROW problem, variation order, change in defined scope, lack of adequate site investigation, poor planning, and cash flow problems are major causes of claim resulting in cost overrun for road construction projects under ERA. A study conducted by Road Research Center (2015) on ERA's roads completed in the period from 2006 up to 2015 as a sampling frame revealed that additional request from local government (change of scope of work), drainage related problem (poor design), variation order, inadequate design and drawing are the major causes of claim resulting in cost and adverse weather condition,

increased quantities, ROW problem, variation order, late issuing of drawings, shortage of cement, site security, and inadequate design are major causes of claim resulting in time overrun for road construction projects under ERA. A research work of Asratie et al. (2021) outlined that cash flow problem, poor planning, lack of access to foreign currency, delay in possession of site, frequent breakdown of equipment, delay in delivery of material and equipment, inflation, delay in payments, and poor communication are the significant causes of claim for road construction projects under ERA.

Ethiopian Roads Administration follows claim and dispute resolution procedures stipulated in FIDIC condition of contract, PPA condition of contract, and ERA's Claim and Dispute Management Manual for management of claims in road construction. Accordingly; ERA established claim and dispute management process that has six stages. These stages are potential claim identification stage; claim notification and substantiation stage; claim assessment stage; DRE dispute resolution stage; arbitration dispute resolution stage; litigation dispute resolution stage. Either client, in his case ERA, or contractor may identify potential claim in due course of construction. The claimant notify the other party by sending notice of claim to the consultant (engineer) within specified time limit as stipulated in condition of contract and subsequently substantiate the claim with required documentation. Contract engineer, construction engineer and project manager are professionals of contractor who involve in making of the claim from contractor side; and counterpart engineer, lead engineer and team leader are professional who involve in making of the claim from client side. Assessment of notified, and then substantiated claims is made by the engineer. Staffs of consultant who involve in assessment of claim are quantity surveyor, claim expert, deputy resident engineer and resident engineer. Thus; notice of claim is submitted to the engineer first, full or interim claim is submitted to the engineer for determination, engineer gives determination on claim, if any party disagree with Engineer determination gives notice to dispute within specified time lines, involvement of DRE is triggered, DRE gives his decision within specified time limit, if any party disagree with DRE's decision gives notice of dissatisfaction and, then gives to other party notice for arbitration, Arbitrators give award within specified time limit.

2.9 Summary of Literature Review and Research Gap

Risks, conflicts, claims and disputes are inevitable in construction projects due to distinctive features of project (Mishmish & El-Sayegh, 2018). They have cause-effect relationship, for

the posterior to happen the anterior must happen and parties to the contract have to fail to reach agreement. Good management of the posterior results in either non-existence or minimized impact of the anterior. Several researches have been made on the causes, effects, and management of construction claims and some of them are summarized as follows.

Researches on causes of construction claims include those of Mehany et al., (2018); Manda et al., (2019); Levin, (2016); Mishmish & El-Sayegh, (2018); Hashem M. Mehany & Grigg, (2015); Asratie et al., (2021); Elhag et al., (2020); Assaf et al., (2019); Zanelidin, (2020); Al-Qershi & Kishore, (2017); Shaikh et al., (2020); Zhu & Cheung, (2020); Getahun et al., (2016). Mehany et al. (2018) identified design errors, differing site conditions, changes, weather, and strike, among others as causes of claims in construction by using descriptive data analysis. Manda et al. (2019) conducted study to identify cause of claims, remedies for settlement of claim; and concluded that land acquisition, improper documentation, cost overrun, lack of coordination are the main causes of claim by using descriptive data analysis method. Levin (2016) described additional work not specified in the contract documents; work different from that specified in the contract; work out of sequence; Owner furnishing equipment late, in poor condition, or not suitable for the intended use; accelerated performance; differing site furnishing equipment late, in poor condition, or not suitable for the intended use; accelerated performance; differing site condition; differences in contract interpretation; defective specifications; delays from the owner's acts or failure to act; unwarranted work rejection; increased inspection requirements, tests, or quality control program; owner's failure to disclose information; strikes; and forces of nature as causes of claims in construction. Mishmish & El-Sayegh (2018) conducted study to assess the most frequent claims and their root causes and concluded that most frequent cause is variation, and its root causes are poor design, speed of tendering, speed of construction, and changes by clients. The next most frequent cause is delay, and its root causes are mismanagement, lack of resources. The analysis of data was made by using Spearman's coefficient ratio analysis. Hashem M. Mehany & Grigg (2015) conducted study to identify causes of claims and concluded that schedule delay is most significant cause of claim. They used descriptive frequency analysis, regression analysis and correlation analysis to come up with their findings. Rybka et al. (2017) reviewed study to identify and prioritize factors for the major causes of claim; and concluded that change order, prolonged administrative procedure, possession of site, impediment by third party, and unforeseen physical condition are the main

causes of claim by using descriptive data analysis method. Asratie et al. (2021) conducted study to identify and assess risks events pertinent to local contractors and concluded that cash flow problem, inadequate planning, foreign currency problem, ROW problem, are the main risks events in construction by using relative importance index data analysis. Elhag et al. (2020) reviewed that top causes of claims and disputes are variations as a result of clients-initiated change requests; contractors' selection on low bid only rather than including quality and performance considerations; and unfair risk allocation where majority of risks are transferred to contractors by using relative importance index data analysis. Assaf et al. (2019) reviewed that the top causes of claims and disputes were attributed to all parties, including consultants, contractors and clients and variation order due to requirement from clients, variation in quantities due to new requirements from the client, delay caused by contractor, and inconsistency in drawing and specification are the significant causes of claims. They used significance index data analysis technique to come up with their findings. Other causes revealed in previous studies include variations, contractor's delay and inadequate site investigation before bidding by using Spearman's rank correlation coefficient data analysis technique (Mishmish & El-Sayegh, 2018); variation orders, delay caused by owner, changes in material and labor costs and variations in quantities by using relative importance index data analysis technique (Zaneldin, 2020); delay in handing over site, variation between actual and original quantities, excessive change orders by owner, delay of shop drawings approval by owner's representative and scope change of the project by using relative importance index data analysis technique (Al-Qershshi & Kishore, 2017); delay in decision-making, selection process and delay caused by poor planning delay of payment, incomplete design, variation order, change order by owner, lack of communication and poor project management by descriptive data analysis technique (Shaikh et al., 2020). Zhu & Cheung (2020) carried out study to determine cause of dispute; and concluded that risk differential, and power asymmetries are causes of dispute using case studies. Getahun et al. (2016) conducted study to find out the dominant causes of dispute in road construction and revealed that design errors and inadequate specification are main causes from design related factors; delay in work progress, time extension, financial failure of the contractor, tendering and technical inadequacy of the contractor are main causes from contractor related factors; payment delay, late giving of possession of site, variation order and unrealistic expectation are main causes of dispute from client related factor; weather, legal and economic factors, security, and fragmented nature of the sector are ranked as the main causes of dispute from external

factors. They use relative importance index data analysis technique to come up with their findings.

Effects of construction claims are not fully studied but rather explained in studies of Gad et al., (2011); M. S. Mehany et al., (2018); Joshi & Pimplikar, (2021); H. M. Mehany & Grigg, (2015); Dinku & Kasshay, (2003); Belachew et al., (2017); Werkinah & Mite, (2020); Rai et al., (2021); Shaikh et al., (2020); Naji, (2017); G. J. Kikwasi, (2021); G. Kikwasi, (2013); and Malik & Ali, (2019). Gad et al. (2011) explained project delays, reduced team spirit, increased project costs, and damaged business relationships are effects of improperly managed claims. M. S. Mehany et al. (2018) described loss of huge amount of money as effects of claims in construction. Joshi & Pimplikar (2021) pointed that time overrun; delay & subsequent cost overrun of the construction project are the effects of construction disputes. H. M. Mehany & Grigg (2015) explained that cost overruns are common in road construction, and many of these cost overruns are effects of claims that originate from diverse sources. Dinku & Kasshay (2003) described cost overrun, project delay completion time, strained relationship between parties which have impact on project performance as effects of construction claims. Belachew et al. (2017) revealed that cost overrun is the effect of construction claim by studying the causes for cost overrun in road construction. They used Spearman's ratio correlation analysis technique to come up with their finding of significant causes of claim for cost overrun. Similarly; Werkinah & Mite (2020) revealed that cost overrun is the effect of construction claim by studying the causes for cost overrun in the road construction. They used mean score and Spearman's rank correlation coefficient data analysis technique to come up with their findings of causes of claim for cost overrun. Rai et al. (2021) explained that time and cost overruns, erosion of the brand value and the working relationship between the parties are the effects of construction claims. Shaikh et al. (2020) explained that huge number of claims result in troubles including additional cost and time to complete the project. Naji (2017) pointed that delay time, and compromises of quality are the effects of construction claims; and mean score data analysis and fuzzy neural network program are used for data analysis. G. J. Kikwasi (2021) revealed that delays in completion and delivering of construction projects, cost overrun, disputes among parties to the contract, poor contractual relationship among parties, project abandonment, lowers creditability of contractors, lowers creditability of consultants, lowers profits to the contractor, extra expenses due to litigation, extension of time, and suspension of the works are effects of

construction claims. One sample t-test was used to find out significant effects of claims in construction and concluded that delay in completion and project delivery, cost overrun, disputes among contracting parties, poor contractual relation among parties, extra expense due to litigation and extension of time are significant effects of construction claims. G. Kikwasi (2013) found out time overrun, cost overrun, negative social impact, idling resources, and disputes are main effects of construction claims. Relative importance index analysis technique was used to rank the effects of the claims. Malik & Ali (2019) revealed that additional expense in managerial and administration; possibility of litigation cases; loss of company profile; loss of profitability and perhaps business viability; loss of productivity; time delays and cost overrun; extended and/or more complex award process; loss of professional reputation; breakdown in cooperation between parties; high tender prices; rework and relocation cost for men, equipment and materials and; cash flow are effects of claims. They used descriptive data analysis techniques like mean, standard deviation and variance to come up with their findings of effect of construction claims.

On aspects of causes and effects relationship of construction claims; some studies were undertaken by G. J. Kikwasi, (2021); Sambasivan et al., (2017); Ametepey et al., (2018); Khair et al., (2016); Malik & Ali, (2019); Werkinah & Mite, (2020); Belachew et al., (2017). G. J. Kikwasi (2021) revealed that variation is positively related to other causes of claim such as delay in payment, delay in completion of work, variation in quantities, drawing and specification inconsistency. Variations are similarly linked to effects of delay in completion and delivery of construction project, poor contractual relationship among contracting parties, extra expense due to litigation, and extension of time. Bivariate data analysis technique was adopted to establish relationship between causes and effects of claim in construction. Sambasivan et al. (2017) found that cost overrun results from consultant-related and material-related causes of claim; disputes results from cost overrun; arbitration results from consultant-related, cost overrun and dispute factors; litigation results from client-related, disputes and arbitration factors; and abandonment results from consultant-related, external-related, disputes, arbitration and litigation factors. Relative importance index and SEM, a multi-variate analysis method, were used to come up with the findings. Ametepey et al. (2018) revealed that delay of local government construction projects is triggered by client-related and contractor related causes. Severity index analysis and correlation analysis were used to come up with the findings. Khair et al. (2016) pointed out that cost overrun, time overrun, dispute, and total abandonment are top effects of as a result of construction claims.

Relative importance index data analysis technique was used to come up with the findings. Malik & Ali (2019) revealed that late giving of possession of site, variation initiated by the client, change of scope, acceleration, unrealistic expectations from owner related; delay in work progress, time extension, technical inadequacy of contractor, cash flow problem from contractor related; design error, inadequate design and specification from design related; ambiguity in contract document, different interpretation of contract clauses, risk allocation from contract related; lack of team spirit, culture from human related factor; site conditions and unforeseen ground conditions from site related factor; economic and legal factors and weather from external factors are causes of construction claims that result in additional expense in managerial and administration; possibility of litigation cases; loss of company profile; loss of profitability and perhaps business viability; loss of productivity; time delays and cost overrun; extended and/or more complex award process; loss of professional reputation; breakdown in cooperation between parties; high tender prices; rework and relocation cost for men, equipment and materials and; cash flow problems. Descriptive data analysis such as mean, standard deviation and variance were used to come up with the findings. Werkinch & Mite (2020) revealed that design error, right of way problem, widening of road section in town, change in defined scope, lack of adequate site investigation during design stage, lack of proper planning, and contractor's financial problem are main causes for cost overrun in the road construction. Mean score and Spearman's rank correlation coefficient were used to establish the finding of cost overrun due to causes of claims. Belachew et al. (2017) found that material cost fluctuation, cost underestimation, delay in supply of raw materials and equipment, inadequate review and contract documents, lack of coordination at design phase, lack of cost planning/monitoring during pre-and post-contract stages, inaccurate evaluation of project time duration, lack of experience of technical consultants, and schedule delay and change are main causes of claim result in cost overrun in road construction. Spearman's correlation coefficient was used for data analysis to come up with the findings.

Research works on management of construction claim include those of (M. S. Mehany et al., 2018); (Zhu & Cheung, 2020); (Getahun et al., 2016); (Eshetu, 2021); (Elhag et al., 2020); (Parchami Jalal et al., 2021); (Ali et al., 2020). Mehany et al (2018) conducted study to determine observational trend in reducing claim and dispute; and concluded that partnering with stakeholders significantly reduces claim and dispute. Descriptive data analysis and

inferential data analysis (the Kruskal-Wallis (K-W) test and Spearman correlation) were used to come up with the finding that partnering significantly effective means of claim management. Zhu & Cheung (2020) carried out study to find out power of incentives in minimizing dispute; and concluded that incentivization acts as an efficient way to minimize construction disputes by conducting case studies. Getahun et al. (2016) conducted study to find out the causes of dispute and dispute resolution mechanisms in dispute management; and concluded that negotiation and arbitration are preferred dispute resolution techniques. Relative importance index data analysis technique was used to come up with the findings. Eshetu (2021) conducted study to find out best dispute resolution technique in dispute management; and concluded that preventive approach and alternative dispute resolution techniques such as amicable settlement are preferred techniques in dispute management. In this study; descriptive data analysis technique was used to come up with the findings. Elhag et al. (2020) conducted study to figure out whether implementing collaborative procurement approach can help in claim management; and concluded that effective social relationship, non-opportunistic behavior, mutual respect and trust among the project parties are key factors in collaborative approach and lead to fewer disputes in construction projects. In the study; relative importance index analysis technique was used to come up with the finding. Parchami Jalal et al. (2021) studied BIM application in construction claim management and concluded that BIM based claim management has advantageous over conventional claim management in early identification of situations with the potentiality of a claim, vast amount of storage space for data, quick and facilitated access to the information, facilitation of claim management processes, information consistency and increase in collaboration and coordination between participants and visualization of claim in BIM model. In the study Friedman non- parametric test was used to analysis survey data to classify causes of claim as hard claim so as to be represented in BIM model. Ali et al. (2020) conducted study on BIM based claim management in construction and concluded that the use of ICT has tremendously facilitated the practitioners in achieving greater project success and higher organizational productivity. In the study relative importance index was used to analysis causes of time claim to be represented in BIM model.

It may be deduced that many of the research works reviewed above were focused on ranking of causes, effects, and management of claims to reveal the significant causes and effects of construction claims and effective management of construction claim. While it can be

acknowledged that researchers have explored much on causes, effects, and management of claims in construction; researches on relationships between causes of claim, relationships between effects of claim, and relationships between causes and effects of claims in construction projects are not explored much. Accordingly; it is vital to establish the relationships between the causes of claim, effects of claim, and causes and effects of construction claims to come up with causes that are related to many causes, effects that are related to many effects, causes that are related to many effects. Therefore; this research work focused on establishment of relationships between causes of claim, effects of claim, and causes and effects of construction claims for road projects under Central Directorate of Ethiopian Roads Administration. To achieve such establishment of relationships; causes of claim and effects of claim reviewed from literatures were summarized in tabular forms as follow.

Table2. 1 Causes of claims in construction

No.	Causes of claims	Reference
1	Design errors or poor design	Mehany et al. (2018); Rybka et al. (2017); Asratie et al. (2021); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); G. J. Kikwasi (2021); Malik & Ali (2019); Werkinah & Mite (2020); Belachew et al. (2017)
2	Differing site condition	Mehany et al. (2018); Levin (2016); Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Rybka et al. (2017); Malik & Ali (2019); Werkinah & Mite (2020)
3	Changes or Variation order	Mehany et al (2018); Levin (2016); Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Rybka et al (2017); Asratie et al (2021); Elhag et al (2020); Zanelidin (2020); Al-Qershi & Kishore (2017); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019); Werkinah & Mite (2020); Belachew et al. (2017)

4	Adverse weather condition	Mehany et al. (2018); Hashem M. Mehany & Grigg (2015); Asratie et al. (2021); Getahun et al. (2016); Malik & Ali (2019)
5	Strike	Mehany et al. (2018); Levin (2016); Rybka et al. (2017); Asratie et al. (2021); Malik & Ali (2019)
6	Change in scope of work	Manda et al. (2019); Levin (2016); Rybka et al. (2017); Zanelidin (2020); Al-Qershi & Kishore (2017); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019); Werkinah & Mite (2020)
7	Inadequate bid information	Manda et al. (2019); Levin (2016); Getahun et al. (2016); Belachew et al. (2017)
8	Faulty and late owner supplied material and equipment	Manda et al. (2019); Levin (2016); Hashem M. Mehany & Grigg (2015); Asratie et al. (2021)
9	Inadequate drawing and specification	Manda et al. (2019); Levin (2016); Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Getahun et al. (2016); G. J. Kikwasi (2021); Malik & Ali (2019)
10	Insufficient time for bid preparation	Manda et al. (2019); Getahun et al. (2016)
11	Disruption (Interference in works causing delay)	Manda et al. (2019); Mishmish & El-Sayegh (2018); Rybka et al. (2017); Asratie et al. (2021); Assaf et al. (2019); Zanelidin, (2020)
12	Lack of access to construction site (work in congested area)	Manda et al. (2019); Rybka et al. (2017)
13	Acceleration	Manda et al. (2019); Levin (2016); Hashem M. Mehany & Grigg (2015); Malik & Ali (2019)
14	Unbalanced bidding and under estimation	Manda et al. (2019); Asratie et al. (2021); Elhag et al. (2020); Shaikh et al. (2020); G. J. Kikwasi (2021)

15	Differences in contract interpretation	Levin (2016); Getahun et al. (2016); Malik & Ali (2019)
16	Late issue of instruction or clarification	Levin (2016); Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Al-Qershi & Kishore (2017); Shaikh et al. (2020); G. J. Kikwasi (2021)
17	Termination or suspension of work	Levin (2016); Mishmish & El-Sayegh (2018)
18	Delay in inspection	Levin (2016); Mishmish & El-Sayegh (2018); Asratie et al. (2021)
19	Ambiguities in contract clauses	Mishmish & El-Sayegh (2018); Getahun et al. (2016); Malik & Ali (2019); Assaf et al. (2019)
20	Insufficient design document and specification	Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Rybka et al (2017); Shaikh et al. (2020); G. J. Kikwasi (2021); Malik & Ali (2019); Belachew et al. (2017)
21	Delay in granting possession of site (ROW)	Mishmish & El-Sayegh (2018); Rybka et al. (2017); Asratie et al. (2021); Al-Qershi & Kishore (2017); Getahun et al. (2016); Malik & Ali (2019); Werkinch & Mite (2020)
22	Late payment	Mishmish & El-Sayegh (2018); Asratie et al. (2021); Assaf et al. (2019); Getahun et al. (2016)
23	Poor workmanship	Mishmish & El-Sayegh (2018); Asratie et al. (2021); Getahun et al. (2016)
24	Delay in work progress	Mishmish & El-Sayegh (2018); Hashem M. Mehany & Grigg (2015); Hashem M. Mehany & Grigg (2015); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019)
25	Poor planning	Mishmish & El-Sayegh (2018); Hashem M.

		Mehany & Grigg (2015); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019)
26	Delay in material and equipment delivery (late mobilization)	Hashem M. Mehany & Grigg (2015); Asratie et al. (2021); Belachew et al. (2017)
27	Poor site management	Hashem M. Mehany & Grigg (2015); Asratie et al. (2021); Shaikh et al. (2020); Werkinah & Mite (2020); Belachew et al. (2017)
28	Unforeseen physical condition	Rybka et al. (2017); Asratie et al. (2021); Malik & Ali (2019)
29	Change in legal regulation	Rybka et al. (2017); Asratie et al. (2021); Malik & Ali (2019)
30	Inflation (material cost fluctuation)	Asratie et al. (2021); Malik & Ali (2019); Belachew et al. (2017); Zanelidin (2020)
31	inadequate project duration	Asratie et al. (2021); Malik & Ali (2019); Belachew et al. (2017); Getahun et al. (2016)
32	site safety	Asratie et al. (2021)
33	shortage of labor	Asratie et al. (2021)
34	Cash flow problem	Asratie et al. (2021); Getahun et al. (2016); Malik & Ali (2019); Werkinah & Mite (2020)
35	Shortage of project managers and construction professionals	Asratie et al. (2021); Belachew et al. (2017)
36	poor communication among contracting parties	Asratie et al. (2021); Shaikh et al. (2020); Malik & Ali (2019); Belachew et al. (2017)
37	Shortage of construction material	Asratie et al. (2021)
38	Shortage of equipment and spare	Asratie et al. (2021)

	part	
39	Technical inadequacy of contractor	Getahun et al. (2016); Malik & Ali (2019); Belachew et al. (2017)
40	Unrealistic expectation	Getahun et al. (2016); Malik & Ali (2019)
41	Security problem (hostilities, war)	Getahun et al. (2016)
42	Force of natures (pandemic)	Levin (2016)
43	Work in congested area	Manda et.al (2019)
44	Errors in setting out information	Shaikh et.al (2020)

Table2. 2 Effects of claims in construction

No.	Effects of Claim	Reference
1	Cost overrun	Gad et al. (2011); M. S. Mehany et al. (2018); Joshi & Pimplikar (2021); H. M. Mehany & Grigg (2015); Dinku & Kasshay (2003); Belachew et al. (2017); Werkinah & Mite (2020); Rai et al. (2021); Shaikh et al. (2020); G. J. Kikwasi (2021); G. Kikwasi (2013); Malik & Ali (2019)
2	Time overrun	Gad et al. (2011); Joshi & Pimplikar (2021); Dinku & Kasshay (2003); Rai et al. (2021); Shaikh et al. (2020); Naji (2017); G. J. Kikwasi (2021); G. Kikwasi (2013); Malik & Ali (2019); Khair et al. (2016)
3	Stranded relation between contracting parties	Gad et al. (2011); Dinku & Kasshay (2003); Rai et al. (2021); G. J. Kikwasi (2021); Malik & Ali (2019)

4	Damage business relationship	Gad et al. (2011); Rai et al. (2021); G. J. Kikwasi (2021); Malik & Ali (2019)
5	Disputes	G. J. Kikwasi (2021); G. Kikwasi (2013); Malik & Ali (2019); Khair et al. (2016)
6	Project abandonment	G. J. Kikwasi (2021); Khair et al. (2016)
7	Compromise of quality due to suspension of work	Naji (2017)
8	Lower profitability	G. J. Kikwasi (2021); Malik & Ali (2019)
9	Extra expense due to litigation	G. J. Kikwasi (2021); Malik & Ali (2019)
10	Suspension of work	G. J. Kikwasi (2021)
11	Negative social impact	G. Kikwasi (2013)
12	Idling resources	G. Kikwasi (2013)
13	Additional expense in managerial and administrative	Malik & Ali (2019)
14	Extended or more complex award process	Malik & Ali (2019)
15	High tender price	Malik & Ali (2019)
16	Rework and relocation of resources	Malik & Ali (2019)

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is where study area of the problem, research design, and population of the study, sampling method, data collection method, data analysis method, reliability and validity of the research for the study is discussed.

3.2 Study Area

Ethiopian Roads Administration (ERA) is a public institution whose mandate is to administer construction and maintenance of road and bridges under federal government jurisdiction; to give technical assistance to Regional Roads Authority; and to conduct research and development on road sector.

ERA administers road construction under contract administration directorate. The contract administration directorate divides in to five regions, namely, north region directorate, south region directorate, central region directorate, east region directorate, and west region directorate. Among these five regions this research was conducted in the central region due to availability of information in earliest possible time and relative nearness of the projects to ERA's head office, Addis Ababa. Central region directorate administers road construction projects existing in geographical location of 300 km radius from epicenter of Addis Ababa. This includes North Showa Zone, East Showa Zone, West Showa Zone, South West Showa Zone, Arsi Zone of Oromia Regional State; North Showa Zone, parts of East Gojjam of Amhara Regional State. Though geographical location is a basis for road project to be administered under different region directorates; there is a flexibility of assigning road projects those are not in the region geographically to other region depending on contract administration work load on directorates.

3.3 Research Design

Research design is the overall plan of the study in order to integrate different component of the study in coherent and logical manner to properly address research problems. It includes identification of research problems, selection of research topic, and research type; review of literatures on research topic; preparation, measuring and collection of research data (survey

data); analysis of research data; discussion and recommendation on the findings from the research.

The research topic was identified from persistent claim problems facing road construction projects and titled as “A Relationship model of Causes and Effects of Claims in Roads Construction Projects: A Case of Roads Construction Projects under Central Directorate of Ethiopian Roads Administration”. The aim of topic of the study was to establish causes and effects relationship of construction claims so as to aid claim management in road construction projects. The research type for this study was quantitative research of correlation explanatory type which basically involves a questionnaire survey, and case study. Literatures were reviewed thoroughly on research topic. The review was relevant book, journal, articles, progress reports, and contract documents for road construction project in ERA.

After literature review; questionnaires were prepared for gathering data in order to achieve the objective of the study. A metric scaling technique, Likert 5-point scale, was employed to measure data from respondents as it is the most common scale for obtaining respondents’ response. After collecting important data through questionnaires, and case studies; the data were analyzed by data analysis techniques with the help of software SPSS; and the result of the data was discussed thoroughly. Finally; recommendation was made based on the findings.

3.4 Population of the Study

Target population for the study was road construction projects in Ethiopian Roads Authority under central region directorate. At the time of study; there were thirty ongoing projects under central region.

3.5 Sample Size of the Study

The objective of sampling is to provide a practical means of enabling the data collection and processing components of research to be carried out at the same time ensuring that the sample provides a good representation of the population. If the population is sufficiently small, a full population may be researched (Fellows & Liu, 2008).

ERA was administering thirty active construction projects under central region and the study area of this research was road construction projects under central region of contract management directorate of ERA. As there were only thirty road construction projects under

the central region; the sample size was considered purposely full population of the study, that was, thirty road construction projects.

3.6 Sources of Data

In order to achieve the objectives of the study; the data sources were both primary and secondary sources. Primary sources consisted of survey data whereas secondary data occur as raw data or processed data. In this research primary data were collected through questionnaire survey, and secondary data were collected from archival documents and letters for case study.

3.7 Data Collection Instruments

The following data collection instruments were used. These were questionnaire survey, and case study.

3.7.1 Questionnaire Survey

Questionnaire provides firsthand information and understanding of the respondents towards the problem. Search for literature on construction claims was made to establishing available knowledge on their causes, effects and relationship and accordingly questionnaires were prepared and distributed to respondents from client, consultants, and contractors. The questionnaires were closed-end type. The selected respondents were team leaders, lead engineers, and counterpart engineers from client; resident engineers, deputy resident engineers, and claim experts from consultant; and project managers, construction managers, and contract engineers from contractors involving in the road construction projects under central region contract management directorate of ERA. The respondents were professionals those have been involving in claim management of their respective projects. For this study; at least one of the professional from each party to the contract has been required to give opinion of his/her to the questionnaire. Accordingly; eighty set of questionnaires were distributed to the thirty projects of which thirty questionnaire sets were to be filled by one of the selected respondents from the contractor, another thirty were to be filled by one of the selected respondents from the consultant, and twenty were to be filled by selected respondents from the client.

The questionnaires were divided in to three separate parts. Part one consisted of variables related to general information such as name of the firm, type of the firm, experiencing of the firm in road construction, profession of respondents, progress of the construction projects. Part two comprised closed questionnaires for rating causes of claims in road construction and

forty four causes of construction claims extracted from literatures as shown in table 2.1 and six other causes of claim obtained through discussion with expertise in ERA were included for the respondents to rate using five point Likert scale meaning 5= strongly agree, 4= agree, 3= partially agree, 2= neutral, and 1= disagree. Part three comprised closed questionnaires for rating the impact of effects of construction claims and sixteen effects of construction claims extracted from literatures as shown in table 2.2 were included in the questionnaires to respondents to rate using five point Likert scale meaning 5= very high, 4= high, 3= medium, 2= low, and 1= very low.

The questionnaires were administered through electronic delivery and hand delivery. The questionnaires were distributed to eighty respondents (thirty respondents from consultant, thirty respondents from contractor, and twenty respondents from client).

3.7.2 Case Study

In this study; case study was conducted to supplement the findings obtained through questionnaire. Five cases having high impact were selected for the study from construction projects under central region contract management directorate of ERA.

3.8 Pilot Study

A pilot study was conducted to know how well the measuring instrument, in this case data of questionnaire survey, meets the objectives of the study. The pilot study was conducted by interviewing and showing questionnaire prepared from literature review to three expertises in the field of construction claim management. After reviewing the draft questionnaire survey; the experts recommended that six more causes of claim shall be included in the questionnaire survey and commented that the content of questionnaire survey can meet the objectives of the study.

3.9 Data Analysis Techniques

The data obtained from survey are raw data and require analysis in order to get meaningful and interpretable results so that conclusion and recommendation can be made about the objectives of the study. In this study; descriptive data analysis, one sample t-test, and Spearman's rank correlation were used to convert raw data obtained through data collection methods in to output.

3.9.1 Descriptive Data Analysis

Descriptive data analysis use frequency, percentage, mean, standard deviation, crosstab, etc. for presenting description findings of the survey. In other words; descriptive analysis was used for analysis of part one of questionnaire survey.

This technique was used in this study to analyze data related to the characteristics of respondents, their organizations, and responses to work progress, experience, work title of respondents, originality of the firm, and number of claim encountered in the project for part one of questionnaire survey.

3.9.2 Single Sample t Test

The single sample t test is used to compare a single sample to a population for which the standard deviation is not known and the t test is used to determine if the mean of sample is similar to the mean of the population (Fellows & Liu, 2008). To know the t test value is statistically significant outcome; the value is compared with t distribution table. Single sample t-test was also used in the works of (G. J. Kikwasi, 2021) for determining significant variables. The single sample t test was used to determine the significant causes and effects of claims in the study. In this study; Likert's scale was used to measure the questionnaire data ranging from 1(disagree) to 5(strongly agree) to obtain the opinion of the respondents. It is usually difficult to know population mean and standard deviation with this type of scale as a result; average value (3) indicating ambivalence is defined as hypothesized mean.

The t formula that is used for t test is:

$$t = \frac{M - \mu}{S_m} \dots\dots\dots (3.1)$$

Where; M is sample mean; μ is hypothesized mean; and S_m is estimated standard error of the mean.

S_m is also calculated as:

$$S_m = \frac{S}{\sqrt{N}} \dots\dots\dots (3.2)$$

Where; S is standard deviation; and N is number of samples (respondents)

S is calculated as:

$$S = \sqrt{\frac{\sum(X-M)^2}{N-1}} \dots\dots\dots (3.3)$$

Where; N-1 is degree of freedom and it is defined as the number of variables that are free to vary when using an inferential statistic. When t- test is used; degree of freedom, or number of scores that vary, increases as a function of sample size. Thus N-1 is used in the estimation of standard deviation.

3.9.3 Correlation Analysis

Correlation analysis is used to identify any relationship between different variables used in data analysis. To test the association between the parameters that affect claims, correlation analysis was used to assess the tendency for two or more variables to vary consistently (Creswell 2008) cited in (H. M. Mehany & Grigg, 2015). Spearman's correlation coefficient was used in the works of Mishmish & El-Sayegh (2018); Ametepey et al. (2018); G. J. Kikwasi (2021); and Belachew et al. (2017) to identify relationship between variables. In this study the correlation was performed by using Spearman rank order test, with help of SPSS software to determine causes-causes relationship, effect-effect relationship, and cause-effect relationship among most significant causes of construction claim and effects of construction claims respectively.

$$r_s = 1 - \frac{6 \sum d^2}{(N^3 - N)} \dots\dots\dots (3.4)$$

Where r_s = Spearman's rank correlation coefficient,

d = difference in ranking

N = number of samples (respondents).

A positive value indicates positive relationship while a negative value indicates negative relationship. A correlation coefficient ranges from -1 to +1. The closer correlation coefficients to +1 or -1, the more closely the variables are related. The value of correlation coefficient closer to +1 implies there is strong positive linear relationship between two variables while the value of correlation coefficient closer to -1 shows a strong negative linear relationship between the variables. If the coefficient of correlation lies between ± 0.5 and

± 1.0 , it has high degree of correlation. For correlation coefficient between ± 0.3 to ± 0.5 , the degree of correlation is moderate. For correlation coefficient between ± 0.1 to ± 0.3 , the degree of correlation is low. Zero coefficient of correlation indicates no relation at all between the variables. Significant correlations are usually those correlations whose absolute values are greater than critical values shown in statistical correlation tables.

3.9.4 A Relationship Model for causes and effects

After relationships between causes and effects of claim in the road projects had been established by using Spearman's correlation coefficient method; graphical models were developed based on the concept of the Gaussian Graphical Model. The GGM consists of set of variables, denoted by circles, and a set of lines that indicate the relationship between variables. The thickness of the lines indicates strength of relationship between the variables, and the absence of line shows no or very weak relationship (Bhushan et al., 2019). The directed lines show casual relationship, whereas the undirected lines shows when there is no cause-effect relationship between variables (Jordan, 2004).

In the study; the relationship model between causes of claim was developed using undirected lines, the relationship model between effects of claims was also developed using undirected lines, but the relationship between causes and effects of claim was developed using directed lines.

3.10 Reliability and Validity of the Study

Reliability and validity are used to evaluate the quality of research work. They indicate how well a method, technique, or tests measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure.

3.10.1 Reliability Analysis

The reliability analysis is mainly carried out by calculating the Cronbach's alpha coefficient for internal consistency (Oktavia et al., 2018). Cronbach's alpha coefficient is the most suitable measure for reliability when making use of Likert's scale (Taherdoost, 2016). Cronbach alpha ranges in value from 0 to 1. A cutoff point of 0.90 to 1 is interpreted as excellent reliability, 0.70 to 0.9 as high reliability, 0.50 to 0.70 as moderate reliability, and 0 to 0.50 as low reliability (Taherdoost, 2016). The reliability analysis of the study was carried out by using Cronbach's alpha coefficient and the interpretation of reliability was made on the following table.

Table3. 1 Interpretation of Cronbach's alpha coefficient (Oktavia et al., 2018)

Cronbach's alpha coefficient	Interpretation
Greater than or equal to 0.90	Excellent
0.80 to 0.90	Good
0.70 to 0.79	Adequate
Below 0.70	Less applicable

3.10.2 Validity Analysis

Validity explains how good the survey data covers the actual target of the study (Taherdoost, 2016). Validity can be determined using experts who shall evaluate how sound the questionnaire meets the target of the study, and correlations among variables (Taherdoost, 2016; and Oktavia et al., 2018). In this study; a pilot study was conducted before distributing of the questionnaires and the objective of the pilot study was to verify the validity of the questionnaires with respect of addressing the outcome of the study. Besides; correlation analysis was used to validate the study as correlation is a good indication for validity of a study.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1 Results and discussions of the Study

Data for the study were collected through questionnaire survey and case study. The data of questionnaire survey were analyzed using SPSS Version 20 software. The outputs of the data after analysis and case study, and discussion of the outcomes are presented in the following section as follows.

4.2 Results of Questionnaire Survey

Questionnaire survey was presented in three parts. Parts one was about general information regarding road construction project including party to the contract, position of the respondent in the project, experience of the respondent, experience of firm in the road construction, originality of the firm, work progress and number of claims encountered in their respective road construction projects. Part two was about significant causes of claim in road construction project and fifty causes of claims were put for rating as significant causes of claim. Part three was about effects of claim in road construction projects and sixteen effects were put for rating as significant effects of claim. Thirty road construction projects were considered in the study and the questionnaires were prepared to be filled at least by one staffs of client, consultant, and contractor directly involve in claim management of their respective road projects. Accordingly; total of eighty sets of questionnaire were disbursed among client, consultants, and contractors. Twenty sets were distributed to the client; thirty were distributed to the consultants, and thirty were distributed to the contractors. The results from response of the respondents are presented as follows.

4.2.1 Rate of response to the questionnaire

Total of twenty sets of questionnaire were distributed to client to be filled by client staff directly involve in claim management of the road projects; total of thirty sets of questionnaire were distributed to consultants to be filled by one of their staff directly involves in claim management; and total of thirty sets of questionnaire were distributed to contractors to be filled by one of their staff involves in the claim management of their respective road projects. The response rates of client, consultant, and contractor to the questionnaire are presented in the table 4.1 below.

Table4. 1 Response rate to the survey from parties to the contract

Party to the contract	Distributed questionnaire in number	Responded questionnaire in number	Response rate in percent
Client	20	18	90.0%
Consultant	30	23	76.7%
Contractor	30	17	56.7%
Total	80	58	72.5%

Table 4.1 shows 18 out of 20 questionnaires to the client were responded; 23 out of 30 questionnaires to consultants were responded; and 17 out of 30 questionnaires to the contractors were responded. Thus; 58 out of 80 respondents were responded to the questionnaire. Accordingly the overall response rate was 72.5%.

Thus; the results of responses gathered from the 58 respondents to the variables in the questionnaire are presented as follows.

4.2.2 Party of the respondent to the road projects

The parties to the contract are client, consultant, and contractor. The response rates of parties to the contract for the questionnaire were analyzed using frequency analysis of descriptive analysis and presented in figure 4.1 below.

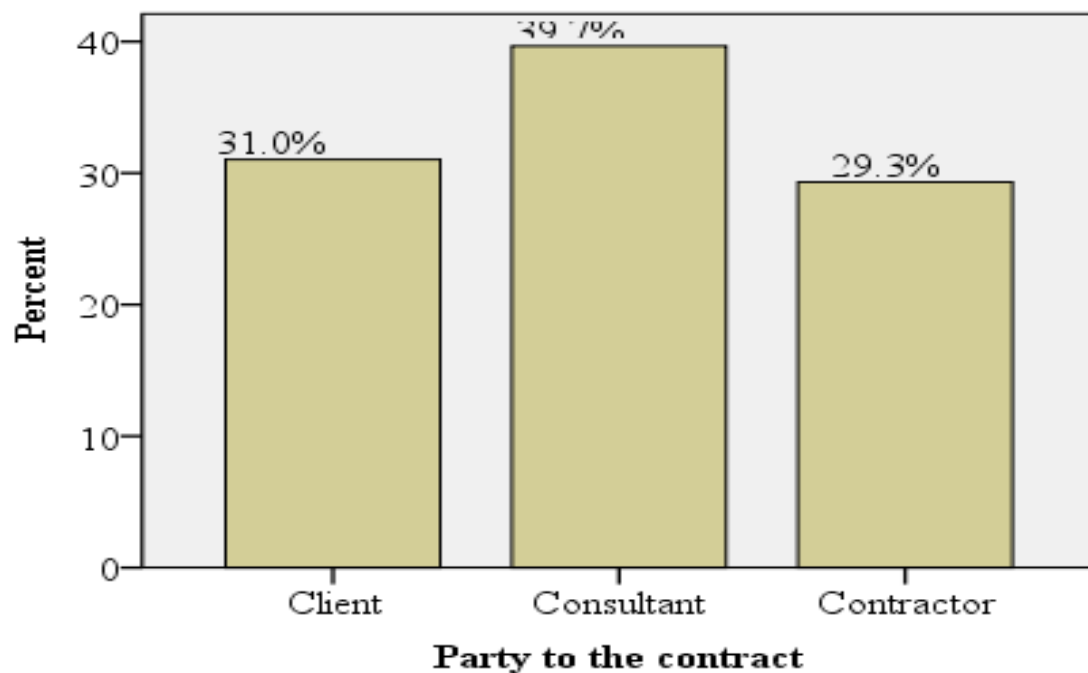


Figure4. 1 Respondent's party to the contract

Figure 4.1 shows out of 58 respondents; 31.0% were client's staffs; 39.7% were consultant's staffs; and 29.3% were contractors' staffs.

4.2.3 Position of the respondent in the road projects

Questionnaires were administered to professionals having relevant knowledge of claim in road construction projects and working on it in the road construction projects of the study area. The respondents' profession or title of work and number of respondents under each work title was analyzed using frequency analysis of descriptive analysis and presented in the figure 4.2 below.

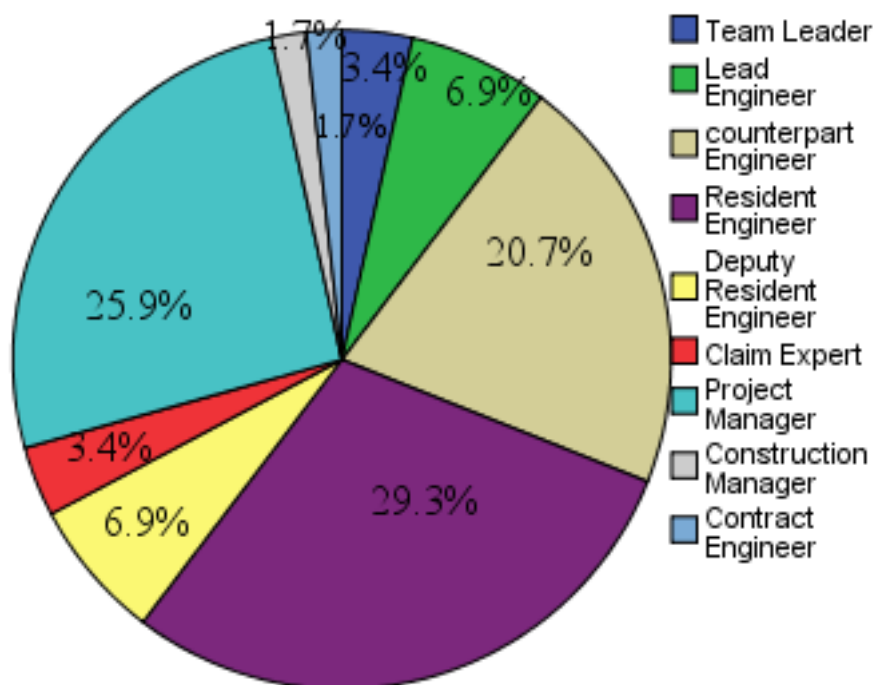


Figure4. 2 Position of respondents in the projects

Figure 4.2 shows the professional title of the respondents participated in responding to the questionnaire survey. Team leader, lead engineer, and counterpart engineer are titles for client's staffs. Resident engineer, deputy resident engineer, and claim expert are titles for consultant's staff. Project manager, construction manager, and contract engineer are titles for contractor's staff. Accordingly; 3.4% of the respondents were team leaders, 6.9% of the respondents were lead engineer, 20.7% were counterpart engineers, 29.3% were resident

engineers, 6.9% were deputy resident engineers, 3.4% were claim experts, 25.9% were project managers, 1.7% were construction managers, and 1.7% were contract engineers.

4.2.4 Work experience of the respondents in the road projects

Experience of the respondents was analyzed using frequency analysis of descriptive analysis and presented in table 4.3 below.

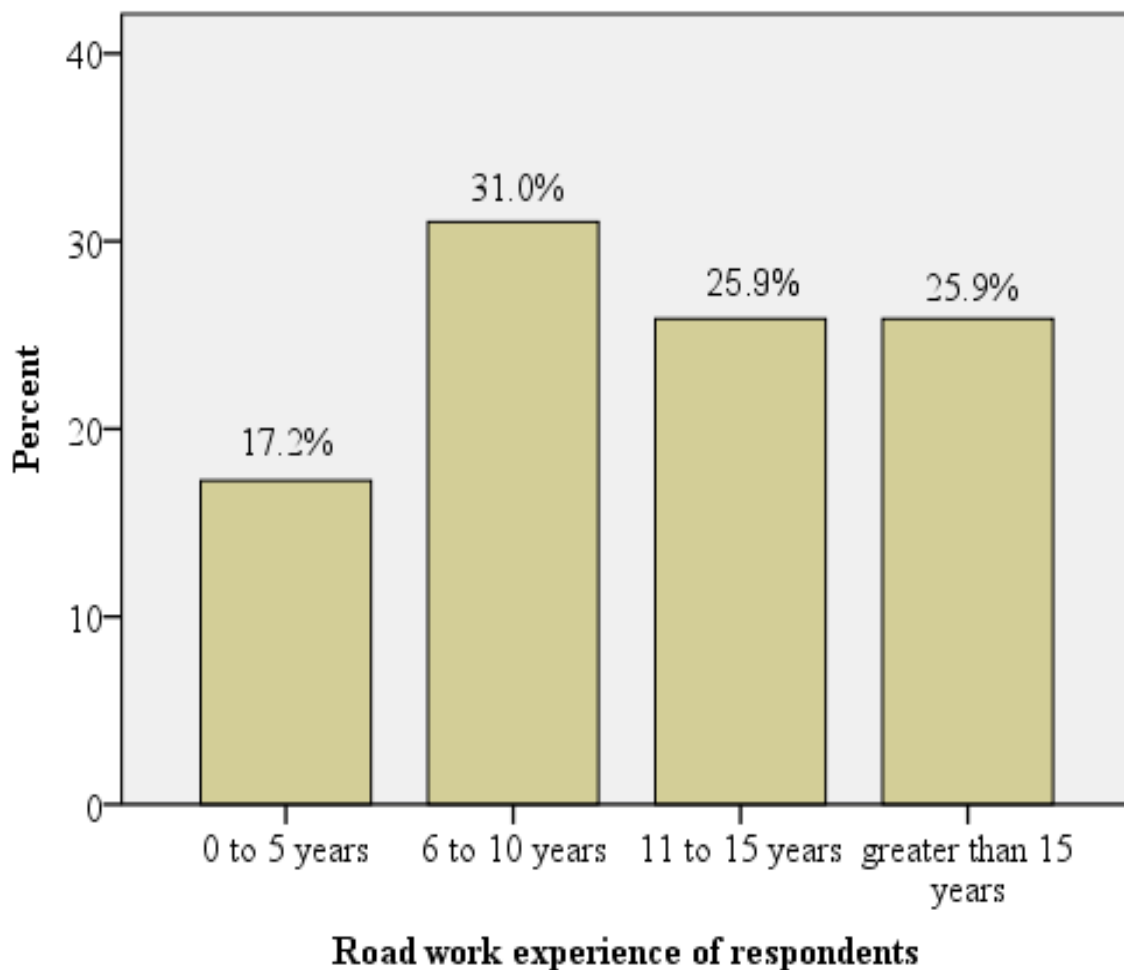


Figure4. 3 Experience of respondents in road construction

Figure4.3 shows the work experience of the respondents in the road construction projects. Accordingly; 17.2% of the respondents had experience of 0 to 5 years in road construction, 31.0% of the respondents had 6 to 10 years experience in road construction, 25.9% of the respondents had 11 to 15 years experience in road construction, and also 25.9% of the respondents had greater than 15 years experience in road construction.

4.2.5 Work progress of the road projects

The work progresses of the construction projects in the study area obtained from respondents were analyzed using frequency analysis of descriptive analysis technique using SPSS software and the result of the analysis is presented in figure 4.4 below.

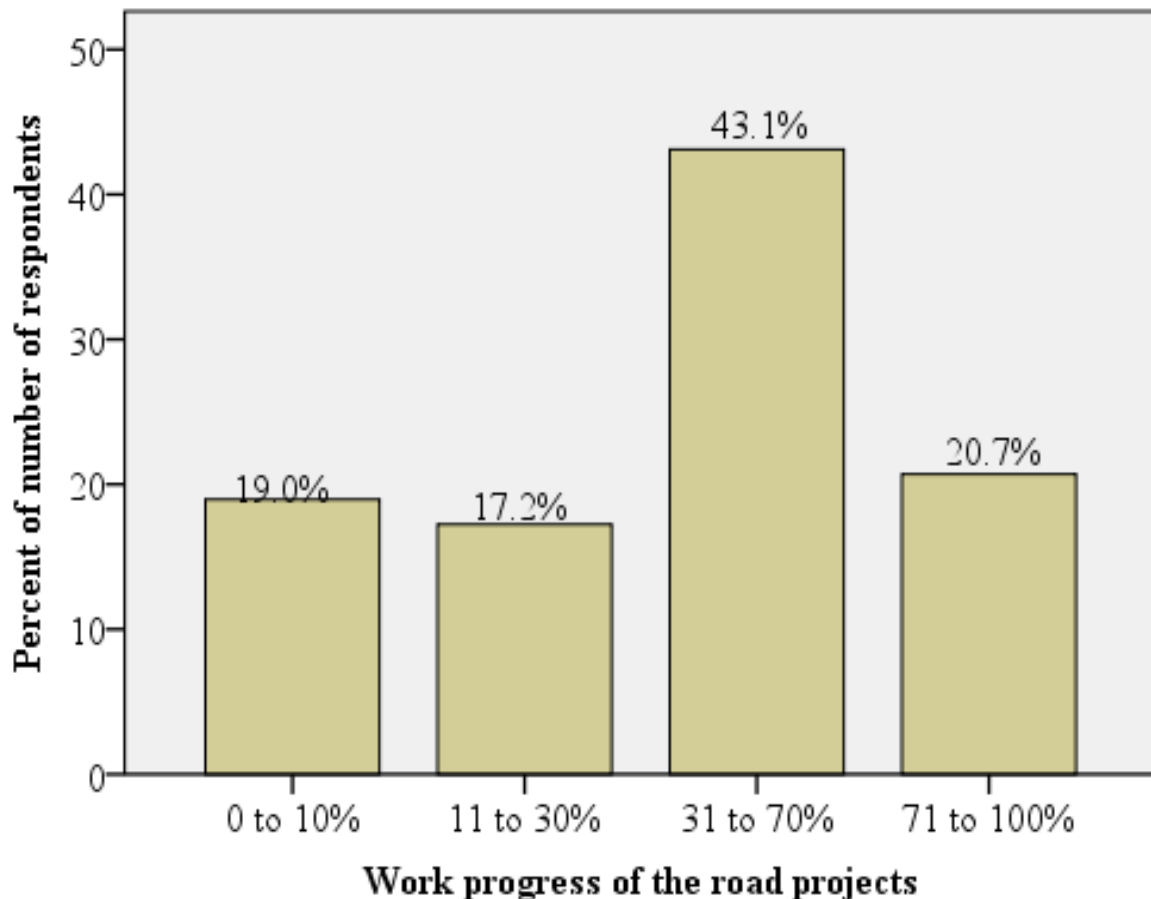


Figure4. 4 Work progress of road projects in the study

Figure 4.4 shows percent of respondents responded to the interval of work progress for road construction projects in the study. 19% of the respondent replied that the progress of the road project they were assigned to was in the progress interval of 0 to 10%; 17.2% of the respondent responded that the progress of the road project they were assigned to was in the progress interval of 11 to 30%; 43.1% of the respondent said that the progress of the road project they were assigned to was in the interval of 31 to 70%; and 20.7% of the respondent replied that the progress of the road project they were assigned to was 71 to 100%.

4.2.6 Number of claims in the road projects

Numbers of claims in the road construction projects of the study area were analyzed using frequency analysis of descriptive analysis by using SPSS software and presented in Figure 4.5 below.

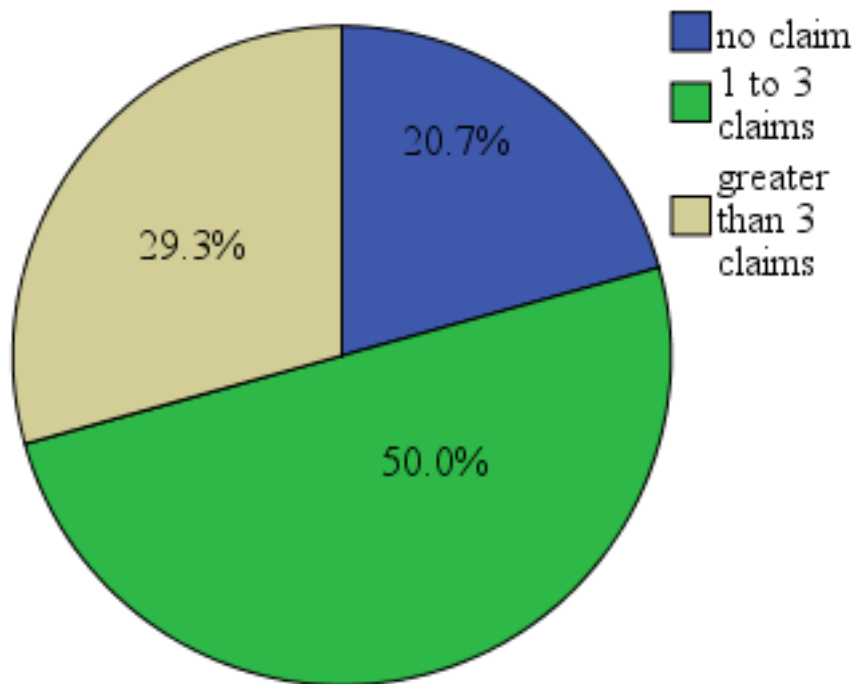


Figure4. 5 Number of claims in the road projects

Figure 4.5 shows number of claims in the road projects as per the given measurement interval. 20.7% of the respondent responded that the road project they were assigned to had no claims up to the time of data collection; 50.0% of the respondent replied that the road project they were assigned to had 1 to 3 claims; and 29.3% of the respondent responded that the road project they were assigned to had greater than 3 claims at the time of data collection.

4.2.7 Number of claims with respect to progress of the road project

To know the number of claims in the road projects with respect to progress of the work; crosstab analysis of descriptive statistics were used and the result is presented in the table 4.2 below. The table shows the percentage shares of respondents, responded to number of claims in the project, to each progress intervals. That is; out of respondents responded to no claim,

1 to 3 claims, and greater than 3 claims options in their respective projects; how many of them are in the project with progress intervals of 0 to 10%, 11 to 30%, and 71 to 100%.

It is to be noted that 20.7% of the respondents replied that there were no claim in their respective projects; 50.0% of the respondents responded that there were 1 to 3 claims in their projects; and 29.3% of the respondents replied that there were more than 3 claims in their road projects. Furthermore; 19.0% of the respondent replied that the progress of their road construction was 0 to 10%, 17.2% of the respondent replied that the work progress of their respective road was 11 to 30%, 43.1% of the respondent responded that the work progress of their projects was 31 to 70%, and 20.7% of the respondent replied that the work progress of their respective projects was 71 to 100%.

Table4. 2 Number of claims with respect to work progress of the projects

Claims in the Projects		Work progress				Total
		0 to 10%	11 to 30%	31 to 70%	71 to 100%	
No claim	Count	8	1	3	0	12
	% of Total	13.8%	1.7%	5.2%	0.0%	20.7%
1 to 3 claims	Count	3	4	18	4	29
	% of Total	5.2%	6.9%	31.0%	6.9%	50.0%
Greater than 3 claims	Count	0	5	4	8	17
	% of Total	0.0%	8.6%	6.9%	13.8%	29.3%
Total	Count	11	10	25	12	58
	% of Total	19.0%	17.2%	43.1%	20.7%	100.0%

Table 4.2 shows number of claims in the road projects with respect to construction progress of the projects. Accordingly out of 20.7% who responded to as there were no claim in their road projects; 13.8% of them replied that their respective work progress was 0 to 10%, 1.7% out of 20.7% responded that their projects respective work progress was 11 to 30%, 5.2% out of 20.7% responded that their projects respective work progress was 31 to 70%, and 0% out of 20.7% responded that their respective projects work progress was 71 to 100%. Out of 50.0% who responded that there were 1 to 3 claims had occurred on their respective road

projects; 5.2% of them replied that their respective work progress was 0 to 10%, 6.9% out of 50.0% responded that their respective work progress was 11 to 30%, 31.0% out of 50.0% responded that their respective work progress was 31 to 70%, and 6.9% out of 50.0% responded that their respective work progress was 71 to 100%. Out of 29.3% who responded that there were more than 3 claims in their respective road projects; 0% replied that their respective progress of work was 0 to 10%, 8.6% out of 29.3% responded that their respective project work progress was 11 to 30%, and 13.8% out of 29.3% replied that their respective project work progress was 71 to 100%.

4.2.8 Causes of claim in the road projects

Total of fifty causes of claims were identified and distributed to the respondent for rating by using Likert's scale of measurement. The responses of the respondents were analyzed by using one sample t-test method to identify significant causes of claims in the road projects. The result of the t-test analysis is presented in the table 4.3 below.

Table 4. 3 Result of one sample t-test for causes of claim

Causes of claim	One-Sample Test					
	Test value=3					
	t	(N-1)	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Design error	4.278	57	0.000	0.586	0.31	0.86
Differing site condition	3.647	57	0.001	0.517	0.23	0.80
Variation Order	8.074	57	0.000	0.983	0.74	1.23
Adverse weather condition	3.434	57	0.001	0.448	0.19	0.71
Strike of labor	1.626	57	0.109	0.207	-0.05	0.46
Change in scope of work	4.789	57	0.000	0.707	0.41	1.00
Inadequate bid information	1.440	57	0.155	0.224	-0.09	0.54

Faulty and late owner supplied material and equipment	-0.622	57	0.536	-0.103	-0.44	0.23
Inadequate drawing and specification	0.348	57	0.729	0.052	-0.25	0.35
Insufficient time for bid preparation	-0.119	57	0.905	-0.017	-0.31	0.27
Disruption as causes of claim	7.498	57	0.000	0.828	0.61	1.05
Lack of access to construction site	1.652	57	0.104	0.241	-0.05	0.53
Acceleration of work	-0.817	57	0.417	-0.121	-0.42	0.18
unbalanced bidding and under estimation	1.493	57	0.141	0.207	-0.07	0.48
Difference in contract interpretation	-0.482	57	0.632	-0.069	-0.36	0.22
Late issue of instruction or clarification	2.545	57	0.014	0.328	0.07	0.59
Termination or suspension of work	1.509	57	0.137	0.241	-.08	0.56
Delay in inspection	-0.369	57	0.713	-0.052	-0.33	0.23
Ambiguities in contract clauses	-0.286	57	0.776	-0.034	-0.28	0.21
Insufficient design document	0.225	57	0.823	0.034	-0.27	0.34

Delay in granting possession of site	12.122	57	0.000	1.397	1.17	1.63
Late payment	5.662	57	0.000	0.776	0.50	1.05
Poor workmanship	1.813	57	0.075	0.241	-0.03	0.51
Delay in work progress	6.343	57	0.000	0.828	0.57	1.09
Poor planning	3.970	57	0.000	0.586	0.29	0.88
Late mobilization	3.837	57	0.000	0.552	0.26	0.84
Poor site management	2.357	57	0.022	0.379	0.06	0.70
Unforeseen ground condition	3.248	57	0.002	0.431	0.17	0.70
Change in legal regulation	0.468	57	0.641	0.069	-0.23	0.36
Inflation (material cost fluctuation)	6.084	57	0.000	0.914	0.61	1.21
Inadequate project duration	0.714	57	0.478	0.103	-0.19	0.39
Construction related accident due to poor safety management	-2.536	57	0.014	-0.345	-0.62	-0.07
Shortage of labor	-1.176	57	0.245	-0.155	-0.42	0.11
Cash flow problem	5.696	57	0.000	0.810	0.53	1.10
Shortage of project managers and construction professional	-0.108	57	0.915	-0.017	-0.34	0.30

Poor communication among contracting parties	1.346	57	0.184	0.172	-0.08	0.43
Shortage of construction material	4.621	57	0.000	0.621	0.35	0.89
Shortage of equipment and spare parts	3.164	57	0.002	0.448	0.16	0.73
Technical inadequacy of contractor	0.851	57	0.398	0.138	-0.19	0.46
Unrealistic expectation	-0.323	57	0.748	-0.052	-0.37	0.27
Security problem (hostilities, war)	5.392	57	0.000	0.793	0.50	1.09
Forces of nature (Pandemic)	0.590	57	0.557	0.086	-0.21	0.38
Work in congested area	-1.470	57	0.147	-0.207	-0.49	0.08
Errors in setting out information	-1.754	57	0.085	-0.241	-0.52	0.03
Interference with test on completion	-1.691	57	0.096	-0.224	-0.49	0.04
Late commencement of project	1.217	57	0.229	0.207	-0.13	0.55
Fossils, archeological and geological findings	-1.933	57	0.058	-0.293	-0.60	0.01

Taking over parts of work	-1.421	57	0.161	-0.190	-0.46	0.08
Contractor to search causes of failure of work	-1.657	57	0.103	-0.207	-0.46	0.04
Delay damages	1.691	57	0.096	0.207	-0.04	0.45

Table 4.3 shows the t-value for each causes of claim in the road projects as per the response of the respondent with degree of freedom (N-1), and confidence interval of 95%.

The significant causes of claim in the road projects under the study were determined by comparing the above t- values with the critical value of t-tables. The critical value from t-table for degree of freedom 57 and confidence level of 95% is 2.003. Thus; causes of claim having t-value greater than 2.003 were considered significant in the road projects. Accordingly; 19 causes of claims were found significant in the road projects under the study and those were design error (t-value=4.278), differing site condition (t-value=3.647), variation order (t-value=8.074), adverse weather condition (t-value=3.434), change in scope of work (t-value=4.789), disruption (t-value=7.498), late issue of instruction (t-value=2.545), delay in granting possession of site (ROW) (t-value=12.122), late payment (t-value=5.662), delay in work progress (t-value=6.343), poor planning (t-value=3.970), late mobilization (t-value=3.837), poor site management (t-value=2.357), unforeseen ground condition (t-value=3.248), inflation (t-value=6.084), cash flow problem (t-value=5.698), shortage of construction materials (t-value=4.621), shortage of equipment & spare parts (t-value=3.164), and security problem (t-value=5.392). The significant causes of claim, which were found to be significant as per the t-test, for the road projects considered in the study are presented in table 4.4 below.

Table 4. 4 Significant causes of claim in the road projects

Significant causes of claim						
	t	N-1	Sig. (2-tailed)	Mean Difference	95% Interval Difference	Confidence of the

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					Lower	Upper
Delay in granting possession of site	12.122	57	0.000	1.397	1.17	1.63
Variation Order	8.074	57	0.000	0.983	0.74	1.23
Disruption	7.498	57	0.000	0.828	0.61	1.05
Delay in work progress	6.343	57	0.000	0.828	0.57	1.09
Inflation(material cost fluctuation)	6.084	57	0.000	0.914	0.61	1.21
Cash flow problem	5.696	57	0.000	0.810	0.53	1.10
Late payment	5.662	57	0.000	0.776	0.50	1.05
Security problem (hostilities, war)	5.392	57	0.000	0.793	0.50	1.09
Change in scope of work	4.789	57	0.000	0.707	0.41	1.00
Shortage of construction material	4.621	57	0.000	0.621	0.35	0.89
Design error	4.278	57	0.000	0.586	0.31	0.86
Poor planning	3.970	57	0.000	0.586	0.29	0.88
Late mobilization	3.837	57	0.000	0.552	0.26	0.84
Differing site condition	3.647	57	0.001	0.517	0.23	0.80
Adverse weather condition	3.434	57	0.001	0.448	0.19	0.71
Unforeseen ground condition	3.248	57	0.002	0.431	0.17	0.70
Shortage of equipment and spare parts	3.164	57	0.002	0.448	0.16	0.73
Late issue of instruction or clarification	2.545	57	0.014	0.328	0.07	0.59
Poor site management	2.357	57	0.022	0.379	0.06	0.70

Table 4.4 shows hierarchy of significant causes of claim in the road projects. Delay in granting of possession of site (t-value=12.122) was the first most significant causes of claim; variation order (t-value=8.004) was the second most significant causes of claim; disruption (t-value=7.498) was the third most significant causes of claim; delay in work progress (t-value=6.343) was the fourth significant causes of claim; inflation (t-value=6.084) was the fifth significant causes of claim; cash flow problem (t-value=5.696) was the sixth significant causes of claim; late payment (t-value=5.662) was the seventh significant cause of claim; security problem (t-value=5.392) was the eighth significant causes of claim; change in scope of work (t-value=4.789) was the ninth significant causes of claim; shortage of construction materials (t-value=4.621) was the tenth significant causes of claim; design error (t-value=4.278) was the eleventh significant causes of claim; poor planning (t-value=3.970) was the twelfth significant causes of claim; late mobilization (t-value=3.837) was the thirteenth significant causes of claim; differing site conditions (t-value=3.647) was the fourteenth significant causes of claim; adverse weather condition (t-value=3.434) was the fifteenth significant causes of claim; unforeseen ground condition (t-value=3.248) was the sixteenth significant causes of claim; shortage of equipment & spare parts (t-value=3.164) was the seventeenth significant cause of claim; late issue of instruction (t-value=2.545) was the eighteenth significant causes of claim; and poor site management (t-value=2.357) was the nineteenth significant causes of claim.

4.2.9 Effects of claims in the road projects

Total of sixteen effects of claims were identified and distributed to the respondent for rating by using Likert's scale of measurement. The responses of the respondents were analyzed by using one sample t-test method to identify significant effects of claims in the road projects. The result of the t-test analysis is presented in the table 4.5 below.

Table 4. 5 Result of one sample t-test for effects of claim

One-Sample Test						
Effects of claim	Test Value = 3					
	t	N-1	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper

Cost overrun	12.303	57	0.000	1.190	1.00	1.38
Time overrun	16.191	57	0.000	1.362	1.19	1.53
Stranded relation between contracting parties	2.299	57	0.025	0.276	0.04	0.52
Damage business relationship	2.349	57	0.022	0.276	0.04	0.51
Disputes	6.530	57	0.000	0.759	0.53	0.99
Project abandonment	2.288	57	0.026	0.345	0.04	0.65
Compromise of quality due to suspension	1.636	57	0.107	0.224	-0.05	0.50
Lower profitability	4.471	57	0.000	0.552	0.30	0.80
Extra expense due to litigation	1.636	57	0.107	0.224	-0.05	0.50
Suspension of work	3.318	57	0.002	0.448	0.18	0.72
Negative social impact	4.817	57	0.000	0.603	0.35	0.85
Idling of resources	6.492	57	0.000	0.741	0.51	0.97
Additional expense in managerial and administrative	2.175	57	0.034	0.293	0.02	0.56
Extended or more complex award process	-0.864	57	0.391	-0.103	-0.34	0.14

Higher tender price	1.539	57	0.129	0.224	-0.07	0.52
Rework and relocation of resources	4.271	57	0.000	0.517	0.27	0.76

Table 4.5 shows the t-value for each causes of claim in the road projects as per the response of the respondent with degree of freedom (N-1), and confidence interval of 95%.

The significant effects of claim in the road projects under the study were determined by comparing the above t- values with the critical value of t-tables. The critical value from t-table for degree of freedom 57 and confidence level of 95% is 2.003. Thus; effects of claim having t-value greater than 2.003 were considered significant in the road projects. Accordingly; 12 effects of claim were found to be significant effects of claim for road projects under the study. Those significant effects of claim were cost overrun (t-value=12.303), time overrun (t-value=16.191), stranded relation between contracting parties (t-value=2.299), damage business relationship (t-value=2.349), disputes (t-value=6.530), project abandonment (t-value=2.288), lower profitability (t-value=4.471), suspension of work (t-value=3.318), negative social impact (t-value=4.817), idling of resources (t-value=6.492), additional expense in managerial & administration (t-value=2.175), and rework & relocation of resources (t-value=4.271). The significant effects of claim, which were found to be significant based on t-test analysis, are presented in table 4.4 below.

Table 4. 6 Significant effects of claim for the road projects

Significant effects of claim	Test Value = 3					
	t	N-1	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Time overrun	16.191	57	0.000	1.362	1.19	1.53
Cost overrun	12.303	57	0.000	1.190	1.00	1.38
Disputes	6.530	57	0.000	0.759	0.53	0.99

Idling of resources	6.492	57	0.000	0.741	0.51	0.97
Negative impact	4.817	57	0.000	0.603	0.35	0.85
Lower profitability	4.471	57	0.000	0.552	0.30	0.80
Rework and relocation of resources	4.271	57	0.000	0.517	0.27	0.76
Suspension of work	3.318	57	0.002	0.448	0.18	0.72
Damage business relationship	2.349	57	0.022	0.276	0.04	0.51
Stranded relation between contracting parties	2.299	57	0.025	0.276	0.04	0.52
Project abandonment	2.288	57	0.026	0.345	0.04	0.65
Additional expense in managerial and administrative	2.175	57	0.034	0.293	0.02	0.56

Table 4.6 shows hierarchy of significant effects of claim in the study. Accordingly; time overrun (t-value=16.191) was the first most significant effect of claim; cost overrun (t-value=12.303) was the second most significant effect of claim; disputes (t-value=6.530); was the third most significant effects of claim; idling of resources (t-value=6.492) was the fourth significant effects of claim; negative social impact (t-value=4.817) was the fifth significant effects of claim; lower profitability (t-value=4.471) was the sixth significant effects of claim; rework & relocation of resources (t-value=4.271) was the seventh significant effects of claim; suspension of works (t-value=3.318) was the eighth significant effects of claim; damage business relationship (t-value=2.349) was the ninth significant effects of claim; stranded relationship between contracting parties (t-value=2.299) was the tenth significant effects of claim; project abandonment (t-value=2.288) was the eleventh significant effects of claim; and additional expenses in managerial & administrative (t-value=2.175) was the twelfth significant effects of claim.

4.2.10 Relationship for causes of claim in the road projects

The relationships between causes of claim were established by using Spearman's correlation coefficient (bivariate correlation analysis using SPSS software). Nineteen significant causes of claim were identified and these significant causes were correlated for relationship. Significant correlations were identified by using correlation table and those correlation coefficient greater than the critical coefficient value in the table were considered significant. Accordingly; for N=58 at significant level of 95%, the critical value is 0.259, and correlation coefficient greater than 0.259 were considered significant correlations. The results of the correlations are presented in tables as follows.

Table 4. 7 Correlation of delay in granting of possession of site and other causes

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Delay in granting possession of site	1.000		58
Variation order	0.470	0.000	58
Disruption	0.059	0.659	58
Delay in work progress	0.392	0.002	58
Inflation(material cost fluctuation)	0.352	0.001	58
Cash flow problem	0.352	0.007	58
Late payment	0.448	0.000	58
Security problem (hostilities, war)	0.318	0.015	58
Change in scope of work	0.229	0.084	58
Shortage of construction material	0.250	0.058	58
Design error	0.444	0.000	58
Poor planning	0.224	0.091	58
Late mobilization	0.202	0.129	58

Differing site condition	0.369	0.004	58
Adverse weather condition	0.258	0.050	58
Unforeseen ground condition	0.300	0.022	58
Shortage of equipment and spare parts	0.280	0.033	58
Late issue of instruction or clarification	0.256	0.052	58
Poor site management	0.136	0.308	58

Table 4.7 shows correlation between delay in possession of site and other significant causes of claim in the project. Accordingly; delay in possession of site had significant positive relationship with variation order ($r_s=0.470$), delay in progress of work ($r_s=0.390$), inflation ($r_s=0.352$), cash flow problem ($r_s=0.352$), late payment ($r_s=0.448$), security problem ($r_s=0.318$), design error ($r_s=0.444$), differing site condition ($r_s=0.369$), unforeseen ground condition ($r_s=0.300$), and shortage of equipment & spare parts ($r_s=0.280$).

Table 4. 8 Correlation of variation order and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Variation order	1.000		58
Delay in granting possession of site	0.470	0.000	58
Disruption	0.251	0.058	58
Delay in work progress	0.269	0.041	58
Inflation(material cost fluctuation)	0.324	0.013	58
Cash flow problem	0.211	0.112	58
Late payment	0.243	0.066	58

Security problem (hostilities, war)	0.317	0.015	58
Change in scope of work	0.432	0.001	58
Shortage of construction material	0.038	0.038	58
Design error	0.395	0.002	58
Poor planning	0.173	0.193	58
Late mobilization	0.122	0.361	58
Differing site condition	0.557	0.000	58
Adverse weather condition	0.357	0.006	58
Unforeseen ground condition	0.380	0.003	58
Shortage of equipment and spare parts	0.105	0.432	58
Late issue of instruction or clarification	0.408	0.001	58
Poor site management	0.237	0.073	58

Table 4.8 shows correlation between variation order and other significant causes of claim in the road projects. Accordingly; variation order had significant positive relationship with delay in possession of site ($r_s=0.470$), delay in work progress ($r_s=0.269$), inflation ($r_s=0.324$), security problem ($r_s=0.317$), change in scope of work ($r_s=0.432$), design error ($r_s=0.395$), differing site condition ($r_s=0.557$), adverse weather condition ($r_s=0.357$), unforeseen ground condition ($r_s=0.380$), and late issue of instruction ($r_s=0.408$).

Table 4. 9 Correlation of disruption of work and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Disruption	1.000		58

Delay in granting possession of site	0.059	0.659	58
Variation order	0.251	0.058	58
Delay in work progress	0.131	0.326	58
Inflation(material cost fluctuation)	0.114	0.393	58
Cash flow problem	0.477	0.000	58
Late payment	0.125	0.350	58
Security problem (hostilities, war)	0.251	0.058	58
Change in scope of work	0.222	0.094	58
Shortage of construction material	0.341	0.009	58
Design error	0.217	0.101	58
Poor planning	0.269	0.041	58
Late mobilization	0.313	0.017	58
Differing site condition	0.296	0.024	58
Adverse weather condition	0.252	0.057	58
Unforeseen ground condition	0.469	0.000	58
Shortage of equipment and spare parts	0.331	0.011	58
Late issue of instruction or clarification	0.306	0.019	58
Poor site management	0.278	0.034	58

Table 4.9 shows correlation of disruption of work with other significant causes of claim in the road projects. Accordingly; disruption of work had significant positive relationship with cash flow problem ($r_s=0.477$), shortage of construction material ($r_s=0.341$), poor planning ($r_s=0.269$), late mobilization ($r_s=0.313$), differing site condition ($r_s=0.296$), unforeseen ground

condition ($r_s=0.469$), shortage of equipment & spare parts ($r_s=0.331$), late issue of instruction ($r_s=0.306$), and poor site management ($r_s=0.278$).

Table 4. 10 Correlation of delay in work progress and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Delay in work progress	1.000		58
Delay in granting possession of site	0.392	0.002	58
Variation order	0.269	0.041	58
Disruption	0.131	0.326	58
Inflation(material cost fluctuation)	0.472	0.000	58
Cash flow problem	0.483	0.000	58
Late payment	0.310	0.018	58
Security problem (hostilities, war)	0.176	0.185	58
Change in scope of work	0.064	0.633	58
Shortage of construction material	0.465	0.000	58
Design error	0.370	0.004	58
Poor planning	0.817	0.000	58
Late mobilization	0.742	0.000	58
Differing site condition	0.246	0.062	58
Adverse weather condition	0.139	0.299	58
Unforeseen ground condition	0.289	0.028	58
Shortage of equipment and spare parts	0.549	0.000	58

Late issue of instruction or clarification	0.153	0.252	58
Poor site management	0.569	0.000	58

Table 4.10 shows correlation of delay in progress of work with other significant causes of claim in the road projects. Accordingly; delay in progress of work had significant positive relationship with delay in granting possession of site ($r_s=0.392$), variation order ($r_s=0.269$), inflation ($r_s=0.472$), cash flow problem ($r_s=0.483$), late payment ($r_s=0.310$), shortage of construction materials ($r_s=0.465$), design error ($r_s=0.370$), poor planning ($r_s=0.817$), late mobilization ($r_s=0.742$), unforeseen ground condition ($r_s=0.289$), shortage of equipment & spare parts ($r_s=0.549$), and poor site management ($r_s=0.569$).

Table 4. 11 Correlation of inflation and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Inflation(material cost fluctuation)	1.000		58
Delay in granting possession of site	0.412	0.001	58
Variation order	0.324	0.013	58
Disruption	0.114	0.393	58
Delay in work progress	0.472	0.000	58
Cash flow problem	0.538	0.000	58
Late payment	0.369	0.004	58
Security problem (hostilities, war)	0.336	0.010	58
Change in scope of work	-0.004	0.974	58
Shortage of construction material	0.461	0.000	58

Design error	0.055	0.681	58
Poor planning	0.305	0.020	58
Late mobilization	0.313	0.017	58
Differing site condition	0.121	0.367	58
Adverse weather condition	0.414	0.001	58
Unforeseen ground condition	0.152	0.256	58
Shortage of equipment and spare parts	0.446	0.000	58
Late issue of instruction or clarification	0.280	0.033	58
Poor site management	0.312	0.017	58

Table 4.11 shows correlation of inflation with other significant causes of claim in the road projects. Accordingly; inflation had significant positive relationship with delay in possession of site ($r_s = 0.412$), variation order ($r_s = 0.324$), delay in work progress ($r_s = 0.472$), cash flow problem ($r_s = 0.538$), late payment ($r_s = 0.369$), security problem ($r_s = 0.336$), shortage of construction materials ($r_s = 0.461$), poor planning ($r_s = 0.305$), late mobilization ($r_s = 0.313$), adverse weather condition ($r_s = 0.414$), shortage of equipment ($r_s = 0.446$), late issue of instruction ($r_s = 0.280$), and poor site management ($r_s = 0.312$).

Table 4. 12 Correlation of cash flow problem and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Cash flow problem	1.000		58
Delay in granting possession of site	0.352	0.007	58
Variation order	0.211	0.112	58
Disruption	0.477	0.000	58

Delay in work progress	0.483	0.000	58
Inflation(material cost fluctuation)	0.538	0.000	58
Late payment	0.522	0.000	58
Security problem (hostilities, war)	0.538	0.000	58
Change in scope of work	0.224	0.091	58
Shortage of construction material	0.698	0.000	58
Design error	0.311	0.017	58
Poor planning	0.489	0.000	58
Late mobilization	0.576	0.000	58
Differing site condition	0.363	0.005	58
Adverse weather condition	0.504	0.000	58
Unforeseen ground condition	0.437	0.001	58
Shortage of equipment and spare parts	0.608	0.000	58
Late issue of instruction or clarification	0.346	0.008	58
Poor site management	0.452	0.000	58

Table 4.12 shows correlation of cash flow problem with other significant causes of claim in the road projects. Accordingly; cash flow problem had significant positive relationship with delay in possession of site ($r_s=0.352$), disruption of work ($r_s=0.477$), delay in work progress ($r_s=0.483$), inflation ($r_s=0.538$), late payment ($r_s=0.522$), security problem ($r_s=0.538$), shortage of construction materials ($r_s=0.698$), design error ($r_s=0.311$), poor planning ($r_s=0.489$), late mobilization ($r_s=0.576$), differing site condition ($r_s=0.363$), adverse weather condition ($r_s=0.504$), unforeseen ground condition ($r_s=0.437$), shortage of equipment & spare parts ($r_s=0.608$), late issue of instruction ($r_s=0.346$), and poor site management ($r_s=0.452$).

Table 4. 13 Correlation of late payment and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Late payment	1.000		58
Delay in granting possession of site	0.448	0.000	58
Variation order	0.243	0.066	58
Disruption	0.125	0.350	58
Delay in work progress	0.310	0.018	58
Inflation(material cost fluctuation)	0.369	0.004	58
Cash flow problem	0.522	0.000	58
Security problem (hostilities, war)	0.482	0.000	58
Change in scope of work	0.033	0.808	58
Shortage of construction material	0.484	0.000	58
Design error	0.354	0.006	58
Poor planning	0.258	0.051	58
Late mobilization	0.317	0.015	58
Differing site condition	0.499	0.000	58
Adverse weather condition	0.429	0.001	58
Unforeseen ground condition	0.429	0.001	58
Shortage of equipment and spare parts	0.446	0.000	58
Late issue of instruction or clarification	0.351	0.007	58

Poor site management	0.239	0.071	58
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Table 4.13 shows correlation of late payment with other significant causes of claim in the road projects. Accordingly; late payment had significant positive relationship with delay in possession of site ($r_s=0.448$), delay in work progress ($r_s=0.310$), inflation ($r_s=0.369$), cash flow problem ($r_s=0.522$), security problem ($r_s=0.482$), shortage of construction materials ($r_s=0.484$), design error ($r_s=0.354$), late mobilization ($r_s=0.317$), differing site condition ($r_s=0.499$), adverse weather condition ($r_s=0.429$), unforeseen ground condition ($r_s=0.429$), shortage of equipment & spare parts ($r_s=0.446$), and late issue of instruction ($r_s=0.351$).

Table 4. 14 Correlation of security problem and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Security problem (hostilities, war)	1.000		58
Delay in granting possession of site	0.318	0.015	58
Variation order	0.317	0.015	58
Disruption	0.251	0.058	58
Delay in work progress	0.176	0.185	58
Inflation(material cost fluctuation)	0.336	0.010	58
Cash flow problem	0.538	0.000	58
Late payment	0.482	0.000	58
Change in scope of work	0.155	0.244	58
Shortage of construction material	0.457	0.000	58
Design error	0.372	0.004	58
Poor planning	0.219	0.099	58
Late mobilization	0.290	0.027	58

Differing site condition	0.390	0.002	58
Adverse weather condition	0.548	0.000	58
Unforeseen ground condition	0.523	0.000	58
Shortage of equipment and spare parts	0.425	0.001	58
Late issue of instruction or clarification	0.366	0.005	58
Poor site management	0.357	0.006	58

Table 4.14 shows correlation of security problem with other significant causes of claim in the road projects. Accordingly; security problem had significant positive relationship with delay in possession of site ($r_s=0.318$), variation order ($r_s=0.317$), inflation ($r_s=0.336$), cash flow problem ($r_s=0.538$), late payment ($r_s=0.482$), shortage of construction materials ($r_s=0.457$), design error ($r_s=0.372$), late mobilization ($r_s=0.290$), differing site condition ($r_s=0.390$), adverse weather condition ($r_s=0.548$), unforeseen ground condition ($r_s=0.523$), shortage of equipments & spare parts ($r_s=0.425$), late issue of instruction ($r_s=0.366$), and poor site management ($r_s=0.357$).

Table 4. 15 Correlation of change in scope of work and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Change in scope of work	1.000		58
Delay in granting possession of site	0.229	0.084	58
Variation order	0.432	0.001	58
Disruption	0.222	0.094	58
Delay in work progress	0.064	0.633	58

Inflation(material cost fluctuation)	-0.004	0.974	58
Cash flow problem	0.224	0.091	58
Late payment	0.033	0.808	58
Security problem (hostilities, war)	0.155	0.244	58
Shortage of construction material	0.063	0.639	58
Design error	0.278	0.035	58
Poor planning	-0.060	0.653	58
Late mobilization	0.011	0.933	58
Differing site condition	0.383	0.003	58
Adverse weather condition	0.154	0.249	58
Unforeseen ground condition	0.210	0.113	58
Shortage of equipment and spare parts	-0.026	0.846	58
Late issue of instruction or clarification	0.324	0.013	58
Poor site management	0.065	0.626	58

Table 4.15 shows correlation of change in scope of work with other significant causes of claim in the projects. Accordingly; change in scope of works had significant positive relationship with variation order ($r_s=0.432$), design error ($r_s=0.278$), differing site condition ($r_s=0.383$), and late issue of instruction ($r_s=0.324$).

Table 4. 16 Correlation of shortage of construction materials and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
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Shortage of construction material	1.000		58
Delay in granting possession of site	0.250	0.058	58
Variation order	0.038	0.778	58
Disruption	0.341	0.009	58
Delay in work progress	0.465	0.000	58
Inflation(material cost fluctuation)	0.461	0.000	58
Cash flow problem	0.698	0.000	58
Late payment	0.484	0.000	58
Security problem (hostilities, war)	0.457	0.000	58
Change in scope of work	0.063	0.639	58
Design error	0.255	0.053	58
Poor planning	0.408	0.001	58
Late mobilization	0.635	0.000	58
Differing site condition	0.221	0.095	58
Adverse weather condition	0.378	0.003	58
Unforeseen ground condition	0.543	0.000	58
Shortage of equipment and spare parts	0.778	0.000	58
Late issue of instruction or clarification	0.278	0.035	58
Poor site management	0.507	0.000	58

Table 4.16 shows correlation of shortage of materials with other causes of claim of the road projects. Accordingly; shortage of construction materials had significant positive relationship

with disruption of work ($r_s=0.341$), delay in progress of work ($r_s=0.465$), inflation ($r_s=0.461$), cash flow problem ($r_s=0.698$), late payment ($r_s=0.484$), security problem ($r_s=0.457$), poor planning ($r_s=0.408$), late mobilization ($r_s=0.635$), adverse weather condition ($r_s=0.378$), unforeseen ground condition ($r_s=0.543$), shortage of equipment & spare parts ($r_s=0.778$), late issue of instruction, and poor site management ($r_s=0.507$).

Table 4. 17 Correlation of design error and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Design error	1.000		
Delay in granting possession of site	0.444	0.000	58
Variation order	0.395	0.002	58
Disruption	0.217	0.101	58
Delay in work progress	0.370	0.004	58
Inflation(material cost fluctuation)	0.055	0.681	58
Cash flow problem	0.311	0.017	58
Late payment	0.354	0.006	58
Security problem (hostilities, war)	0.372	0.004	58
Change in scope of work	0.278	0.035	58
Shortage of construction material	0.255	0.053	58
Poor planning	0.425	0.001	58
Late mobilization	0.347	0.008	58
Differing site condition	0.508	0.000	58
Adverse weather condition	0.294	0.025	58
Unforeseen ground condition	0.534	0.000	58

Shortage of equipment and spare parts	0.344	0.008	58
Late issue of instruction or clarification	0.425	0.001	58
Poor site management	0.394	0.002	58

Table 4.17 shows the correlation of design error with other causes of claim in the road projects. Accordingly; design error had significant positive relationship with delay in possession of site ($r_s=0.444$), variation order ($r_s=0.395$), delay in work progress ($r_s=0.370$), cash flow problem ($r_s=0.311$), late payment ($r_s=0.354$), security problem ($r_s=0.372$), change in scope of work ($r_s=0.278$), poor planning ($r_s=0.425$), late mobilization ($r_s=0.347$), differing site condition ($r_s=0.508$), adverse weather condition ($r_s=0.294$), unforeseen ground condition ($r_s=0.534$), shortage of equipment & spare parts ($r_s=0.344$), late issue of instruction ($r_s=0.425$), and poor site management ($r_s=0.394$).

Table 4. 18 Correlation of poor planning and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Poor planning	1.000		58
Delay in granting possession of site	0.224	0.091	58
Variation order	0.173	0.193	58
Disruption	0.269	0.041	58
Delay in work progress	0.817	0.000	58
Inflation(material cost fluctuation)	0.305	0.020	58
Cash flow problem	0.489	0.000	58
Late payment	0.258	0.051	58
Security problem (hostilities, war)	0.219	0.099	58

Change in scope of work	-0.060	0.653	58
Shortage of construction material	0.408	0.001	58
Design error	0.425	0.001	58
Late mobilization	0.809	0.000	58
Differing site condition	0.235	0.075	58
Adverse weather condition	0.140	0.294	58
Unforeseen ground condition	0.355	0.006	58
Shortage of equipment and spare parts	0.561	0.000	58
Late issue of instruction or clarification	0.195	0.142	58
Poor site management	0.725	0.000	58

Table 4.18 shows correlation of poor planning with other significant causes of claim in the road projects. Accordingly; poor planning had significant positive relationship with disruption of work ($r_s=0.269$), delay in work progress ($r_s=0.817$), inflation ($r_s=0.305$), cash flow problem ($r_s=0.489$), shortage of construction materials ($r_s=0.408$), design error ($r_s=0.425$), late mobilization ($r_s=0.809$), unforeseen ground condition ($r_s=0.355$), shortage of equipment & spare parts ($r_s=0.561$), and poor site management ($r_s=0.725$).

Table 4. 19 Correlation of late mobilization and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Late mobilization	1.000		
Delay in granting possession of site	0.202	0.129	58

Variation order	0.122	0.361	58
Disruption	0.313	0.017	58
Delay in work progress	0.742	0.000	58
Inflation(material cost fluctuation)	0.313	0.017	58
Cash flow problem	0.576	0.000	58
Late payment	0.317	0.015	58
Security problem (hostilities, war)	0.290	0.027	58
Change in scope of work	0.011	0.933	58
Shortage of construction material	0.635	0.000	58
Design error	0.347	0.008	58
Poor planning	0.809	0.000	58
Differing site condition	0.326	0.012	58
Adverse weather condition	0.216	0.103	58
Unforeseen ground condition	0.445	0.000	58
Shortage of equipment and spare parts	0.664	0.000	58
Late issue of instruction or clarification	0.200	0.133	58
Poor site management	0.833	0.000	58

Table 4.19 shows correlation of late mobilization with other significant causes of claim in the road projects. Accordingly; late mobilization had significant positive relationship with disruption of work ($r_s=0.313$), delay in progress of work ($r_s=0.742$), inflation ($r_s=0.313$), cash flow problem ($r_s=0.576$), late payment ($r_s=0.317$), security problem ($r_s=0.290$), shortage of construction material ($r_s=0.635$), design error ($r_s=0.347$), poor planning ($r_s=0.809$), differing

site condition ($r_s=0.326$), unforeseen ground condition ($r_s=0.445$), shortage of equipment & spare parts ($r_s=0.664$), and poor site management ($r_s=0.833$).

Table 4. 20 Correlation of differing site condition and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Differing site condition	1.000		58
Delay in granting possession of site	0.369	0.004	58
Variation order	0.557	0.000	58
Disruption	0.296	0.024	58
Delay in work progress	0.246	0.062	58
Inflation(material cost fluctuation)	0.121	0.367	58
Cash flow problem	0.363	0.005	58
Late payment	0.499	0.000	58
Security problem (hostilities, war)	0.390	0.002	58
Change in scope of work	0.383	0.003	58
Shortage of construction material	0.221	0.095	58
Design error	0.508	0.000	58
Poor planning	0.235	0.075	58
Late mobilization	0.326	0.012	58
Adverse weather condition	0.329	0.012	58
Unforeseen ground condition	0.449	0.000	58
Shortage of equipment and spare parts	0.299	0.023	58

Late issue of instruction or clarification	0.504	0.000	58
Poor site management	0.284	0.031	58

Table 4.20 shows correlation of differing site condition with other causes of claim. Accordingly; differing site condition had significant positive relationship with delay in possession of site ($r_s=0.369$), variation order ($r_s=0.557$), disruption of work ($r_s=0.296$), cash flow problem ($r_s=0.363$), late payment ($r_s=0.499$), security problem ($r_s=0.390$), change in scope of work ($r_s=0.383$), design error ($r_s=0.508$), late mobilization ($r_s=0.326$), adverse weather condition ($r_s=0.329$), unforeseen weather condition ($r_s=0.449$), shortage of equipment ($r_s=0.299$), late issue of instruction ($r_s=0.504$), and poor site management ($r_s=0.284$).

Table 4. 21 Correlation of adverse weather condition and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Adverse weather condition	1.000		58
Delay in granting possession of site	0.258	0.050	58
Variation order	0.357	0.006	58
Disruption	0.252	0.057	58
Delay in work progress	0.139	0.299	58
Inflation(material cost fluctuation)	0.414	0.001	58
Cash flow problem	0.504	0.000	58
Late payment	0.429	0.001	58
Security problem (hostilities, war)	0.548	0.000	58
Change in scope of work	0.154	0.249	58

Shortage of construction material	0.378	0.003	58
Design error	0.294	0.025	58
Poor planning	0.140	0.294	58
Late mobilization	0.216	0.103	58
Differing site condition	0.329	0.012	58
Unforeseen ground condition	0.369	0.004	58
Shortage of equipment and spare parts	0.243	0.066	58
Late issue of instruction or clarification	0.490	0.000	58
Poor site management	0.198	0.136	58

Table 4.21 shows correlation of adverse weather condition with other significant causes of claim in the road projects. Accordingly; adverse weather condition had significant positive relationship with variation order ($r_s=0.357$), inflation ($r_s=0.414$), cash flow problem ($r_s=0.504$), late payment ($r_s=0.429$), security problem ($r_s=0.548$), shortage of construction material ($r_s=0.378$), design error ($r_s=0.294$), differing site condition ($r_s=0.329$), unforeseen ground condition ($r_s=0.369$), and late issue of instruction ($r_s=0.490$).

Table 4. 22 Correlation of unforeseen ground condition and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Unforeseen ground condition	1.000		
Delay in granting possession of site	0.300	0.022	58
Variation order	0.380	0.003	58
Disruption	0.469	0.000	58

Delay in work progress	0.289	0.028	58
Inflation(material cost fluctuation)	0.152	0.256	58
Cash flow problem	0.437	0.001	58
Late payment	0.429	0.001	58
Security problem (hostilities, war)	0.523	0.000	58
Change in scope of work	0.210	0.113	58
Shortage of construction material	0.543	0.000	58
Design error	0.534	0.000	58
Poor planning	0.355	0.006	58
Late mobilization	0.445	0.000	58
Differing site condition	0.449	0.000	58
Adverse weather condition	0.369	0.004	58
Shortage of equipment and spare parts	0.488	0.000	58
Late issue of instruction or clarification	0.393	0.002	58
Poor site management	0.541	0.000	58

Table 4.22 shows correlation of unforeseen ground condition with other significant causes of claim in the road projects. Accordingly; unforeseen ground condition had significant positive relationship with delay in possession of site ($r_s=0.300$), variation order ($r_s=0.380$), disruption of work ($r_s=0.469$), delay in work progress ($r_s=0.289$), cash flow problem ($r_s=0.437$), late payment ($r_s=0.429$), security problem ($r_s=0.523$), shortage of construction materials ($r_s=0.543$), design error ($r_s=0.534$), poor planning ($r_s=0.355$), late mobilization ($r_s=0.445$), differing site condition ($r_s=0.449$), adverse weather condition ($r_s=0.369$), shortage of

equipment & spare parts ($r_s=0.488$), late issue of instruction ($r_s=0.393$), and poor site management ($r_s=0.541$).

Table 4. 23 Correlation of shortage of equipment & spares and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Shortage of equipment and spare parts	1.000		
Delay in granting possession of site	0.280	0.033	58
Variation order	0.105	0.432	58
Disruption	0.331	0.011	58
Delay in work progress	0.549	0.000	58
Inflation(material cost fluctuation)	0.446	0.000	58
Cash flow problem	0.608	0.000	58
Late payment	0.446	0.000	58
Security problem (hostilities, war)	0.425	0.001	58
Change in scope of work	-0.026	0.846	58
Shortage of construction material	0.778	0.000	58
Design error	0.344	0.008	58
Poor planning	0.561	0.000	58
Late mobilization	0.664	0.000	58
Differing site condition	0.299	0.023	58
Adverse weather condition	0.243	0.066	58
Unforeseen ground condition	0.488	0.000	58

Late issue of instruction or clarification	0.150	0.262	58
Poor site management	0.511	0.000	58

Table 4.23 shows correlation of shortage of equipment & spare parts with other significant causes of claim in the road projects. Accordingly; shortage of equipment & spare parts had significant positive relationship with delay in possession of site ($r_s=0.280$), disruption of work ($r_s=0.331$), delay in work progress ($r_s=0.549$), inflation ($r_s=0.446$), cash flow problem ($r_s=0.608$), late payment ($r_s=0.446$), security problem ($r_s=0.425$), shortage of construction materials ($r_s=0.778$), design error ($r_s=0.344$), poor planning ($r_s=0.561$), late mobilization ($r_s=0.664$), differing site condition ($r_s=0.299$), unforeseen ground condition ($r_s=0.488$), and poor site management ($r_s=0.511$).

Table 4. 24 Correlation of late issue of instruction and other causes of claim

Significant causes of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Late issue of instruction or clarification	1.000		
Delay in granting possession of site	0.256	0.052	58
Variation order	0.408	0.001	58
Disruption	0.306	0.019	58
Delay in work progress	0.153	0.252	58
Inflation(material cost fluctuation)	0.280	0.033	58
Cash flow problem	0.346	0.008	58
Late payment	0.351	0.007	58
Security problem (hostilities, war)	0.366	0.005	58
Change in scope of work	0.324	0.013	58

Shortage of construction material	0.278	0.035	58
Design error	0.425	0.001	58
Poor planning	0.195	0.142	58
Late mobilization	0.200	0.133	58
Differing site condition	0.504	0.000	58
Adverse weather condition	0.490	0.000	58
Unforeseen ground condition	0.393	0.002	58
Shortage of equipment and spare parts	0.150	0.262	58
Poor site management	0.349	0.007	58

Table 4.24 shows correlation of late issue of instruction with other significant causes of claim in the road projects. Accordingly; late issue of instruction had significant positive relationship with variation order ($r_s=0.408$), disruption of work ($r_s=0.308$), inflation ($r_s=0.280$), cash flow problem ($r_s=0.346$), late payment ($r_s=0.351$), security problem ($r_s=0.366$), change in scope of work ($r_s=0.324$), shortage of construction materials ($r_s=0.278$), design error ($r_s=0.425$), differing site condition ($r_s=0.504$), adverse weather condition ($r_s=0.490$), unforeseen ground condition ($r_s=0.393$), and poor site management ($r_s=0.349$).

Table 4. 25 Correlation of poor site management and other causes of claim

Significant causes of claim	Spearman's rho correlation coefficients	Sig (2-tailed)	N
Poor site management	1.000		
Delay in granting possession of site	0.136	0.308	58
Variation order	0.237	0.073	58
Disruption	0.278	0.034	58

Delay in work progress	0.569	0.000	58
Inflation(material cost fluctuation)	0.312	0.017	58
Cash flow problem	0.452	0.000	58
Late payment	0.239	0.071	58
Security problem (hostilities, war)	0.357	0.006	58
Change in scope of work	0.065	0.626	58
Shortage of construction material	0.507	0.000	58
Design error	0.394	0.002	58
Poor planning	0.725	0.000	58
Late mobilization	0.833	0.000	58
Differing site condition	0.284	0.031	58
Adverse weather condition	0.198	0.136	58
Unforeseen ground condition	0.541	0.000	58
Shortage of equipment and spare parts	0.511	0.000	58
Late issue of instruction or clarification	0.349	0.007	58

Table 4.25 shows correlation of poor site management with other significant causes of claim. Accordingly; poor site management had significant positive relationship with disruption of work ($r_s=0.278$), delay in progress of work ($r_s=0.569$), inflation ($r_s=0.312$), cash flow problem ($r_s=0.452$), security problem ($r_s=0.357$), shortage of construction materials ($r_s=0.507$), design error ($r_s=0.394$), poor planning ($r_s=0.725$), late mobilization ($r_s=0.833$), differing site condition ($r_s=0.284$), unforeseen ground condition ($r_s=0.541$), shortage of equipment & spare parts ($r_s=0.511$), and late issue of instruction ($r_s=0.349$).

4.2.11 A Relationship Model for causes of claim in the Road Projects

After the relationships between causes of claim were established by using Spearman's correlation coefficient method; these relationships were depicted in graphical model. The significant causes of claim identified in the study as per their ranking order were delay in granting possession of site, variation order, disruption of work, delay in progress of work, inflation, cash flow problem, late payment, security problem, change in scope of work, shortage of construction materials, design error, poor planning, late mobilization, differing site condition, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. These causes of claim were coded for easy presentation in graphical model as follows.

- C1 for delay in granting possession of site
- C2 for variation order
- C3 for disruption of work
- C4 for delay in work progress
- C5 for inflation
- C6 for cash flow problem
- C7 for late payment
- C8 for security problem
- C9 for change in scope of work
- C10 for shortage of construction material
- C11 for design error
- C12 for poor planning
- C13 for late mobilization
- C14 for differing site condition
- C15 for adverse weather condition
- C16 for unforeseen ground condition
- C17 for shortage of equipment & spare parts
- C18 for late issue of instruction
- C19 for poor site management

The graphical model consists of nodes and undirected lines. The nodes represent causes of claim and the undirected lines represent relationship b/n each nodes. The significant

relationships between causes of claim were established and the causes of claim were arranged systematically to form chain of relationship forming loop in the model. C2 was connected to C1; C1 was connected to C4; C4 was connected to C5; C5 was connected to C6; C6 was connected to C7; C7 was connected to C8; C8 was connected to C10; C10 was connected to C12; C12 was connected to C11; C11 was connected to C9; C9 was connected to C18; C18 was connected to C3; C3 was connected to C17; C17 was connected to C16; C16 was connected to C19; C19 was connected to C13; C13 was connected to C14; C14 was connected to C15; C15 was connected to C2 based on their relationship to form loop chain of relationship. The significant relationship established in this study showed moderate to high degree of relationship. The orders of arrangement of causes of claim that formed loop chain of relation were as follows.

- C2 (variation order)
- C1 (delay in granting possession of site)
- C4 (delay in work progress)
- C5 (inflation)
- C6 (cash flow problem)
- C7 (late payment)
- C8 (security problem)
- C10 (shortage of construction materials)
- C12 (poor planning)
- C11(design error)
- C9 (change in scope of work)
- C18 (late issue of instruction)
- C3 (disruption of work)
- C17 (shortage of equipment & spare parts)
- C16 (unforeseen ground condition)
- C19 (poor site management)
- C13 (late mobilization)
- C14 (differing site condition)
- C15 (adverse weather condition)
- C2 (variation order)

Thus; the relationships between causes of claim in the study was modeled as shown below.

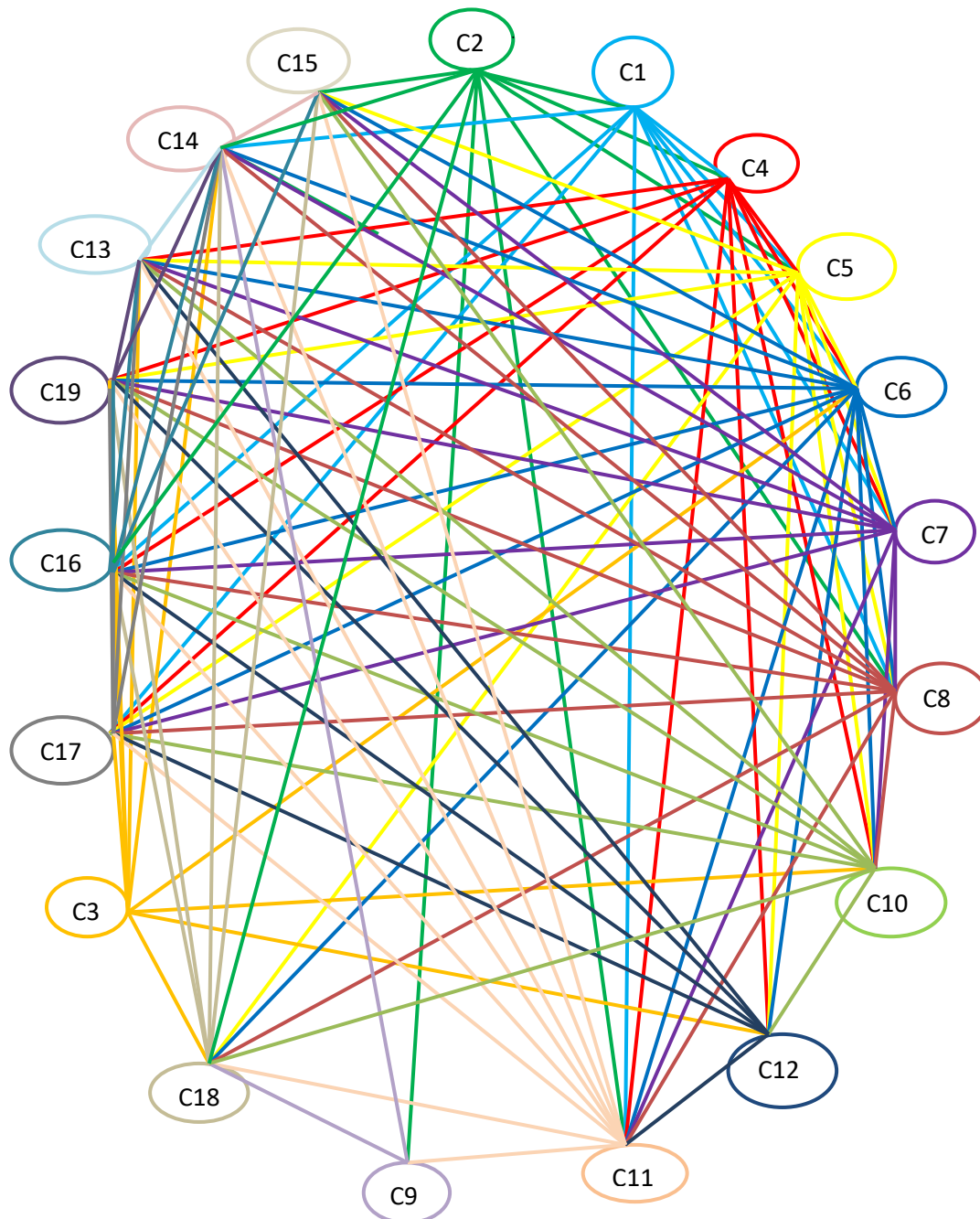


Figure4. 6 Relationship model for causes of claim

Figure 4.6 shows relationship between causes of claim graphically. The nodes represent causes of claim. The undirected lines represent relationships b/n the causes of claim and the relationships are vise versa. The presence of line connecting the nodes represents significant

positive relationships (moderate to high degree of relationship), whereas, the absence of line b/n nodes indicates no relationship or insignificant relationship exists between the nodes.

4.2.12 Relationships for Effects of claim in the Road Projects

The relationships between effects of claim were established by using Spearman's correlation coefficient (bivariate correlation analysis using SPSS software). Twelve significant effects of claim were identified and these significant were correlated for relationship. The results of the correlations are presented in tables as follows.

Table 4. 26 Correlation of time overrun and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	1.000		58
Cost overrun	0.858	0.000	58
Disputes	0.467	0.000	58
Idling of resources	0.431	0.001	58
Negative social impact	0.443	0.000	58
Lower profitability	0.319	0.015	58
Rework and relocation of resources	0.418	0.001	58
Suspension of work	0.404	0.002	58
Damage business relationship	0.349	0.007	58
Stranded relation between contracting parties	0.328	0.012	58
Project abandonment	0.438	0.001	58
Additional expense in managerial and administrative	0.436	0.001	58

Table 4.26 shows correlation of time overrun with other significant effects of the road projects. Accordingly; time overrun had significant positive relationship with cost overrun($r_s=0.858$), disputes ($r_s=0.467$), idling of resources ($r_s=0.431$), negative social impacts ($r_s=0.4430$), lower profitability ($r_s=0.319$), rework & relocation of resources ($r_s=0.418$), suspension of work ($r_s=0.404$), damage of business relationship ($r_s=0.349$), stranded relationship ($r_s=0.328$), project abandonment ($r_s=0.438$), and additional expense in managerial & administrative ($r_s=0.436$).

Table 4. 27 Correlation of cost overrun and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Cost overrun	1.000		58
Time overrun	0.858	0.000	58
Disputes	0.500	0.000	58
Idling of resources	0.353	0.007	58
Negative social impact	0.488	0.000	58
Lower profitability	0.265	0.044	58
Rework and relocation of resources	0.450	0.000	58
Suspension of work	0.503	0.000	58
Damage business relationship	0.401	0.002	58
Stranded relation between contracting parties	0.347	0.008	58
Project abandonment	0.528	0.000	58
Additional expense in managerial and administrative	0.378	0.003	58

Table 4.27 shows correlation of cost overrun with other significant effects of claim in the road projects. Accordingly; cost overrun had significant positive relationship with time overrun ($r_s=0.858$), disputes ($r_s=0.500$), idling of resources ($r_s=0.353$), negative social impacts ($r_s=0.488$), lower profitability ($r_s=0.265$), rework & relocation of resources ($r_s=0.450$), suspension of work ($r_s=0.503$), damage of business relationship ($r_s=0.401$), stranded relationship b/n contracting parties ($r_s=0.347$), project abandonment ($r_s=0.528$), and additional expense in managerial & administrative ($r_s=0.378$).

Table 4. 28 Correlation of disputes and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Disputes	1.000		58
Time overrun	0.467	0.000	58
Cost overrun	0.500	0.000	58
Idling of resources	0.317	0.015	58
Negative social impact	0.515	0.000	58
Lower profitability	0.171	0.199	58
Rework and relocation of resources	0.544	0.000	58
Suspension of work	0.712	0.000	58
Damage business relationship	0.673	0.000	58
Stranded relation between contracting parties	0.463	0.000	58
Project abandonment	0.787	0.000	58
Additional expense in managerial and administrative	0.344	0.008	58

Table 4.28 shows correlation of disputes with other significant effects of claim in the road projects. Accordingly; disputes had significant positive relationship with time overrun ($r_s=0.4670$), cost overrun ($r_s=0.500$), idling of resources ($r_s=0.317$), negative social impacts ($r_s=0.515$), rework & relocation of resources ($r_s=0.544$), suspension of work ($r_s=0.712$), damage business relationship ($r_s=0.675$), stranded relationship b/n contracting parties ($r_s=0.463$), project abandonment ($r_s=0.787$), and additional expenses in managerial & administrative ($r_s=0.344$).

Table 4. 29 Correlation of idling of resources and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Idling of resources	1.000		58
Time overrun	0.431	0.001	58
Cost overrun	0.353	0.007	58
Disputes	0.317	0.015	58
Negative social impact	0.343	0.008	58
Lower profitability	0.246	0.063	58
Rework and relocation of resources	0.354	0.006	58
Suspension of work	0.309	0.018	58
Damage business relationship	0.176	0.188	58
Stranded relation between contracting parties	0.135	0.311	58
Project abandonment	0.335	0.010	58
Additional expense in managerial and administrative	0.378	0.003	58

Table 4.29 shows correlation of idling of resources with other effects of claim in the road projects. Accordingly; idling of resources had significant positive relationship with time overrun ($r_s=0.431$), cost overrun ($r_s=0.353$), disputes ($r_s=0.317$), negative social impact ($r_s=0.343$), rework & relocation of resources ($r_s=0.354$), suspension of work ($r_s=0.309$), project abandonment ($r_s=0.335$), and additional expenses in managerial & administrative ($r_s=0.378$).

Table 4. 30 Correlation of negative social impacts and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Negative social impact	1.000		58
Time overrun	0.443	0.000	58
Cost overrun	0.488	0.000	58
Disputes	0.515	0.000	58
Idling of resources	0.343	0.008	58
Lower profitability	0.210	0.114	58
Rework and relocation of resources	0.587	0.000	58
Suspension of work	0.605	0.000	58
Damage business relationship	0.431	0.001	58
Stranded relation between contracting parties	0.365	0.005	58
Project abandonment	0.522	0.000	58
Additional expense in managerial and administrative	0.540	0.000	58

Table 4.30 shows correlation of negative social impact with other significant effects of claim in the road projects. Accordingly; negative social impact had significant positive relationship with time overrun ($r_s=0.443$), cost overrun ($r_s=0.488$), disputes ($r_s=0.515$), idling of resources ($r_s=0.343$), rework & relocation of resources ($r_s=0.587$), suspension of work ($r_s=0.605$), damage business relationship ($r_s=0.431$), stranded relationship b/n contracting parties ($r_s=0.365$), project abandonment ($r_s=0.522$), and additional expenses in managerial & administrative ($r_s=0.540$).

Table 4. 31 Correlation of lower profitability and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Lower profitability	1.000		58
Time overrun	0.319	0.015	58
Cost overrun	0.265	0.044	58
Disputes	0.171	0.199	58
Idling of resources	0.246	0.063	58
Negative social impact	0.210	0.114	58
Rework and relocation of resources	0.309	0.018	58
Suspension of work	0.337	0.010	58
Damage business relationship	0.118	0.376	58
Stranded relation between contracting parties	0.017	0.900	58
Project abandonment	0.264	0.045	58
Additional expense in managerial and administrative	0.391	0.002	58

Table 4.31 shows correlation of lower profitability with other effects of claim in the studied road projects. Accordingly; lower profitability had significant positive relationship with time overrun ($r_s=0.319$), cost overrun ($r_s=0.265$), rework & relocation of resources ($r_s=0.309$), suspension of work ($r_s=0.337$), project abandonment ($r_s=0.264$), and additional expenses in managerial & administrative ($r_s=0.391$).

Table 4. 32 Correlation of rework & relocation of resources and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Rework and relocation of resources	1.000		58
Time overrun	0.418	0.001	58
Cost overrun	0.450	0.000	58
Disputes	0.544	0.000	58
Idling of resources	0.354	0.006	58
Negative social impact	0.587	0.000	58
Lower profitability	0.309	0.018	58
Suspension of work	0.469	0.000	58
Damage business relationship	0.487	0.000	58
Stranded relation between contracting parties	0.250	0.059	58
Project abandonment	0.520	0.000	58
Additional expense in managerial and administrative	0.456	0.000	58

Table 4.32 shows correlation of rework & relocation of resources with other significant effects of claim in the studied road projects. Accordingly; rework & relocation of resources

had significant positive relationship with time overrun ($r_s=0.418$), cost overrun ($r_s=0.450$), disputes ($r_s=0.544$), idling of resources ($r_s=0.354$), negative social impacts ($r_s=0.587$), lower profitability ($r_s=0.3090$), suspension of works ($r_s=0.469$), damage of business relationship ($r_s=0.487$), project abandonment ($r_s=0.520$), and additional expenses in managerial & administrative ($r_s=0.456$).

Table 4. 33 Correlation of suspension of works and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Suspension of work	1.000		58
Time overrun	0.404	0.002	58
Cost overrun	0.503	0.000	58
Disputes	0.712	0.000	58
Idling of resources	0.309	0.018	58
Negative social impact	0.605	0.000	58
Lower profitability	0.337	0.010	58
Rework and relocation of resources	0.469	0.000	58
Damage business relationship	0.516	0.000	58
Stranded relation between contracting parties	0.376	0.004	58
Project abandonment	0.777	0.000	58
Additional expense in managerial and administrative	0.308	0.019	58

Table 4.33 shows correlation of suspension of works with other significant effects of claim in the studied road projects. Accordingly; suspension of works had significant positive

relationship with time overrun ($r_s=0.404$), cost overrun ($r_s=0.503$), disputes ($r_s=0.712$), idling of resources ($r_s=0.309$), negative social impacts ($r_s=0.605$), lower profitability ($r_s=0.337$), rework & relocation of resources ($r_s=0.469$), damage of business relationship ($r_s=0.516$), stranded relationship b/n contracting parties ($r_s=0.376$), project abandonment ($r_s=0.777$), and additional expenses in managerial & administrative ($r_s=0.308$).

Table 4. 34 Correlation of damage business relationship and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Damage business relationship	1.000		58
Time overrun	0.349	0.007	58
Cost overrun	0.401	0.002	58
Disputes	0.673	0.000	58
Idling of resources	0.176	0.188	58
Negative social impact	0.431	0.001	58
Lower profitability	0.118	0.376	58
Rework and relocation of resources	0.487	0.000	58
Suspension of work	0.516	0.000	58
Stranded relation between contracting parties	0.641	0.000	58
Project abandonment	0.653	0.000	58
Additional expense in managerial and administrative	0.376	0.004	58

Table 4.34 shows correlation of damage of business relationship with other significant effects of claim in the studied road projects. Accordingly; damage of business relation had

significant positive relationship with time overrun ($r_s = 0.349$), cost overrun ($r_s = 0.401$), disputes ($r_s = 0.673$), negative social impacts ($r_s = 0.431$), rework & relocation of resources ($r_s = 0.487$), suspension of works ($r_s = 0.516$), stranded relationship b/n contracting parties ($r_s = 0.641$), project abandonment ($r_s = 0.653$), and additional expenses in managerial & administrative ($r_s = 0.376$).

Table 4. 35 Correlation of stranded relationship and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Stranded relation between contracting parties	1.000		58
Time overrun	0.328	0.012	58
Cost overrun	0.347	0.008	58
Disputes	0.463	0.000	58
Idling of resources	0.135	0.311	58
Negative social impact	0.365	0.005	58
Lower profitability	0.017	0.900	58
Rework and relocation of resources	0.250	0.059	58
Suspension of work	0.376	0.004	58
Damage business relationship	0.641	0.000	58
Project abandonment	0.452	0.000	58
Additional expense in managerial and administrative	0.324	0.013	58

Table 4.35 shows correlation of stranded communication b/n contracting parties with other significant effects of claim in the studied road projects. Accordingly; stranded

communication b/n contracting parties had significant positive relationship with time overrun ($r_s=0.328$), cost overrun ($r_s=0.347$), disputes ($r_s=0.463$), negative social impacts ($r_s=0.365$), suspension of works ($r_s=0.376$), damage of business relationship ($r_s=0.641$), project abandonment ($r_s=0.452$), and additional expenses of managerial & administrative ($r_s=0.324$).

Table 4. 36 Correlation of project abandonment and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Project abandonment	1.000		58
Time overrun	0.438	0.001	58
Cost overrun	0.528	0.000	58
Disputes	0.787	0.000	58
Idling of resources	0.335	0.010	58
Negative social impact	0.522	0.000	58
Lower profitability	0.264	0.045	58
Rework and relocation of resources	0.520	0.000	58
Suspension of work	0.777	0.000	58
Damage business relationship	0.653	0.000	58
Stranded relation between contracting parties	0.452	0.000	58
Additional expense in managerial and administrative	0.318	0.015	58

Table 4.36 shows correlation of project abandonment with other effects of claim in the studied road projects. Accordingly; project abandonment had significant positive relationship with time overrun ($r_s=0.438$), cost overrun ($r_s=0.528$), disputes ($r_s=0.787$), idling of resources

($r_s=0.335$), negative social impact ($r_s=0.522$), lower profitability ($r_s=0.264$), rework & relocation of resources ($r_s=0.520$), suspension of works ($r_s=0.777$), damage of business relation ($r_s=0.653$), stranded relationship b/n contracting parties ($r_s=0.452$), and additional expenses of managerial & administrative ($r_s=0.318$).

Table 4. 37 Correlation of additional expense in management and other effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Additional expense in managerial and administrative	1.000		58
Time overrun	0.436	0.001	58
Cost overrun	0.378	0.003	58
Disputes	0.344	0.008	58
Idling of resources	0.378	0.003	58
Negative social impact	0.540	0.000	58
Lower profitability	0.391	0.002	58
Rework and relocation of resources	0.456	0.000	58
Suspension of work	0.308	0.019	58
Damage business relationship	0.376	0.004	58
Stranded relation between contracting parties	0.324	0.013	58
Project abandonment	0.318	0.015	58

Table 4.37 shows correlation of additional expenses in managerial and administrative with other significant effects of claim in the studied road projects. Accordingly; additional expenses in managerial & administrative had significant positive relationship with time

overrun ($r_s=0.436$), cost overrun ($r_s=0.378$), disputes ($r_s=0.344$), idling of resources ($r_s=0.378$), negative social impacts ($r_s=0.540$), lower profitability ($r_s=0.391$), rework & relocation of resources ($r_s=0.456$), suspension of work ($r_s=0.308$), damage of business relation ($r_s=0.376$), stranded relation b/n contracting parties ($r_s=0.324$), and project abandonment ($r_s=0.318$).

4.2.13 Relationship Model for Effects of Claim in the Road Projects

After the relationships between effects of claim were established by using Spearman's correlation coefficient method; these relationships were depicted in graphical model. The significant effects of claim identified in the study as per their ranking order were time overrun, cost overrun, disputes, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of works, damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. These effects of claim were coded for easy presentation in graphical model as follows.

- E1 for time overrun
- E2 for cost overrun
- E3 for disputes
- E4 for idling of resources
- E5 for negative social impacts
- E6 for lower profitability
- E7 for rework & relocation of resources
- E8 for suspension of work
- E9 for damage of business relationship
- E10 for stranded communication b/n contracting parties
- E11 for project abandonment
- E12 for additional expenses in managerial & administrative activities

The graphical model consists of nodes and undirected lines. The nodes represent effects of claim and the undirected lines represent moderate to high degree of relationship b/n each nodes. The relationships between effects of claim were established and the effects of claim were arranged systematically to form chain of relationship forming loop in the model. E1 was connected to E2; E2 was connected to E3; E3 was connected to E4; E4 was connected to E5;

E5 was connected to E7; E7 was connected to E6; E6 was connected to E8; E8 was connected to E9; E9 was connected to E10; E10 was connected to E11; E11 was connected to E12; E12 was connected to E1 to form loop chain of relationship. The significant relationships established in this study were found to have moderate to high degree of relationships. The orders of arrangement of effects of claim that formed loop chain of relation were as follows.

- E1 (time overrun)
- E2 (cost overrun)
- E3 (dispute)
- E4 (idling of resources)
- E5 (negative social impacts)
- E7 (rework & relocation of resources)
- E6 (lower profitability)
- E8 (suspension of work)
- E9 (damage of business relationship)
- E10 (stranded communication b/n contracting parties)
- E11 (project abandonment)
- E12 (additional expenses in managerial & administrative activities)
- E1 (time overrun)

The relationships between time overrun and cost overrun; cost overrun and dispute; dispute and idling of resources; idling of resources and negative social impacts; negative social impacts and rework & relocation of resources; rework & relocation of resources; rework & relocation of resources and lower profitability; lower profitability and suspension of works; suspension of works and damage of business relationship; damage of business relation and stranded communication between contracting parties; stranded communication between contracting parties and project abandonment; project abandonment and additional expenses in managerial & administrative activities; additional expenses in managerial & administrative activities and time overrun formed loop chain of relationship in the model. The other significant relationships between effects of claim were connected by undirected lines within the loop of model. The solid lines were used to indicate significant positive relationship

between effects of claim, whereas, no lines used to indicate either zero or insignificant relationships between effects of claim.

Thus; the relationships between effects of claim in the study was modeled as shown below.

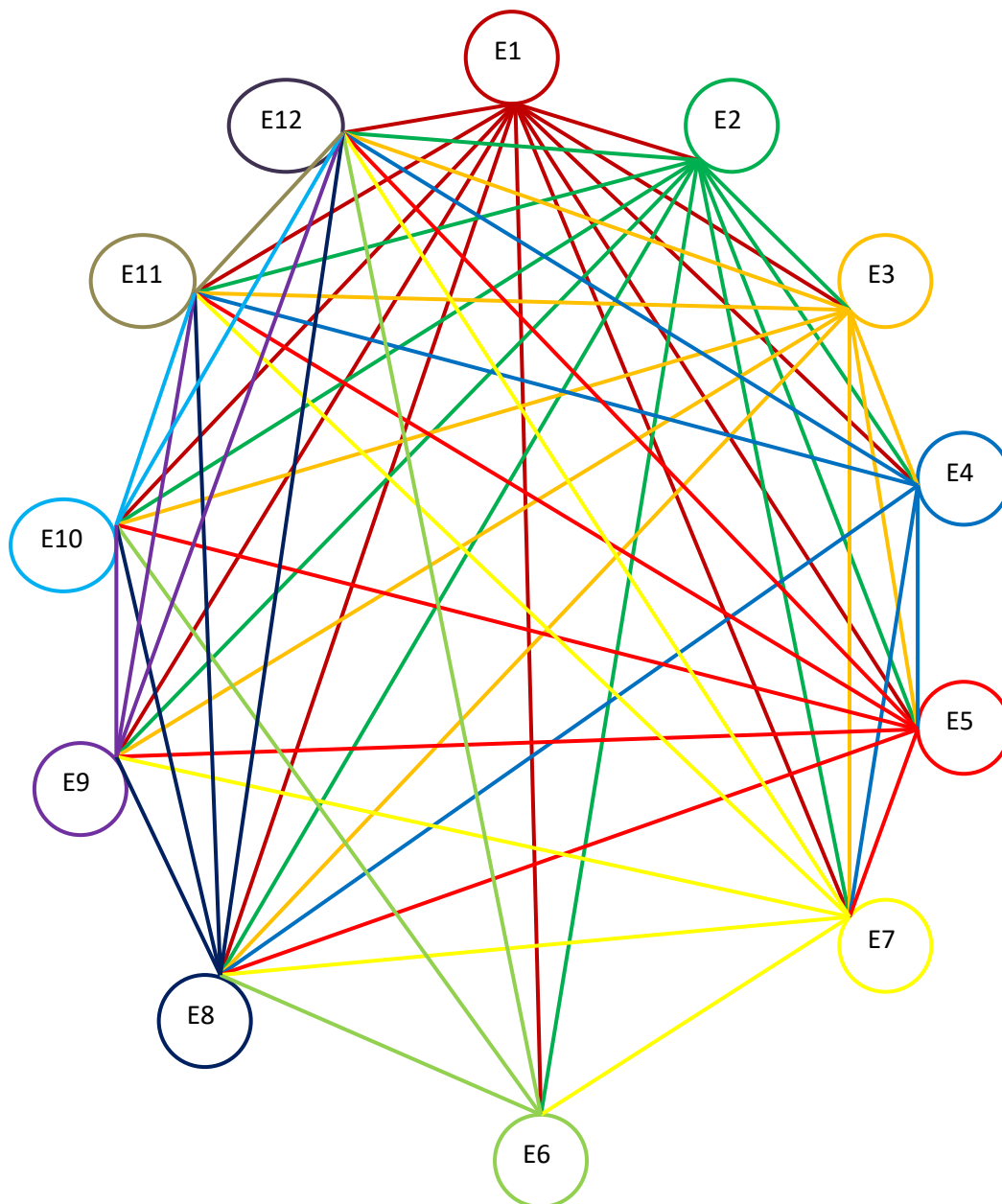


Figure4. 7 Relationship model for effects of claim

Figure 4.7 shows relationship between effects of claim. The nodes represent effects of claim and the lines represent moderate to high degree of relationships. The undirected lines depict

the relationships are vice versa. The solid lines represent the presence of significant positive relationship between effects of claim, whereas, no lines represent the presence of zero relationship or insignificant relationships between effects of claim in the study.

4.2.14 Relationships for Causes and Effects of Claim in the Road Projects

The relationships between causes and effects of claim were established by using Spearman's correlation coefficient (bivariate correlation analysis using SPSS software). Nineteen significant causes and twelve significant effects of claim were identified and these significant causes and effects were correlated for relationship. The results of the correlations are presented in tables as follows.

Table 4. 38 Correlation of ROW and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.445	0.000	58
Cost overrun	0.397	0.002	58
Disputes	0.252	0.057	58
Idling of resources	0.225	0.090	58
Negative social impact	0.253	0.055	58
Lower profitability	0.177	0.183	58
Rework and relocation of resources	0.173	0.195	58
Suspension of work	0.235	0.075	58
Damage business relationship	0.280	0.033	58
Stranded relation between contracting parties	-0.007	0.958	58
Project abandonment	0.182	0.172	58

Additional expense in managerial and administrative	0.208	0.118	58
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Table 4.38 shows correlation of ROW with significant effects of claim in the studied road projects. Accordingly; ROW had significant positive relationship with time overrun ($r_s=0.445$), cost overrun ($r_s=0.397$), and damage of business relation ($r_s=0.280$).

Table 4. 39 Correlation of VO and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.564	0.000	58
Cost overrun	0.481	0.000	58
Disputes	0.353	0.007	58
Idling of resources	0.193	0.147	58
Negative social impact	0.334	0.010	58
Lower profitability	0.289	0.028	58
Rework and relocation of resources	0.421	0.001	58
Suspension of work	0.387	0.003	58
Damage business relationship	0.247	0.062	58
Stranded relation between contracting parties	0.017	0.899	58
Project abandonment	0.264	0.045	58
Additional expense in managerial and administrative	0.226	0.088	58

Table 4.39 shows correlation of VO with significant effects of claim in the studied road projects. Accordingly; VO had significant positive relationship with time overrun ($r_s=0.564$), cost overrun ($r_s=0.481$), disputes ($r_s=0.353$), negative social impacts ($r_s=0.334$), lower profitability ($r_s=0.289$), rework & relocation of resources ($r_s=0.421$), suspension of work ($r_s=0.387$), and project abandonment ($r_s=0.264$).

Table 4. 40 Correlation of disruption of work and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.295	0.025	58
Cost overrun	0.115	0.391	58
Disputes	0.367	0.005	58
Idling of resources	0.021	0.873	58
Negative social impact	0.232	0.080	58
Lower profitability	0.148	0.267	58
Rework and relocation of resources	0.235	0.075	58
Suspension of work	0.336	0.010	58
Damage business relationship	0.296	0.024	58
Stranded relation between contracting parties	0.429	0.001	58
Project abandonment	0.352	0.007	58
Additional expense in managerial and administrative	0.331	0.011	58

Table 4.40 shows correlation of disruption with significant effects of claim in the studied road projects. Accordingly; disruption had significant positive relationship with time overrun ($r_s=0.295$), disputes ($r_s=0.367$), suspension of work ($r_s=0.336$), damage of business relationship ($r_s=0.296$), stranded communication b/n contracting parties ($r_s=0.429$), project abandonment ($r_s=0.352$), and additional expenses in managerial & administrative ($r_s=0.331$).

Table 4. 41 Correlation of delay in progress of work and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.172	0.198	58
Cost overrun	0.049	0.716	58
Disputes	-0.007	0.958	58
Idling of resources	0.025	0.852	58
Negative social impact	0.143	0.286	58
Lower profitability	0.273	0.038	58
Rework and relocation of resources	0.032	0.813	58
Suspension of work	0.049	0.714	58
Damage business relationship	-0.005	0.969	58
Stranded relation between contracting parties	-0.070	0.603	58
Project abandonment	-0.084	0.530	58
Additional expense in managerial and administrative	0.205	0.123	58

Table 4.41 shows correlation of delay in progress of work with significant effects of claim in the studied road projects. Accordingly; delay in progress of work had significant positive effect with lower profitability ($r_s=0.273$).

Table 4. 42 Correlation of inflation and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.334	0.010	58
Cost overrun	0.247	0.061	58
Disputes	0.181	0.175	58
Idling of resources	0.186	0.162	58
Negative social impact	0.004	0.974	58
Lower profitability	0.372	0.004	58
Rework and relocation of resources	0.289	0.028	58
Suspension of work	0.305	0.020	58
Damage business relationship	0.141	0.293	58
Stranded relation between contracting parties	-0.022	0.872	58
Project abandonment	0.168	0.206	58
Additional expense in managerial and administrative	0.142	0.287	58

Table 4.42 shows correlation of inflation with other significant effects of claim in the studied road projects. Accordingly; inflation had significant positive relationship with time overrun ($r_s=0.334$), lower profitability ($r_s=0.372$), rework & relocation of resources ($r_s=0.289$), and suspension of work ($r_s=0.305$).

Table 4. 43 Correlation of cash flow problem and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.298	0.023	58
Cost overrun	0.143	0.285	58
Disputes	0.185	0.163	58
Idling of resources	0.226	0.088	58
Negative social impact	0.021	0.877	58
Lower profitability	0.247	0.061	58
Rework and relocation of resources	0.181	0.173	58
Suspension of work	0.241	0.068	58
Damage business relationship	0.147	0.272	58
Stranded relation between contracting parties	0.249	0.059	58
Project abandonment	0.057	0.673	58
Additional expense in managerial and administrative	0.347	0.008	58

Table 4.43 shows correlation of cash flow problem with other significant effects of claim in the studied road projects. Accordingly; cash flow problem had significant positive relationship with time overrun ($r_s=0.298$), and additional expense in managerial & administrative ($r_s=0.347$).

Table 4. 44 Correlation of late payment and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.392	0.002	58
Cost overrun	0.362	0.005	58
Disputes	0.258	0.050	58
Idling of resources	0.402	0.002	58
Negative social impact	0.275	0.036	58
Lower profitability	0.343	0.008	58
Rework and relocation of resources	0.135	0.312	58
Suspension of work	0.335	0.010	58
Damage business relationship	0.285	0.030	58
Stranded relation between contracting parties	0.263	0.046	58
Project abandonment	0.168	0.207	58
Additional expense in managerial and administrative	0.372	0.004	58

Table 4.44 shows correlation of late payment with significant effects of claim in the studied road projects. Accordingly; late payment had significant positive relationship with time overrun ($r_s=0.392$), cost overrun ($r_s=0.362$), idling of resources ($r_s=0.402$), negative social impacts ($r_s=0.275$), lower profitability ($r_s=0.343$), suspension of work ($r_s=0.335$), damage of business relation ($r_s=0.285$), stranded communication b/n contracting parties ($r_s=0.263$), and additional expenses in managerial & administrative ($r_s=0.372$).

Table 4. 45 Correlation of security problem and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.442	0.001	58
Cost overrun	0.415	0.001	58
Disputes	0.479	0.000	58
Idling of resources	0.397	0.002	58
Negative social impact	0.058	0.665	58
Lower profitability	0.275	0.037	58
Rework and relocation of resources	0.275	0.036	58
Suspension of work	0.263	0.046	58
Damage business relationship	0.359	0.006	58
Stranded relation between contracting parties	0.340	0.009	58
Project abandonment	0.277	0.035	58
Additional expense in managerial and administrative	0.395	0.002	58

Table 4.45 shows correlation of security problem with significant effects of claim in the studied road projects. Accordingly; security problem had significant positive relationship with time overrun ($r_s=0.442$), cost overrun ($r_s=0.415$), disputes ($r_s=0.479$), idling of resources ($r_s=0.397$), lower profitability ($r_s=0.275$), rework & relocation of resources ($r_s=0.275$), suspension of work ($r_s=0.263$), damage of business relation ($r_s=0.359$), stranded communication b/n contracting parties ($r_s=0.340$), project abandonment ($r_s=0.277$), and additional expenses in managerial & administrative ($r_s=0.395$).

Table 4. 46 Correlation of change in scope of work and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.216	0.104	58
Cost overrun	0.247	0.061	58
Disputes	0.245	0.064	58
Idling of resources	0.089	0.508	58
Negative social impact	0.392	0.002	58
Lower profitability	0.143	0.284	58
Rework and relocation of resources	0.252	0.057	58
Suspension of work	0.420	0.001	58
Damage business relationship	0.214	0.107	58
Stranded relation between contracting parties	0.231	0.081	58
Project abandonment	0.216	0.104	58
Additional expense in managerial and administrative	0.156	0.242	58

Table 4.46 shows correlation of change in scope of work with significant effects of claim in the studied road projects. Accordingly; change in scope of work had positive relationship with negative social impact ($r_s=0.392$), and suspension of work ($r_s=0.420$).

Table 4. 47 Correlation of shortage of construction material and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.178	0.182	58
Cost overrun	0.091	0.496	58
Disputes	0.222	0.094	58
Idling of resources	0.137	0.304	58
Negative social impact	0.046	0.732	58
Lower profitability	0.416	0.001	58
Rework and relocation of resources	0.201	0.130	58
Suspension of work	0.222	0.093	58
Damage business relationship	0.176	0.187	58
Stranded relation between contracting parties	0.179	0.179	58
Project abandonment	0.166	0.212	58
Additional expense in managerial and administrative	0.333	0.011	58

Table 4.47 shows correlation of shortage of construction materials with significant effects of claim in the studied road projects. Accordingly; shortage of construction materials had significant positive relationship with lower profitability ($r_s=0.416$), and additional expenses in managerial & administrative ($r_s=0.333$).

Table 4. 48 Correlation of design error and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.253	0.056	58
Cost overrun	0.280	0.033	58
Disputes	0.291	0.027	58
Idling of resources	0.174	0.190	58
Negative social impact	0.344	0.008	58
Lower profitability	0.256	0.052	58
Rework and relocation of resources	0.246	0.063	58
Suspension of work	0.266	0.044	58
Damage business relationship	0.320	0.014	58
Stranded relation between contracting parties	0.159	0.233	58
Project abandonment	0.121	0.367	58
Additional expense in managerial and administrative	0.302	0.021	58

Table 4.48 shows correlation of design error with significant effects of claim in the studied road projects. Accordingly; design error had significant positive relationship with cost overrun ($r_s=0.280$), disputes ($r_s=0.291$), negative social impacts ($r_s=0.344$), suspension of works ($r_s=0.266$), damage of business relationship ($r_s=0.320$), and additional expenses in managerial & administrative ($r_s=0.302$).

Table 4. 49 Correlation of poor planning and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.097	0.470	58
Cost overrun	-0.045	0.738	58
Disputes	0.063	0.639	58
Idling of resources	-0.015	0.910	58
Negative social impact	0.136	0.310	58
Lower profitability	0.147	0.272	58
Rework and relocation of resources	0.017	0.902	58
Suspension of work	0.085	0.524	58
Damage business relationship	0.030	0.821	58
Stranded relation between contracting parties	0.050	0.821	58
Project abandonment	-0.063	0.637	58
Additional expense in managerial and administrative	0.194	0.145	58

Table 4.49 shows correlation of poor planning with significant effects of claim in the studied road projects. Accordingly; poor planning had no significant positive as well as negative relationship with effects of claim included in the study.

Table 4. 50 Correlation of late mobilization and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.115	0.392	58
Cost overrun	-0.012	0.927	58
Disputes	0.091	0.499	58
Idling of resources	0.024	0.856	58
Negative social impact	0.082	0.539	58
Lower profitability	0.281	0.032	58
Rework and relocation of resources	0.062	0.645	58
Suspension of work	0.142	0.288	58
Damage business relationship	0.078	0.559	58
Stranded relation between contracting parties	0.164	0.218	58
Project abandonment	0.061	0.650	58
Additional expense in managerial and administrative	0.240	0.070	58

Table 4.50 shows correlation of late mobilization with significant effects of claim in the studied road projects. Accordingly; late mobilization had significant positive relationship with lower profitability ($r_s=0.280$).

Table 4. 51 Correlation of differing site condition and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.399	0.002	58
Cost overrun	0.377	0.004	58
Disputes	0.313	0.017	58
Idling of resources	0.295	0.024	58
Negative social impact	0.403	0.002	58
Lower profitability	0.158	0.235	58
Rework and relocation of resources	0.228	0.085	58
Suspension of work	0.389	0.003	58
Damage business relationship	0.453	0.000	58
Stranded relation between contracting parties	0.441	0.001	58
Project abandonment	0.248	0.061	58
Additional expense in managerial and administrative	0.379	0.003	58

Table 4.51 shows correlation of differing site condition with significant effects of claim in the studied road projects. Accordingly; differing site conditions had significant positive relationship with time overrun ($r_s=0.399$), cost overrun ($r_s=0.377$), disputes ($r_s=0.313$), idling of resources ($r_s=0.295$), negative social impacts ($r_s=0.403$), suspension of work ($r_s=0.389$), damage of business relationship ($r_s=0.453$), stranded communication b/n contracting parties ($r_s=0.441$), and additional expenses in managerial & administrative ($r_s=0.379$).

Table 4. 52 Correlation of adverse weather condition and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.265	0.044	58
Cost overrun	0.150	0.260	58
Disputes	0.409	0.001	58
Idling of resources	0.340	0.009	58
Negative social impact	0.054	0.686	58
Lower profitability	0.443	0.000	58
Rework and relocation of resources	0.343	0.008	58
Suspension of work	0.247	0.062	58
Damage business relationship	0.305	0.020	58
Stranded relation between contracting parties	0.201	0.130	58
Project abandonment	0.165	0.217	58
Additional expense in managerial and administrative	0.274	0.038	58

Table 4.52 shows correlation of adverse weather condition with significant effects of claim in the studied road projects. Accordingly; adverse weather condition had significant positive relationship with time overrun ($r_s=0.265$), disputes ($r_s=0.409$), idling of resources ($r_s=0.340$), lower profitability ($r_s=0.443$), rework & relocation of resources ($r_s=0.343$), damage of business relationship ($r_s=0.305$), and additional expenses in managerial & administrative ($r_s=0.274$).

Table 4. 53 Correlation of unforeseen ground condition and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.366	0.005	58
Cost overrun	0.401	0.002	58
Disputes	0.530	0.000	58
Idling of resources	0.215	0.105	58
Negative social impact	0.259	0.050	58
Lower profitability	0.303	0.021	58
Rework and relocation of resources	0.302	0.021	58
Suspension of work	0.446	0.000	58
Damage business relationship	0.319	0.015	58
Stranded relation between contracting parties	0.284	0.031	58
Project abandonment	0.415	0.001	58
Additional expense in managerial and administrative	0.294	0.025	58

Table 4.53 shows correlation of unforeseen ground condition with other significant effects of claim in the studied road projects. Accordingly; unforeseen ground condition had significant positive relationship with time overrun ($r_s=0.366$), cost overrun ($r_s=0.401$), disputes ($r_s=0.530$), negative social impacts ($r_s=0.259$), lower profitability ($r_s=0.303$), rework & relocation of resources ($r_s=0.302$), suspension of work ($r_s=0.446$), damage of business relationship ($r_s=0.319$), stranded communication b/n contracting parties ($r_s=0.284$), project abandonment ($r_s=0.415$), and additional expenses in managerial & administrative ($r_s=0.294$).

Table 4. 54 Correlation of shortage of equipment & spare parts and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	-0.003	0.982	58
Cost overrun	-0.106	0.430	58
Disputes	0.087	0.514	58
Idling of resources	0.076	0.568	58
Negative social impact	-0.029	0.828	58
Lower profitability	0.221	0.095	58
Rework and relocation of resources	0.005	0.972	58
Suspension of work	0.127	0.342	58
Damage business relationship	0.110	0.412	58
Stranded relation between contracting parties	0.074	0.583	58
Project abandonment	0.006	0.963	58
Additional expense in managerial and administrative	0.268	0.042	58

Table 4.54 shows shortage of equipment and spare parts with significant effects of claim in the studied road projects. Accordingly; shortage of equipment and spare parts had significant positive relationship with additional expenses in managerial and administrative ($r_s=0.268$).

Table 4. 55 Correlation of late issue of instruction and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.290	0.027	58
Cost overrun	0.319	0.015	58
Disputes	0.454	0.000	58
Idling of resources	0.292	0.026	58
Negative social impact	0.365	0.005	58
Lower profitability	0.277	0.035	58
Rework and relocation of resources	0.547	0.000	58
Suspension of work	0.423	0.001	58
Damage business relationship	0.548	0.000	58
Stranded relation between contracting parties	0.520	0.000	58
Project abandonment	0.390	0.002	58
Additional expense in managerial and administrative	0.330	0.011	58

Table 4.55 shows correlation of late issue of instruction with significant effects of claim in the studied road projects. Accordingly; late issue of instruction had significant positive relationship with time overrun ($r_s=0.290$), cost overrun ($r_s=0.319$), disputes ($r_s=0.454$), idling of resources ($r_s=0.292$), negative social impacts ($r_s=0.365$), lower profitability ($r_s=0.277$), rework & relocation of resources ($r_s=0.547$), suspension of works ($r_s=0.423$), damage of business relationship ($r_s=0.548$), stranded communication b/n contracting parties ($r_s=0.520$), project abandonment ($r_s=0.390$), and additional expenses in managerial & administrative ($r_s=0.330$).

Table 4. 56 Correlation of poor site management and significant effects of claim

Significant effects of claim	Spearman's correlation coefficients (r_s)	Sig (2-tailed)	N
Time overrun	0.135	0.314	58
Cost overrun	0.114	0.393	58
Disputes	0.241	0.069	58
Idling of resources	0.078	0.559	58
Negative social impact	0.191	0.152	58
Lower profitability	0.277	0.035	58
Rework and relocation of resources	0.209	0.115	58
Suspension of work	0.327	0.012	58
Damage business relationship	0.114	0.394	58
Stranded relation between contracting parties	0.156	0.243	58
Project abandonment	0.253	0.055	58
Additional expense in managerial and administrative	0.201	0.130	58

Table 4.56 shows correlation of poor site management with significant effects of claim in the studied road projects. Accordingly; poor site management had significant positive relationship with lower profitability ($r_s=0.277$), and suspension of works ($r_s=0.327$).

4.2.15 Relationship Model for Causes and Effects of Claim in the Road Projects

After the relationships between causes and effects of claim were established by using Spearman's correlation coefficient method; these relationships were depicted in graphical

model. The significant causes of claim were coded in the ranking order of significance from C1 to C19 and the significant effects of claim were also coded in the ranking order of significance from E1 to E12 as described previously for easy of presentation in the graphical model. Causes of claim and effects of claim were presented with labeled nodes; and the relationships between them were presented by directed lines. The directed lines flow from causes of claim to effects of claim.

The labeled codes were C1 for delay in granting possession of site; C2 for variation order; C3 for disruption of works; C4 for delay in progress of work; C5 for inflation; C6 for cash flow problem; C7 for late payment; C8 for security problem; C9 for change in scope of work; C10 for shortage of construction materials; C11 for design error; C12 for poor planning; C13 for late mobilization; C14 for differing site condition; C15 for adverse weather condition; C16 for unforeseen ground condition; C17 for shortage of equipment and spare parts; C18 for late issue of instruction; C19 for poor site management; E1 for time overrun; E2 for cost overrun; E3 for dispute; E4 for idling of resources; E5 for negative social impacts; E6 for lower profitability; E7 for rework & relocation of resources; E8 for suspension of works; E9 for damage of business relationship; E10 for stranded communication between contracting parties; E11 for project abandonment; and E12 for additional expenses in managerial & administrative activities.

The causes of claim were presented in one column labeled as C1, C2, C3,..., and C19, and the effects of claim were presented in another column labeled as E1, E2, E3,..., and E12. The directed solid lines were drawn from causes of claim towards effects claim to show significant positive relationships existed between them. The absence of directed lines between nodes for causes of claim and nodes for effects of claim illustrated the relationships were either zero or insignificant. Accordingly; the relationship model for causes and effects of claim were developed as shown in figure below. In the figure below; directed line drawn from cause of claim column to effects of claim column with arrow directing towards effects column to show causes and effects relationship. For example; C2 (VO), cause of claim, results in effects of claim such as E1 (time overrun), E2 (cost overrun), E3 (dispute), E4 (idling of resources), E5 (negative social impacts), E7 (rework & relocation of resources), E6 (lower profitability), E8 (suspension of work), and E11 (Project abandonment).

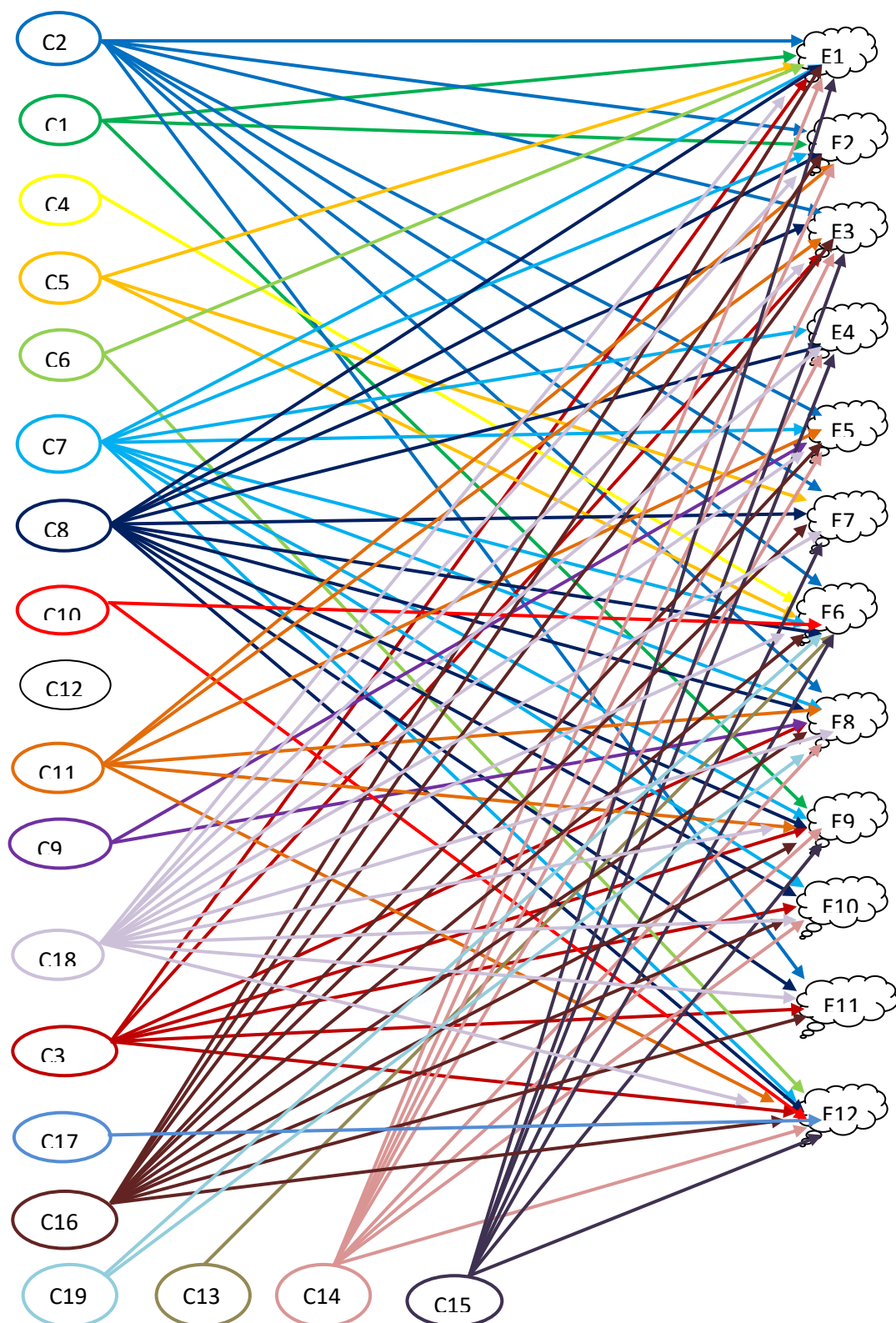


Figure4. 8 Relationship model for causes & effects of claim

Figure 4.8 shows relationship model for causes of claim & effects of claim. Causes of claim were represented with nodes coded as C1, C2, C3, C4... C19 and arranged systematically. Effects of claim were represented with nodes coded as E1, E2, E3,...E12 on the right hand side of the model. Solid directed lines connected nodes representing causes of claim with nodes representing effects of claim to depict significant positive (moderate to high degree) cause-effect relationship existed between causes of claim and effects of claim.

4.3 Results of Case Study

In this study to assess the causes, effects, cause and effects relationship of claim for road construction projects in the study area; case study was also conducted in addition to questionnaire survey. Accordingly cases of five road construction projects were assessed and the results were presented as follows.

4.3.1 Case Study for Road Project One

The project in the study area encountered two claims caused by delay in possession of ROW and security problem. As a result contractor requested for extension of time of 516 days for claim caused by delay in possession of ROW and 242 days for claim caused by security problem. After engineer's determination; the client agreed to extension of time of 159 days for claim caused due to delay in possession of ROW and 72 days for claim caused due to security problem.

Table 4. 57 Causes and Effects of Claim for Road Project One

Claimant	Causes of Claim	Effect of Claim	Magnitude of Effect
Contractor	Delay in possession of site	Extension of time	159 days
Contractor	Security Problem	Extension of time	72 days

Table 4.57 shows case study of a project that had two claims due to causes of delay in possession of site and security problem. Both causes of claims yielded in time overrun of 159 days and 72 days respectively.

4.3.2 Case Study for Road Project Two

The project in the study area encountered claim caused by delay in possession of site. As a result contractor requested for extension of time of 335 days. After engineer's determination; the client agreed to extension of time of 261 days for claim caused due to delay in possession of site.

Table 4. 58 Causes and Effects of Claim for Road Project Two

claimant	Causes of claim	Effect of claim	Magnitude of effect
contractor	Delay in possession of site	Extension of time	261 days

Table 4.58 shows case study of a project that had claim caused due to delay in possession of site and effect of time overrun of 261 days.

4.3.3 Case Study for Road Project Three

The project in the study area encountered claim caused due to delay in possession of site. As a result contractor requested for extension of time of 530 days. After engineer's determination; the client agreed to extension of time of 414 days.

Table 4. 59 Causes and Effects of Claim for Road Project Three

Claimant	Causes of claim	Effect of claim	Magnitude of effect
Contractor	Delay in possession of site	Extension of time	414 days

Table 4.59 shows case study of a project that had claim caused due to delay in possession of site and effect of time overrun of 441 days.

4.3.4 Case Study for Road Project Four

The project in the study area encountered claim due to security problem. The security problem has forced a contractor to suspend construction work and accordingly the contractor incurred cost for idling of resources. The contractor requested for compensation of 59,634,106.56 ETB a result of suspension of work due to security problem.

Table 4. 60 Causes and Effects of Claim for Road Project Four

Claimant	Causes of claim	Effect of claim	Magnitude of effect
Contractor	Security Problem	Suspension of work and cost for idle resources	59,634,106.56 ETB

Table 4.60 shows case study of a project that had a claim caused due to security problem and consequent effect of suspension of work, and idle of resources resulting in cost overrun.

4.3.5 Case Study for Road Project Five

The project in the study area encountered with claims due to security problem, change of scope (variation order), and delay in possession of ROW. The security problem resulted in damage of contractor's equipments and suspension of work for a period of 42 days. Accordingly; a contractor requested for compensation of ETB 18,953,603.32 for damaged property considering hostilities in project was client's risk event and compensation for idling cost of resources during suspension of ETB 12,558,240.00. The contractor also requested for prolongation cost of ETB 7,600,553.31 for extension time granted to the contractor due to change of scope of work and delay of possession of ROW by the client. After engineer's determination; the client accepted the hostilities occurred on project site was client's risk event but argued that the contractor had already received a compensation payment of ETB 15,562,229 from Ethiopian Investment Commission and hence the contractor was entitled only to balance payment of ETB 1,511,959. Although the client acknowledged the idling of resources during suspension of work was due to security problem; the client argued that the contractor should had returned the rental equipments and demobilized own and subcontractor's equipment from site to avoid unnecessary cost and accordingly rejected the claim for idling cost. Furthermore; the client rejected prolongation cost claimed by the contractor, for extended period of project completion due to change of scope of work initiated by the client and delay of possession of site due to default of client, on a basis of notice of claim had not been given within time table stipulated in the contract. The contractor disagreed with client's argument and consequently dispute emerged and the cases were referred to dispute review expert for decision. After reviewing the documents of both parties regarding the claims; the DRE abstained from giving recommendation on cost of damaged

property as the claim was not well substantiated with regards to whether the amount paid by Ethiopian Investment commission was soft loan or compensation payment and even more the determination made by EIC fell under DRE's jurisdiction. However; the DRE gave his decision on cost of idling of equipment due to suspension of work as a result of hostility of ETB 10,602,720.00 should be paid for the contractor. Furthermore; the DRE recommended his decision on prolongation cost due time extension for change of scope of work and delay of possession of site of ETB 7,600,553.31 should be paid for the contractor. The DRE made the decision based on the fact that the client confirmed in his documentation submitted to DRE that he had requested for further substantiation of the prolongation cost claim and, had notice of claim not given the client would have rejected the claim without asking for substantiation of the cost.

Table 4. 61 Causes and Effects of Claim for Project Five: before DRE Intervention

Claimant	Cause of claim	Effect of claim as per contractor request	Effect of claim as per client assessment	Effect of claim after Client's assessment
Contractor	Security problem	Cost of damaged property of ETB 18,953,803.32	Cost of ETB 1,511.959 only as other 15, 562,229 made by EIC to the contractor	Dispute
Contractor	Security problem	Cost of idle equipment of ETB 12,558,240.00	No effect as the claim was rejected	Dispute
Contractor	Change of scope and delay of possession of site	Prolongation cost of ETB 7,600,553.31	No effect as the claim was rejected	Dispute

Table 4.61 shows case study of a project that had claims due to security problem with effects of cost overrun and dispute; claims due to security problem with effects of idle equipment,

cost and dispute; and claims due to delay in possession of site with effects of cost overrun and disputes.

Table 4. 62 Causes and Effects of Claim for Project Five: after DRE Intervention

Claimant	Cause of claim	Effect of claim	Magnitude of Effect
Contractor	Security Problem	Dispute and cost of damaged property	ETB1,511,959 and further amount if contractor substantiated the document
Contractor	Security problem	Dispute and cost	ETB 10,602,720.00
Contractor	Change of scope and ROW	Dispute and cost	ETB 7,600,553.31

Table 4.62 illustrates case study of a project that had a claim reaching dispute stage with effects of cost overrun.

Delay in possession of site, security problems and variation order were causes of claim; and time overrun, cost overrun, suspension of works, idling cost of resources, and disputes were effects of claim in the road projects. Delay in possession of sites were causes for claim in project one, project two, project three, and project five of the case studies. Security problems were causes for claim in project three, and project four of the case study. Variation order was causes of claim in project five of the case study. Time overrun were effects of claim for project one, project two, project three, and project four of the case study. Suspension of work and idling of resources were effects of claim for project three of the case study. Disputes were effects of claim for project four of the case study.

4.4 Discussion of Results of the Study

Discussion of results of the study elaborates the findings of the study. Accordingly; the findings regarding background of the studied projects, significant causes of claim in the studied road projects, significant effects of claim in the studied road projects, relationships between causes of claim in the studied road projects, relationships between effects of claim in the studied road projects, and relationships between causes and effects of claim in the studied road projects were discussed as follows.

4.4.1 Background of the Studied Road projects

The road projects considered in the study were thirty construction projects. The contracting parties involved in the project administrations were client, consultant, and contractor. The client allocated twenty professional from its side for road construction projects in the central directorate of ERA to deal with thirty consultant firms, and thirty contractor firms in the contract management of the projects. The client's staffs involved in the management of claim in road projects were team leader, lead engineer, and counterpart engineer. The consultant's staffs involved in the management of claim were resident engineer, deputy resident engineer, claim expert, and quantity surveyor. The contractor's staffs involved in the management of claim were project manager, construction manager, and contract engineer. Thus; each staff of the parties were aware of claim issues in the project implying any response to the questionnaire by either staffs of the parties represents the issue of claim in their respective projects. In this regard; 18 out of 20 respondents from client, 23 out of 30 respondents from consultant firms, and 17 out of 30 respondents from contractor firms involved in the road projects were responded to the questionnaire survey of the study and as a result almost all road projects in the sample were presented in the study.

The respondents from the road projects comprised of 20.7% counterpart engineer, 6.9% lead engineer, 3.4% team leader, 29.3% resident engineer, 6.9% deputy resident engineer, 3.4% claim expert, 25.9% project manager, 1.7% construction manager, and 1.7% contract engineer. Counterpart engineer, resident engineer, and project manager are the representatives of each party to the contractor who deal with claim in the first hand. Thus; implying 75.9% of the responses were responded by first hand representatives dealing with the claim issues in their respective projects. Furthermore; the work experience of respondents were 0 to 5 yrs (17.2%), 6 to 10 yrs (31%), 11 to 15 yrs (25.9%), and greater than 15 yrs (25.9%), which means, 82.8% of the respondents had greater than 5yrs work experience. Implying 82.8% of the respondents had experience of dealing with claim related issues for more than 5 yrs.

Work progresses of the studied road projects were categorized as 0 to 10%, 11 to 30%, 31 to 70%, and 71 to 100% for the study purpose. 19% of the respondents responded that their road projects were in the interval of 0 to 10% progress; 17.2% of them responded that their road construction project were in the interval of 11 to 30% progress, 43.1% of them responded that their road projects were in the interval of 31 to 70% progress, and 20.7% of them responded

that their road projects were in the interval of 71 to 100% progress. Thus; implying 19% of the road construction projects studied had achieved 0 to 10% work progress, 17.2% of the road projects had achieved 11 to 30% work progress, 43.1% of the road projects had achieved 31 to 70% work progress, and 20.7% of the road projects had achieved 71 to 100% work progress.

Number of claim encountered in the studied road projects were categorized as no claim, 1 to 3 claims, and more than 3 claims for the study purpose. 20.7% of the respondent responded that there were no claims in their respective projects. 50.0% responded that there were 1 to 3 claims in their respective projects, and 29.3% responded that there were more than 3 claims in their respective projects, thus; 79.3 % of the road projects encountered claims at the time of the study. Out of 79.3% road projects encountering claim; 5.2% of them were in the work progress interval of 0 to 10%, 15.5% of them were in the work progress interval of 11 to 30%, 37.9% of them were in the work progress interval of 31 to 70%, and 20.7% of them were in the work progress interval of 71 to 100%. The findings concurred that claims are almost unavoidable in the road construction projects as stated in the studies of (Barakat et al., 2019), (Zhu & Cheung, 2020b), (Manda et al., 2019), and (Mishmish & El-Sayegh, 2018). Furthermore; the results illustrated the occurrence of claim increases with the increase of progress of work but after reaching peak decreases as the work progresses to closure. This is mainly due to fact that risks in the construction surfaced during busy construction work period and the potential of risks to develop in to conflict, and then in to claim is high as the parties to the contract blames each other for the causes of the events.

4.4.2 Discussion on Significant Causes of Claim in the Study

Claims are unavoidable in road construction projects and road projects under central directorate of ERA are not exceptional. Nineteen significant causes of claim were determined in the study. The lists of these significant causes of claim in their ranking order were delay in granting possession of site, variation order, disruption, delay in work progress, inflation, cash flow problem, late payment, security problem, change in scope of work, shortage of construction material, design error, poor planning, late mobilization, differing site condition, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. These causes of claim were also found in the previous study as significant causes of claim and discussed as follows.

Delay in granting of possession of site stated as causes of claim in the study of such as Rybka et al. (2017); Al-Qershi & Kishore (2017); Getahun et al. (2016); Werkinah & Mite (2020); and Mishmish & El-Sayegh (2018). Variation order was stated as cause of claim in the study of such as M. S. Mehany et al. (2018); Asratie et al. (2021); Elhag et al. (2020); Zanelidin (2020); Assaf et al. (2019); Werkinah & Mite (2020); and Belachew et al. (2017). Disruption of work stated as cause of claim in the works of such as Manda et al (2019); Mishmish & El-Sayegh (2018); Rybka et al (2017); Asratie et al. (2021); Assaf et al (2019); and Zanelidin (2020), delay in progress of work as causes of claim in the study of such as Mishmish & El-Sayegh (2018); Shaikh et al. 2020); Assaf et al. (2019); Getahun et al. (2016); and Malik & Ali (2019). Inflation was stated as causes of claim in the study of such as Asratie et al (2021); Malik & Ali (2019); Belachew et al. (2017); Zanelidin (2020). Cash flow problem was stated as causes of claim in the study of such as Asratie et al. (2021); Getahun et al. (2016); Malik & Ali (2019); and Werkinah & Mite (2020). Late payment was stated as cause of claim in the study of such as Mishmish & El-Sayegh (2018); Asratie et al. (2021); Assaf et al. (2019); Getahun et al. (2016). Security was stated as causes of claim in the study of such as Getahun et al. (2016). Change in scope of work was stated as causes of claim in the study of such as Manda et al. (2019); Rybka et al. (2017); Zanelidin (2020); Al-Qershi & Kishore (2017); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019); and Werkinah & Mite (2020). Shortage of construction materials was stated as causes of claim in the study of such as Asratie et al (2021). Design error was stated as causes of claim in the study of such as Mehany et al. (2018); Rybka et al. (2017); Asratie et al. (2021); Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); G. J. Kikwasi (2021); Malik & Ali (2019); Werkinah & Mite (2020); and Belachew et al. (2017). Poor planning was stated as causes of claim in the study of such as Shaikh et al. (2020); Assaf et al. (2019); Getahun et al. (2016); Malik & Ali (2019). Late mobilization was stated as causes of claim in the study of such as Hashem M. Mehany & Grigg (2015); Asratie et al. (2021); and Belachew et al. (2017). Differing site condition was stated as causes of claim in the study of such as Mehany et al. (2018); Mishmish & El-Sayegh (2018); Rybka et al. (2017); Malik & Ali (2019); and Werkinah & Mite (2020). Adverse weather condition was stated as causes of claim in the study of such as Mehany et al. (2018); Asratie et al. (2021); Getahun et al. (2016); and Malik & Ali (2019). Unforeseen ground condition was stated as causes of claim in the study of such as Rybka et al. (2017); Asratie et al. (2021); and Malik & Ali (2019). Shortage of equipment & spare parts was stated as causes of claim in the study of such as Asratie et al. (2021). Late

issue of instruction was stated as causes of claim in the study of such as Mishmish & El-Sayegh (2018); Al-Qershi & Kishore, (2017); Shaikh et al. (2020); G. J. Kikwasi (2021). Poor site management was stated as causes of claim in the study of such as Asratie et al. (2021); Shaikh et al. (2020); Werkinah & Mite (2020); and Belachew et al. (2017).

The significant causes of the claim in the study mostly concurred with other researchers findings of the significant causes of claim in construction projects. Moreover; the case study conducted on five road projects in the study also revealed that delay in granting of possession of site, security problem, and variation order were causes of claim in the road projects. This implies the results of significant causes of claim from questionnaire survey and case study were consistent with findings of previous studies. The persistent occurrence of these causes of claim prevails that claims are unavoidable in construction projects.

4.4.3 Discussion on Significant Effects of Claim in the Study

Claim has significant impact on road construction projects. Twelve significant effects of claim in were determined in the study. The lists of these significant effects of claim in their ranking order were time overrun, cost overrun, disputes, idling of resources, negative social impact, lower profitability, rework & relocation of resources, suspension of work, damage of business relationship, stranded relationship b/n contracting parties, project abandonment, and additional expenses in managerial & administrative. These effects were also found in previous study and discussed as follows.

Time overrun was stated as effects of claim in the study of such as Gad et al. (2011); Joshi & Pimplikar (2021); Rai et al. (2021); Shaikh et al. (2020); Naji (2017); G. J. Kikwasi (2021); G. Kikwasi (2013); Malik & Ali (2019); and Khair et al. (2016). Cost overrun was stated as effects of claim in the study of such as Gad et al. (2011); M. S. Mehany et al. (2018); Joshi & Pimplikar (2021); H. M. Mehany & Grigg (2015); Dinku & Kasshay (2003); Belachew et al. (2017); Werkinah & Mite (2020); Rai et al. (2021); Shaikh et al. (2020); G. J. Kikwasi (2021); G. Kikwasi (2013); and Malik & Ali (2019). Dispute was stated as effect of claim in the study of such as G. J. Kikwasi (2021); G. Kikwasi (2013); Malik & Ali (2019); and Khair et al. (2016). Idling of resources was stated as effects of claim in the study of such as G. Kikwasi (2013). Negative social impact was stated as effect of claim in the study of such as G. Kikwasi (2013). Lower profitability was stated as effects of claim in the study of such as G. J. Kikwasi (2021); and Malik & Ali (2019). Rework & relocation of resources was stated

as effects of claim in the study of such as Malik & Ali (2019). Suspension of work was stated as effect of claim in the study of such as G. J. Kikwasi (2021). Damage of business relationship was stated as cause of claim in the study of such as Gad et al. (2011); Rai et al. (2021); G. J. Kikwasi (2021); and Malik & Ali (2019). Stranded relation b/n contracting parties was stated as effects of claim in the study of such as Gad et al. (2011); Rai et al. (2021); G. J. Kikwasi (2021); and Malik & Ali (2019). Project abandonment was stated as effects of claim in the study of such as G. J. Kikwasi (2021); and Khair et al. (2016). Additional expenses in managerial & administrative were stated as effects of claim in the study of such as Malik & Ali (2019).

The significant effects of claim in the study mostly concurred with the findings of other researchers about significant effects of claim in the construction projects. Besides; the case study conducted on five projects pointed out that time overrun, cost overrun, suspension of works, idling of resources, and disputes were effects of claim. This implies the results of significant causes of claim from questionnaire survey and case study were consistent with findings of previous studies. The persistent outcome of these effects of claim prevails that claims have significant impacts on construction works.

4.4.4 Discussion on Relationship between Causes of Claim in the Study

Relationships between each significant causes of claim in the road projects under central directorate of ERA were established and significant relationships were identified. The significant relationships showed moderate to high degree of relationship in this study. Accordingly; the relationships between causes of claim in the study was discussed as follows.

Delay in granting possession of site was positively related to other causes of claim such as variation order, delay in progress of work, inflation, cash flow problem, late payment, security problem, design error, differing site condition, unforeseen ground condition, and shortage of equipment & spare parts. Variations in sequence of work occur when there is delay in granting of possession of site as the contractor is forced to reschedule its work program. Delay in progress of work occurs due to delay in granting possession of site as granting possession of site enables the contractor to produce and stock construction materials, and use sites for the construction works. Any delay in possession of site hinders the contractor's ability to produces construction materials and even accessing the construction site. Inflation or increase in cost of materials may occur due to delay in granting possession

of site. This is because delay in granting possession of site results in delay of work progress and delaying of work beyond schedule time forces the work to be executed beyond the cost planned for it. Cash flow problem occurs when the contractor could not generate enough revenues from the work to run the project smoothly due to delay in progress of work as a result of delay in possession of site. Late payment occurs when the contractor includes cost of delay of possession of site is included in the payment and the client disputes on it. Security problem hinders the accessibility of site to be granted to the contractor and results in delay in granting possession of site. Design error, differing site condition, and unforeseen ground condition affects granting of site to the contractor because they may initiate search for other sites than initially planned for material production, construction of works, and use of the site. Shortage of equipment & spare parts can result in delay in possession of site because it causes the contractor ineffective in production of materials from the possessed site and as a result the contractor may resort not to request the site for possession at the time.

Variation order, besides delay in possession of site, was positively related to delay in work progress also found in Al-Qershi & Kishore (2017); and G. J. Kikwasi (2021), inflation, security problem, and change in scope of work, design error, differing site condition, adverse weather condition, unforeseen ground condition, and late issue of instruction. Variation order can inherit delay in work progress as variation may constitute change in sequence of work change in method of construction, change in construction materials, or change in quantities of work, etc., and such changes causes delay of work progress due to rescheduling of resources and time. Inflation can occur on materials and labor due to timing of issuance of variation order and execution of varied works. Security problem can cause the quantity of work and the time of execution of work to be varied from initial plan. Change in scope of work occurs due variation in quality and quantity of works from initial design. Design error, differing site condition, adverse weather condition, and unforeseen ground condition trigger variation orders in terms of time, quantity of, sequence of work and quality of work. Late issue of instruction also constitutes variation order as it may cause rework, and rescheduling of resources.

Disruption of works was positively related to cash flow problem, shortage of construction materials, poor planning, late mobilization, differing site condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Disruption of works causes cash flow problem in construction as cash is being

generated by undertaking smoothly different construction activities and disruption of these work results in cash flow problem. Shortage of construction material results in disruption of work as any road construction requires materials for undertaking. Poor planning results in shortage of resources, and ineffective usage of resources at the construction site, which in turn, causes disruption of work due to shortage of resources. Late mobilization of resources causes disruption of work due to scarcity of resources at construction site. Differing site condition results in disruption of work in terms of resource and methodology of construction planned for site may not further useable to site and causing disruption of work until methodology and resources are rescheduled. Poor site management is results of poor management of resources at site of construction, and this ineffective management of resources at site results in disruption of work.

Delay in work progress, in addition to delay in granting possession of site and variation order, was positively related to inflation, cash flow problem, late payment, and shortage of construction materials, design error, poor planning, late mobilization, unforeseen ground condition, and poor site management. Inflation can cause delay in work progress in the anticipation of the contractor for future market stability of construction materials. Cash flow problem causes significant impediment to the progress of work as every work in construction requires resources and the resources are acquired through money transaction. Late payment for the work causes cash flow problem, and the cash flow problem causes delay in work progress. Materials are basic inputs for the construction work and any shortage in construction materials results in delay of work progress. Design error triggers delay in work progress until the design is corrected as the construction work constitutes transformation of design in to existence. Poor planning causes ineffective usage of resources, and this results in delay in work progress. Late mobilization of resources causes mismatch of resources and work at required time in the site, and resulting in delay in work progress due to lack of resources. Unforeseen ground condition are conditions that are unforeseen during design and planning of the construction work and such condition may force the parties to the contract to alter design, planning, and undertaking of the construction work. Thus; it causes delay in progress of work. Poor site management is results of poor management of resources at site of construction, and this ineffective management of resources at site results in delay in progress of work.

Inflation (material cost fluctuation), besides delay in granting possession of site; variation order, and delay in work progress, was positively related to cash flow problem, late payment, security problem, shortage of construction materials, poor planning, late mobilization, adverse weather condition, shortage of construction materials & spare parts, late issue of instruction, and poor site management. Inflation drains a lot of cash from the project for purchase of same quantity of material or service before cost increases happen, causing financial strain on construction project and resulting in cash flow problem. Late payment incurs loss of value of money as a result of inflation. Security problem hinders the progress of work and supply chain of materials may also be disrupted, prompting shortage of material and increase of cost of the material. Shortage of construction material may encounter project as a result of inflation due to contractor's intention of waiting for market stability and searching for alternative sources for relatively cheap price. Poor planning causes ineffective use of resources. Ineffective use of resources results in additional cost on the project due to delay of work and this additional cost exacerbates during inflation. Late mobilization affects material cost. Resources that were supposed to be mobilized and consumed for construction before inflation incur extra cost on the project when late mobilized. Adverse weather condition causes progress of work to be impeded, and forcing the work to be performed in other suitable time. This impediment results in additional cost of construction at the time of inflation due to increment in cost of materials and services. Late issue of instruction causes the same quantity and quality of work to be undertaken at higher cost due to inflation. Poor site management hinders the effectiveness of site work, and causes delay of work. The delay of work incurs financial strain on the project due to inflation.

Cash flow problem, besides delay in granting possession of site; disruption of work; delay in work progress; and inflation, was positively related to late payment, security problem, shortage of construction material, design error, poor planning, late mobilization, differing site condition, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Late payment causes cash flow problem as the project runs by revenue generated from works. Security problem causes problem to the performance of construction work and resulting in cash flow problem in the project. Materials are basic input for construction work and any shortage of construction materials hinders revenue generation from undertaken works, thus, prompts cash flow problem. Design error, poor planning, late mobilization, differing site condition, adverse

weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management hinder progress of work and any hindrance of work causes cash flow problem in the project.

Late payment, in addition to delay in possession of site; delay in work progress; inflation; and cash flow problem, was positively related security problem, shortage of construction materials, design error, late mobilization, adverse weather condition, and unforeseen ground condition, shortage of equipment & spare parts, and late issue of instruction. Security problem hinders measurement of work done to be incorporated in payment certificate and forces the payment of work in area of security problem to be measured and paid for later on after security issue is resolved. Shortage of construction materials, design error, late mobilization, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, and late issue of instruction causes delay of work progress. This delay of work progress prompts the payment for the work to be paid for later than plan time of payment.

Security problem, besides delay in possession of site; variation order; inflation; cash flow problem; and late payment, was positively related to shortage of construction materials, design error, late mobilization, differing site condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Shortage of construction material occurs in construction as a result of security problem due disruption of supply chain and inaccessibility of material extraction site. Design error, differing site condition and unforeseen site condition may occur due lack of full access to site for thorough investigation and study due to security problem. Late mobilization occurs due to inaccessibility of construction site due to security problem. Shortage of construction equipment & spare parts can occur due to disruption of supply chain, inability of mobilization, and damage of equipment due to security problem. Late issue of instruction may be necessitated due to security problem in the site. Poor site management results from continuous follow up of site due to security problem.

Change in scope of work, in addition to variation order, was positively related to design error, differing site condition, and late issue of instruction. The occurrence of design error and subsequent change of design causes change in scope of work in terms of quantity and quality. Differing site condition causes the redesign of the work to adopt with the existing site condition, prompting change in scope of work. Late issue of instruction may constitute design change and thereby the design change triggers change in scope of work.

Shortage of construction materials, besides disruption of work; delay in progress of work; inflation; cash flow problem; late payment; and security problem, was positively related with poor planning, late mobilization, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Poor planning results in failure of purchasing and mobilization of resources in advance before they are required at site for consumption. Late mobilization of resources causes shortage of materials at construction site at the time of need. Adverse weather condition hinders production and transportation of material, thereby, causing shortage of construction materials. Unforeseen ground condition contributes to shortage of construction material in case the unforeseen ground is at extraction site of construction material, and on route of transportation of the construction material. Equipments are vital for extraction and transportation of construction materials. Any shortage of equipment and spare parts causes shortage of construction materials at the construction site. Late issue of instruction contributes to shortage of construction materials in case the equipment for material production is demobilized from the site and it takes time for remobilization. Poor site management causes ineffective usage of material and prompting shortage at the time of need.

Design error, in addition to delay in possession of site; variation order, delay in work progress; cash flow problem; and change in scope of work, was positively related poor planning, late mobilization, differing site condition, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Design error misleads to wrong allocation of resources to the construction site as initial plan bases on design documents resulting in poor planning. Design error leads to wrong allocation of resources and after the design is corrected, need for other resources may be necessary. This need of other resources causes late mobilization of the needed resources. Differing site condition is basically condition of site other than what is considered in the design, thus, it is one result of design error. Unforeseen ground condition may cause design change to mitigate the effect of unforeseen condition in the construction site. Adverse weather condition can cause design error. Design requires thorough investigation of site and data collection from the site. This detail investigation and collection of data may be hampered by adverse weather condition causing accessibility of site difficult for collection of data. Shortage of equipment & spare parts can cause design error. Designers use equipment for data collection, design work and verification of their design. Any malfunction of the

equipment and its shortage contributes to design error. Late issue of instruction can be correction of design error, thus, it can be a result of design error. Poor site management may cause design error in case resources for design are poorly managed during design stage.

Poor planning, besides disruption of work; delay in work progress; inflation; cash flow problem; shortage of construction material; and design error, was positively related late mobilization, unforeseen ground condition, shortage of equipment & spare parts, and poor site management. Poor planning mismatches timing of resources required for construction and planned work item at the site, causing late mobilization of the required resource for the work. Good planner considers certain contingency for uncertain condition of construction site, and lack of mitigation plan for unforeseen ground condition is manifestation of poor planning. Shortage of equipment & spare parts occurs on the site due to poor planning. Good plan details equipment and spare part requirement in timely manner for the construction work. Poor site management is a result of poor planning.

Late mobilization, besides disruption of work; delay in progress of work; inflation; cash flow problem; late payment; security problem; shortage of construction material; design error; and poor planning, was positively related to differing site condition, unforeseen ground condition, shortage of equipment & spare parts, and poor site management. Late mobilization can be due to differing site condition as varied site condition may necessitate new resources other than those mobilized as per initial plan. Unforeseen ground condition may require resources other than those planned for the site work; as a result, it induces late mobilization of the resources. Shortage of equipment & spare parts at construction site necessitate mobilization of other resources to site for the construction work, which are considered late for the sake of ongoing work. Poor site management may result in overlooking of resources required at site for construction and causing late of mobilization of overlooked resources to the site.

Differing site condition, in addition to delay in possession of site; variation order; disruption of work; cash flow problem; late payment; security problem; change in scope of work; design error; and late mobilization, was positively related to adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Differing site condition can be due to varied ground condition and/or varied weather condition from design consideration, as result adverse weather condition may be considered consequence of differing site condition. Unforeseen ground condition is condition in which it is difficult to foresee the condition of ground during design and the condition is

different from design consideration, thus, it is part of differing site condition. Differing site condition may require new equipment as it may require new design to cope up with the new reality of the site, causing shortage of equipment at the site. Late issue of instruction may be due to differing site condition. Poor site management lacks mitigation plan for uncertain conditions of site.

Adverse weather condition, besides variation order; inflation; cash flow problem; late payment; security problem; shortage of construction material; design error; and differing site condition, was positively related to unforeseen ground condition, and late issue of instruction. Work on mitigation of unforeseen ground condition can be hampered by adverse weather condition. Instruction for work may be issued after passage of favorable weather condition in the construction site, and resulting in undertaking of work in adverse weather.

Unforeseen ground condition, in addition to delay in possession of site; variation order; disruption of work; delay in work progress; cash flow problem; late payment; security problem; shortage of construction materials; design error; poor planning; late mobilization; differing site condition; and adverse weather condition, was positively related to shortage of equipment & spare parts, late issue of instruction, and poor site management. Mitigation of unforeseen ground condition may require new design with new requirement of resources, causing shortage of that equipment at the site of construction. Instruction may be issued for mitigation of unforeseen ground condition after discovery of the condition; and thus, the instruction can be late for completion of work. Poor site management lacks mitigation plan for unforeseen condition of site.

Shortage of equipment & spare parts, besides delay in possession of site; disruption of work; delay in work progress; inflation; cash flow problem; shortage of construction materials; design error; poor planning; late mobilization; differing site condition; and unforeseen ground condition, it was positively related to poor site management. Timely maintenance and stocking of spare parts of equipment at construction site are parts of good plan in construction, thus, poor site management results in poor maintenance of equipment and poor stock of spare parts.

Late issue of instruction, in addition to variation order; disruption of work; inflation; cash flow problem; late payment; security problem; change in scope of work; shortage of construction materials; design error; differing site condition; adverse weather condition; and

unforeseen ground condition, was positively related to poor site management. Defective works may be rectified based on instruction issued by expert. Any delay of reporting defective work from site due lack of communication or delay in timely tasting of work for conformity are results of poor site management.

Poor site management was positively related to disruption of work, delay in progress of work, cash flow problem, security problem, shortage of construction materials, design error, poor planning, late mobilization, differing site condition, unforeseen ground condition, shortage of equipment & spare parts, and late issue of instruction. Its relationship with them was discussed previously.

4.4.5 Discussion on Relationship between Effects of Claim in the Study

Relationships between each significant effects of claim in the road projects under central directorate of ERA were established and significant relationships were identified. The significant relationships showed moderate to high degree of relationship in the study. Accordingly; the significant relationships between effects of claim in the study was discussed as follows.

Time overrun was positively related with cost overrun, disputes, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative. Time overrun results in cost overrun, because additional time of construction causes additional expenses for running the construction project. Disputes are effects of claim that come in to action when claims are not settled at project management level of contracting parties. Disputable claims require expertise other than those of project management team. Bringing the issues to the attention of the expertise and getting decision on the matter from them require time. Construction works have negative impacts such as noise pollution, dust pollution, and uncomfortable ride on road users. As the time of construction goes on, this impact will keep on hurting the society. When the road project faces additional time of construction; the project spends additional cost for running the project. This additional cost drains the profit anticipated on the road project, and results in lower profitability. Rework of works is required due wearing and tearing of already constructed but not taken over works due to time overrun. Relocation of resources also requires time for mobilization and demobilization, resulting in

time overrun. Suspension of work is stoppage of work in the site, and the time elapsed during the suspension induces extra time to the project completion. Idling of resources may be due to suspension of work, thus results in additional time of construction in the road projects. Business relation in road construction requires contractor to be paid for the work it performed within contract time, and the client requires quality work to be carried out within contract time. Thus any additional time beyond the contract causes strain on this relation, for example, the client may run out of budget due to fiscal rules and regulations and be forced not to pay for the contractor in time, causing damage of business relationship. Communication between contracting parties can be affected due to time overrun in the construction project, due to blaming of each other for the cause of time overrun. Contractor may abandon construction project due to factors such as security problem, strike of labor, and etc., resulting in delay in time of completion. Time overrun results in additional expenses of managerial & administrative for undertaking the work beyond initial time of completion.

Cost overrun, in addition to time overrun; was positively related to disputes, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, damage of business relation, stranded communication between contracting parties, project abandonment, and additional expense in managerial & administrative activities. Idling of resources cause cost overrun in the project as the contractor incurs cost for idling of resources. Negative social impacts such as dust pollution, noise pollution, and uncomfortable ride on road causes additional expenses on project. The contractor has to employ additional resources to mitigate these impacts and the society also endures additional expense for treatment of pollution and uncomfortable ride illness, thus, causing cost overrun in the road project. Cost overrun drains profit anticipated from the construction project, resulting in lower profitability. Rework & relocation of resources require finance for undertaking; thus, result in cost overrun in the project. Suspension of work causes cost overrun in the project. Due to suspension the contractor faces financial hardship as the revenues are generated from undertaking of construction work; causing the contractor to bear cost of labor, and equipment during suspension. The client also faces additional cost of administering the project due to suspension. Additional cost of construction causes shortage of budget for the client, and forcing the client not to pay for the contractor in contract time, causing damage of business. Cost overrun causes strain in communication between contracting parties due to blaming each other for the causes of cost overrun. Contractor may abandon

construction project due to factors such as security problem, strike of labor, and etc., resulting in cost overrun when the construction work resumes. Additional expenses of managerial & administrative for under taking the work beyond initial time of completion result in cost overrun.

Disputes, besides time overrun; and cost overrun; was positively related to idling of resources, negative social impacts, rework & relocation of resources, suspension of work, damage of business relation, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Idling of resources, negative social impacts, suspension of work, and project abandonment are effects of claim that may not be settled at project management level. In that case; the claim requires intervention of other experts for decision, and the claim is said to be at dispute level. Disputes cause damage of business relationship, and stranded communication b/n contracting parties as the parties to the contract struggle to convince the expert that they are not at default for the dispute. Disputes costs additional expense to the project in paying for the expert service and managing the dispute itself.

Idling of resources, in addition to time overrun; cost overrun; and disputes, was positively related with negative social impacts, rework & relocation of resources, suspension of work, project abandonment, and additional expenses in managerial & administrative activities. Idling of resources creates impression across road users that the resources are not worthy for the construction; but the contractor mobilizes to site for other purposes other than for the construction work at site. Besides; detour maintenance, and dust suppression may be affected due to ineffective use of equipment due to idling. When equipment gets idle at the construction site; rework & relocation of resources may be necessary. Rework of work may be necessary due to lack of intervention for rectification at required time for damage occur on already completed work because of tear and wear. Relocation of resources to other place, where they will be utilized effectively, may come to action for idle resource at the construction site. Suspension of work and project abandonment may happen due to idling of resources at that construction site as the contractor shifts its focuses to other project where the resources are effectively utilized. Additional expenses in managerial & administrative activities for idling of resources are financial burden up on the owner of the equipment as the resources cease to generate any income for the project.

Negative social impacts, besides time overrun; cost overrun; disputes; and idling of resources, was positively related with rework & relocation of resources, suspension of work, damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Dust, bad detour, and poor accommodation of traffic impact the road users negatively; as a result rework & relocation of resources for managing these impacts may be required. Suspensions of work and project abandonment aggravate dust, and unworthy condition of road for the users as the mitigation of these impacts are completely halted. Negative social impacts cause burden on contracting parties for mitigation. Client may withhold payment for the contractor thinking of incompliance of contractor for mitigation of the impacts. On the other hand; the contractor may complain about unfair withholding of payment and costly mitigation of the impacts. These circumstances cause damage of business relationship, and stranded communication b/n contracting parties. Additional expenses for managerial & administrative activities for mitigation of negative social impacts bear financial strain on the project.

Lower profitability, in addition to time overrun; and cost overrun, was positively related to rework & relocation of resources, suspension of work, project abandonment, and additional expenses in managerial & administrative activities. Rework & relocation of resources require additional expense for undertaking of the works. These additional expenses lower profit of the project. Suspensions of work and project abandonment halt project works, causing extra time and cost for completion of the project. The extra cost lowers the profit of the project. Additional expenses for managerial & administrative activities lower the profit of the project.

Rework & relocation of resources, besides time overrun; cost overrun; disputes; idling of resources; negative social impacts; and lower profitability, was positively related to suspension of works, damage of business relationship, project abandonment, and additional expenses in managerial & administrative activities. Suspensions of work and project abandonment require rework & relocation of resources when the project works resume. Rework & relocation of resources cause strain in business relationship b/n contracting parties. Project incurs additional expenses in managerial & administrative activities for carrying out rework & relocation of resources.

Suspension of works, in addition to time overrun; cost overrun; disputes; idling of resources; negative social impacts; lower profitability; and rework & relocation of resources, was positively related to damage of business relationship, stranded communication b/n

contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Suspension of works may result in termination of the contract. The termination of contract yields to dispute b/n contracting parties, thus, causing damage of business relationship and stranded communication b/n the parties. Project abandonment is full halt or suspension of any activity at construction site. Additional cost occurs for managerial and administrative activities of suspended work.

Damage of business relationship, besides time overrun; cost overrun; disputes; negative social impacts; rework & relocation of resources; and suspension of works, was positively related to stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Stranded communication b/n contracting parties causes damage of business relationship because communication is one factor which flourishes business relationship b/n contracting parties. Project abandonment damages reliability of firms and causes damage of business relationship for contracting parties. Additional expenses in managerial & administrative activities may be required to restore damage of business relationship.

Stranded communication b/n contracting parties, besides time overrun; cost overrun; disputes; negative social impacts; suspension of works; and damage of business relationship, was positively related to project abandonment, and additional expenses in managerial & administrative activities. Abandoned project causes stranded communication b/n contracting parties due to lack of adequate channel of communication. Additional expenses in managerial & administrative activities to restore proper channel of communication may be required in road projects like recruiting good communicator.

Project abandonment, in addition to time overrun; cost overrun; disputes; idling of resources; negative social impacts; lower profitability; rework & relocation of resources; suspension of works; and damage of business relationship, was positively related to stranded communication b/n contracting parties, and additional expenses in managerial & administrative activities. Stranded communication b/n contracting parties may result in project abandonment due to lack of communication b/n contracting parties in resolving issues leading to it. Additional expenses in managerial & administrative activities incur in management of abandoned project.

Additional expenses in managerial & administrative activities was positively related to time overrun, cost overrun, disputes, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of works, damage of business relationship, stranded communication b/n contracting parties, and project abandonment. The relationship b/n them was discussed previously.

4.4.6 Discussion on Relationship between Causes and Effects of Claim in the Study

Relationships between each significant causes and effects of claim in the road projects under central directorate of ERA were established and significant relationships were identified. Accordingly; the significant relationships between significant causes and significant effects of claim showing moderate to high degree of relationship in the study were discussed as follows.

Delay in granting possession of site was the most significant causes of claim in the study; and it was positively related to time overrun, cost overrun, and damage of business relationship. Time overrun and cost overrun were the most significant effects in the study. Delay in granting of possession of site causes delay of project in terms of progress, material production, mobilization, and etc as discussed previously. Consequently; it results in time overrun, and cost overrun in the road projects. These time overrun and cost overrun, in turn, result in damage of business relationship as each party blames each other for these time and cost overruns.

Variation order, which was the second most significant cause of claim in the study, was positively related to effects of claim such as time overrun, cost overrun, disputes, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, and project abandonment. Variation orders occur in road projects due to change in the requirement of mostly client. The variations can be change in quantity, change in quality, change in sequence of work, and etc. These variations require change in resources required to the site in terms of quantity, type and quality, thus cause time and cost overruns in the project. Most of the time; Client needs the varied work to be carried out by the rate stipulated in the contract but contractor complains new rate for varied work stating that varied work affects its profitability, thus resulting in disputes. Variation orders may increase work load to the project and, thus, may divert the attention of the work force to the varied work and

causing shortage of equipment and manpower for mitigation of dust control, noise control, and management of traffic for road users. The default in mitigation of dust, noise and traffic accommodation problems affects the society negatively. Variation order may be issued after some parts of the work were completed, and there by necessitates rework and relocation of resources for already completed work. Variation of work also may require new equipment and expertise for undertaking of the work, and resulting in suspension and abandonment of the project until the new resources are being mobilized to the site.

Disruption of works was positively related to effects of claim such as time overrun, disputes, suspension of works, and damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Disruption of works affects the productivity of work force resulting in requirement of additional time for completion of the work. In some cases; the causes of disruption of work may be disputable b/n contracting parties as to who is responsible for disruption and subsequent impacts of disruption. This disputes cause damage of business relationship and stranded communication b/n contracting parties. Continuous disruption of work leads to suspension of work and project abandonment, and also incurs additional expenses for managerial & administrative activities for managing the disrupted works.

Delay in progress of work was positively related to lower profitability. Work progress is the measure of performance of contractor in undertaking the construction work. Work progress enhances revenue of the project. On contrary; delay in progress of work reduces revenue and causing the contractor to over draft cashes from other sources to run the project, thus, resulting in lower profitability of the project.

Inflation was positively related to effects of claim such as time overrun, lower profitability, rework & relocation of resources, and suspension of work. Inflation may result in time overrun due to expectation of contractor for getting back of material cost to original prices and searching for other sources of material for reasonable price. Inflation drains profitability of the project as rise in cost material due to inflation incurs financial strain on the project. Inflation may result in suspension of work when it becomes impossible to carry out works due to unattainable prices of goods. This stoppage of work causes deterioration of partially completed works, prompting rework of works & relocation of resources.

Cash flow problem was positively related to effects of claim such as time overrun, and additional expense in managerial & administrative activities. Cash flow problem may result in time overrun due to low productivity of project as cash flow is a backbone for carrying out construction work. Cash flow problem may cause additional expense in managerial & administrative activities as the project may resort to other sources of finance such as bank loan for continuity of the construction work.

Late payment was positively related to time overrun, cost overrun, idling of resources, negative social impacts, lower profitability, suspension of work, damage of business relationship, stranded communication b/n contracting parties, and additional expenses in managerial & administrative activities. Contractor may resort to slow of progress and subsequent suspension of work when the payment for certified work is late beyond contractual time. These slowing progress of works and suspension of works results in time overrun, cost overrun, damage of business relationship, stranded communication b/n contracting parties. In some cases due to late payment; contractor may go to other sources of finance to fill shortage of cash in the project for keeping the project progress on, thus, causing additional expenses in managerial & administrative activities for handling the case.

Security problem was positively related to time overrun, cost overrun, disputes, idling of resources, lower profitability, rework & relocation of resources, suspension of work, damage business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Security problem causes suspension of works and abandonment of project, resulting in idling of resources. Idling of resources, suspension of works and project abandonment causes time and cost overruns in the project. The costs for idle resource, suspended work, and abandoned project cause dispute b/n contracting parties, there by inducing damage of business relation, stranded communication b/n contracting parties and additional expenses in managerial & administrative activities of works in areas of security problem.

Change in scope of work was positively related to suspension of work and negative social impacts. Change in scope of work may result in suspension of existing work when the changed scope of work requires new requirement and standard. The suspension of work, in turn, aggravates negative social impacts of the project.

Shortage of construction materials was positively related to lower profitability, and additional expenses in managerial & administrative activities in handling of material shortage in the project. Shortage of materials causes delay in progress of work in the project. The delay in progress of work, in turn, hampers revenues of the project from completed work. When the revenue of the contractor decreases due to slow progress of work; the cost of running the project increases causing lower profitability. Shortage of materials increases demand for it in the market, thereby, results in increase of material price. The increase in price of material causes additional expenses that were not considered during cost breakdown analysis of tendered rate for work item. This additional cost drains the profit margin of the project, thus, lowers the profit.

Design error was positively related to effects of claim such as cost overrun, disputes, negative social impacts, suspension of work, damage of business relationship, and additional expenses in managerial & administrative activities. Design error may cause complete change of design in the project. Construction works are suspended until error due to design is fixed. The suspension of works and new design cause cost overrun in the project. Furthermore; the impacts of design error may be disputable b/n contracting parties, thus, causing damage of business relationship and stranded communication b/n contracting parties. Inadequate capacity of drainage structures, which is result of design error, may cause flooding of road during rain. The floods may damage the road and properties of nearby society. Design error also causes additional expenses in managerial & administrative activities in searching for design error and rectification of the error.

Late mobilization was positively related to lower profitability. Late mobilization of resources causes delay of progress of work by hampering the productivity of work force due to late mobilization of resources. The loss of productivity of work force, due to shortage of equipment as a result of late mobilization, results in lower profitability.

Differing site condition was positively related to time overrun, cost overrun, disputes, idling of resources, negative social impacts, suspension of work, damage of business relationship, stranded communication b/n contracting parties, and additional expenses in managerial & administrative activities of the differing condition. Differing site condition is varied condition of site from design consideration of the site, thereby, inducing new design, new methodology, and new resources for the site work. These new design, new methodology and new resources for the site work cause time and cost overruns in the project. In most cases; contractor

demands new rate for undertaking of work during differing site condition but the client insists on bid price for the work resulting in dispute b/n the two parties. The occurrence of dispute causes damage of business relationship and stranded communication b/n contracting parties. Differing site condition may exhibit suspension of works until the design is in conformity with the existing site condition. The suspension of work, in turn, results in idling of resources and neglect of social impacts of the construction projects. Additional expenses in managerial & administrative activities occur for investigation and new design for differing site condition.

Adverse weather condition was positively related to effects of claim such as time overrun, disputes, idling of resources, lower profitability, rework & relocation of resources, damage of business relationship, and additional expenses in managerial & administrative activities. Progress of work is highly affected when the weather is adverse for the construction work. Thus, resources get idle due to adverse effect of the weather in the construction site. Slow progress of works and idling of resources result in time overrun for completion of work, lower profitability and additional expenses for management. The costs for idling of resources and prolongation may cause dispute b/n contracting parties, there by damages business relationship.

Unforeseen ground condition was positively related to effects of claim such as time overrun, cost overrun, disputes, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Unforeseen ground condition requires time and additional cost for investigation and design for the ground condition. Besides; it also causes suspension of work and project abandonment at site until the ground condition is investigated and design for it is completed. Suspension of work, additional time and cost for investigation cause time and cost overruns in the project. Dispute may also occur in the project as to how much time and cost are required for making the site confers with new design for the ground condition. The occurrence of disputes prompts damage of business relationship and stranded communication b/n contracting parties. The occurrence of unforeseen ground condition may affect the already completed section of work for investigation of the ground condition, thus, causing rework of work after investigation is completed.

Shortage of equipment and spare parts was positively related to additional expenses in managerial and administrative. When shortage of equipment & spare parts occurs at site; the

contractor may relent to rental equipment to undertaken the construction works. In this regard; the contractor incurs additional expenses in managerial & administrative activities of rental equipments.

Late issue of instruction was positively related to effects of claim such as time overrun, cost overrun, disputes, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, and damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. Late issue of instruction forces the contractor to undertake the instructed work beyond the scope of its original plan of work. Thus, it results in additional time and cost for performing the work. When there is ambiguity in the contract document about undertaking of a work; the contractor requests for clarification of it. If clarification is delayed for whatsoever reason; the contractor suspends the construction of the work. The suspension of the work and abandonment of the work cause idling of resources assigned for that work. Cost for idling of resources, time overrun, and cost overrun may result in dispute b/n contracting parties, thus, further causing damage of business relationship, and stranded communication b/n contracting parties. Instruction of replacing part of work may be issued after the work is completed as per initial design, thus, causing rework and relocation of resources to make good work as per the instruction. Rework and relocation of resources, in turn, expose the project to additional expenses in managerial and administrative activities, negative social impacts and lower profitability.

Poor site management, which is a result of poor planning, was positively related to effects of claim such as lower profitability, and suspension of work. Poor site management may result in shortage of material and equipment at site. Thus, it causes suspension of work due to lack of them for work at the construction site. The suspension work exposes the project to additional cost for keeping idle man power at site, thus resulting in lower profitability.

4.5 Reliability and Validity of the Study

Reliability and validity of the study are the measure of internal consistency and correctness of data used to achieve the objectives of the study. In this regards; reliability of the study was measured by using Cronbach's alpha coefficient and validity of the study were assessed by conducting pilot study before distribution of the questionnaire survey.

4.5.1 Reliability of the Study

Reliability of questionnaire data was analyzed by Cronbach's alpha coefficient method using SPSS software and the result was presented as shown below.

Table 4. 63 Reliability analysis of the study

Cronbach's Alpha Coefficient	N of Items
0.960	74

Table 4.63 shows reliability analysis of 74 numbers of variables included in the questionnaire. These 74 variables were sum of 8 variables for background of the projects; 50 variables for causes of claim; and 16 variables for effects of claim. Accordingly; Cronbach's alpha coefficient of 0.960 was obtained for the analysis of reliability. According to Oktavia et al. (2018) and Taherdoost (2016); Cronbach's alpha coefficient in the range of 0.9 to 1 are indication of excellent reliability. Hence; the reliability of the study, Cronbach's alpha coefficient of 0.960, was considered excellent.

4.5.2 Validity of the Study

Validity of the study was assessed through pilot study for validation of content and correlation of the result of the study. Pilot study was conducted before distribution of questionnaire survey. The purpose of the pilot study was to determine how well the questionnaire meets the objectives of the study. Accordingly three experts evaluated the content of the questionnaire survey and proposed to go ahead with the questionnaire survey for the study. The correlation results of the study also indicated that there were good correlations between causes of claim, and effects of claim of the study.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The specific objectives of the study were to identify significant causes of claim, significant effects of claim, and to establish a relationship model between causes of claim and effects of claim for road projects under central directorate of ERA. In this regards; all objectives outlined in the study were achieved and summarized as follows.

Nineteen significant causes of claims were identified in the study from results of questionnaire survey and the lists of them in their ranking order were delay in granting possession of site, variation order, disruption of work, delay in progress of work, inflation, cash flow problem, late payment, security problem, change in scope of work, shortage of construction materials, design error, poor planning, late mobilization, differing site condition, adverse weather condition, unforeseen ground condition, shortage of equipment & spare parts, late issue of instruction, and poor site management. Case study also showed that delay in granting possession of site, security problem, variation order, and change in scope of work were causes of claim for road projects considered in the case study. Delay in granting possession of site was found the top most significant causes of claim from results of questionnaire survey and case study of the study. Variation order and security problems, which were second and eighth significant causes of claim respectively from results of questionnaire survey, were found causes of claim for road projects considered in the case study.

Twelve significant effects of claim were identified from the result of questionnaire survey for the study and the lists of them in their ranking order were time overrun, cost overrun, dispute, idling of resources, negative social impacts, lower profitability, rework & relocation of resources, suspension of work, damage of business relationship, stranded communication b/n contracting parties, project abandonment, and additional expenses in managerial & administrative activities. The result of case study also showed that time overrun, cost overrun, idling of resources, disputes, and suspension of works were effects of claim for road projects considered in the study. Time overrun was found the top most significant effects of claim from results of questionnaire survey and case study of the study. Cost overrun, idling of resources, dispute, and suspension of works, which were significant effects of claim from the

results of questionnaire survey, were also found as effects of claim for the road projects considered in the case study.

The nineteen significant causes of claim in the study were correlated for relationship and the study showed that delay in possession of site was positively related to other ten significant causes of claim; variation order was positively related to other ten significant causes of claim; disruption of work was positively related to other nine significant causes of claims; delay in work progress was positively related twelve significant causes of claim; inflation was positively related to thirteen significant causes of claim; cash flow problem was positively related to sixteen significant causes of claim; late payment was positively related to thirteen significant causes of claim; security problem was positively related to fourteen significant causes of claim; change in scope of work was positively related to four significant causes of claim; shortage of construction material was positively related to twelve significant causes of claim; design error was positively related to fifteen significant causes of claim; poor planning was positively related to ten significant causes of claim; late mobilization was positively related to thirteen significant causes of claim; differing site condition was positively related to fourteen significant causes of claim; adverse weather condition was positively related ten significant causes of claim; unforeseen ground condition was positively related to sixteen significant causes of claim; shortage of equipment & spare parts was positively related to fourteen significant causes of claim; late issue of instruction was positively related to thirteen significant causes of claim; and poor site management was positively related to thirteen significant causes of claim.

The twelve significant effects of claim in the study were correlated for relationship and the study showed that time overrun was positively related to other eleven effects of claim; cost overrun was positively related to eleven effects of claim; dispute was positively related to ten significant effects of claim; idling of resources was positively related to eight significant effects of claim; negative social impact was positively related to ten significant effects of claims; lower profitability was positively related to six significant effects of claim; rework & relocation of resources was positively related to ten significant effects of claim; suspension of work was positively related to eleven significant effects of claim; damage of business relationship was positively related to nine significant effects of claim; stranded communication b/n contracting parties was positively related to eight significant effects of claim; project abandonment was positively related to eleven significant effects of claim; and

additional expenses in managerial & administrative activities was positively related to eleven significant effects of claim.

Relationships between significant causes and significant effects of claim were established and the study showed that delay in granting possession of site was positively related to three effects of claim; variation order was related to eight significant effects of claim; disruption of work was positively related seven significant effects of claim; delay in progress of work was positively related one effect of claim; inflation was positively related to three significant effects of claim; cash flow problem was positively related to two effects of claim; late payment was positively related to nine significant effects of claim; security problem was positively related to eleven significant effects of claim; change in scope of work was positively related to two significant effects of claim; shortage of construction materials was positively related to two significant effects of claim; design error was positively related to six significant effects of claim; poor planning, unfortunately, was not related to any significant effects of claim; late mobilization was positively related to one effect of claim; differing site condition was positively related to nine significant effects of claims; adverse weather condition was positively related seven significant effects of claim; unforeseen ground condition was positively related to eleven significant effects of claim; shortage of equipment & spare parts was positively related to one effect of claim; late issue of instruction was positively related to twelve significant effects of claim; and poor site management was positively related to two significant effects of claim.

Therefore; the study concluded that change in scope of work had least number of relationship with other causes of claim, it was positively related to other four causes of claim; and cash flow problem and unforeseen ground condition had most number of relationship with other causes of claim, each of them was positively related to other sixteen causes of claim. The study also showed that chains of relationship forming loop existed between causes of claim, that is, variation order related to delay in granting possession of site; delay in possession of site related to delay in work progress; delay in work progress related inflation; inflation related cash flow problem; cash flow problem related to late payment; late payment related security; security related to shortage of construction material; shortage of construction materials related poor planning; poor planning related to design error; design error related to change in scope of work; change in scope of work related late issue of instruction; late issue of instruction related disruption of work; disruption of work related to shortage of equipment

& spare parts; shortage of equipment & spare parts related to unforeseen ground condition; unforeseen ground condition related to poor site management; poor site management related to differing site condition; differing site condition related to adverse weather condition; adverse weather condition related to variation order in chain of relation forming loop. On the other hand; the study concluded that lower profitability had least number of relations with other significant effects of claim, it was positively related to six effects of claim; and time overrun, cost overrun and additional expenses in managerial & administrative activities had most number of relations with other significant effects of claim, each of them was positively related to eleven significant effects of claim. The study also showed chain of relationship forming loop existed between effects of claim, that is, time overrun related to cost overrun; cost overrun related to dispute; dispute related to idling of resources; idling of resources related negative social impact; negative social impact related to rework & relocation of resources; rework & relocation of resources related to lower profitability; lower profitability related to suspension of work; suspension of work related to damage of business relationship; damage of business relationship related stranded communication b/n contracting parties; stranded communication b/n contracting parties related to project abandonment; project abandonment related to additional expense in managerial & administrative activities; additional expenses in managerial & administrative related to time overrun in chain of relation forming loop. Furthermore; the study concluded that each causes of claim and each effects of claim had networks of relationship and the networks of relationship showed the interdependency of each causes and each effects in triggering the occurrence of each other.

Recommendations

Delay in granting possession of site, variation order, disruption of work, delay in progress of work, inflation, cash flow problem, late payment, security problem, change in scope of work, and shortage of construction materials were found the top ten significant causes of claim for road projects under central directorate of ERA in this study. Furthermore; a study conducted by (Belachew et al., 2017) revealed that inflation was significant causes for cost overrun claim. The study conducted by (Asratie et al., 2021) also revealed that cash flow problem, delay in possession of site, inflation, late payment, and shortage of construction materials were significant causes of claim. The study conducted by (Road Research Center, 2015) showed that delay in possession of site, variation order, late payment, shortage of construction materials, late issue of instruction, security problem, and adverse weather

condition were significant causes for cost and time overruns in ERA's road projects. A study conducted by (Werkineh & Mite, 2020) also revealed that delay in granting possession of site, design error, change in scope of work, differing site condition, and cash flow problem were significant causes for cost overrun in ERA's road projects. Therefore; the causes of claim for road projects under ERA irrespective of location were almost similar. Hence; it is recommended that further study shall be carried out to find out why these causes of claim are persistent for ERA's road projects. Delay in granting possession of site remains one of the most significant causes of claim in ERA's road projects. Granting a site free of obstruction to the contractor is the responsibility of ERA. Therefore; ERA may further review existing land policy as it may be factor for delay of possession of site as recurrent causes of claim. Besides; ERA may introduce a good management frame work for removal of obstruction from site of construction. Variation order is also another persistent causes of claim in ERA's road projects and, thus, it is recommended that requirement of client for the road to be constructed shall include the opinion of local government, and road users. The consultant shall also thoroughly review the requirements of the client during design work. The contracting parties shall establish a good project management team with clear job description for tackling issues related with delay in progress of work, late payment, design error, cash flow problem, and etc.

The study also revealed that the significant causes of claim have significant network of positive relationships between them; and also; the significant effects of claim have significant network of positive relationships between them. Furthermore; each causes of claim are positively related to one or more than one effects of claim. Therefore; as the relationships between causes of claim and effects of claim may have knockout impact on one another; it is recommended to create awareness about the relationships; and to establish management framework based on the relationships.

In general; this study covered identification of significant causes, significant effects, and correlations of causes of claim and effects of claim. The following topics such as investigation for factors causing delay in granting possession of site, variation order, etc. as persistent causes of claim in ERA's road projects; and regression models for significant causes of claims and significant effects of claim in ERA's road projects are, therefore, recommended for future study.

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APPENDIXES

Appendix 1 Questionnaire for the Study

Part I General Information

- 1) What is the name of the construction project that you are working in now?
-
- 2) What is your party to the contract (organization in the project)?
- ☐ Client ☐ Consultant ☐ Contractor
- 3) What is your position (profession) in the construction project? (tick in the box)
- ☐ Team Leader ☐ Lead Engineer ☐ Counterpart Engineer
- ☐ Resident Engineer ☐ Deputy RE ☐ Claim Expert
- ☐ Project Manager ☐ Construction Manger ☐ Contract Engineer
- 4) What is your experience in the profession? (tick in the box)
- ☐ 0-5 years ☐ 6-10 years ☐ 10-15 years
- ☐ Greater than 15 years
- 5) How long have you been with your organization? (tick in the box)
- ☐ 0-5 years ☐ 6-10 years ☐ 10-15 years
- ☐ Greater than 15 years
- 6) Origin of your organization? (tick in the box)
- ☐ Local ☐ Foreign
- 7) What is the experience of your organization in road construction?
- ☐ 0-5 years ☐ 6-10 years ☐ 10-15 years
- ☐ Greater than 15 years
- 8) What is the work progress of the project you are assigned to? (tick in the box)
- ☐ 0-10% ☐ 11-30% ☐ 31-70%
- ☐ 71-100%
- 9) How many claims have occurred in the project you are assigned to?
- ☐ No claim ☐ 1 -3claims ☐ greater than 3 claims

Part II Causes of Claim (Tick your appropriate response in the box given)

- 1) There are different causes of claim in road construction projects. Please indicate degree of your agreement as to whether the following causes of claim are significant causes of claim; and how often each of the following claims occurs in road project? Please tick in the table.

Sr.no	Causes of claim	Degree of Agreement				
		disagree	neutral	Partially agree	agree	Strongly agree
		1	2	3	4	5
1	Design errors					
2	Differing site condition					
3	Changes or Variation order					
4	Adverse weather condition					
5	Strike of labor or community					
6	Change in scope of work					
7	Inadequate bid information					
8	Faulty and late owner supplied material and equipment					
9	Inadequate drawing and specification					
10	Insufficient time for bid preparation					
11	Disruption (Interference in works causing					

	delay)					
12	Lack of access to construction site					
13	Acceleration of work					
14	Unbalanced bidding and under estimation					
15	Differences in contract interpretation					
16	Late issue of instruction or clarification					
17	Termination or suspension of work					
18	Delay in inspection					
19	Ambiguities in contract clauses					
20	Insufficient design document					
21	Delay in granting possession of site (ROW)					
22	Late payment for certified work					
23	Poor workmanship					
24	Delay in work progress					
25	Poor planning					
26	Delay in material and equipment delivery (late mobilization)					
27	Poor site management					
28	Unforeseen physical condition					
29	Change in legal regulation					
30	Inflation					

	(material cost fluctuation)					
31	inadequate project duration					
32	Construction related accident due poor safety management					
33	shortage of labor					
34	Cash flow problem					
35	Shortage of project managers and construction professionals					
36	poor communication among contracting parties					
37	Shortage of construction material					
38	Shortage of equipment and spare part					
39	Technical inadequacy of contractor					
40	Unrealistic expectation					
41	Security problem (hostilities, war)					
42	Force of natures (pandemic)					
43	Work in congested area					
44	Errors in setting out information					
45	Interference with test on completion of work					
46	Late commencement of project due to delay of					

	advance payment					
47	Fossils, archeological and geological findings					
48	Taking over parts of work					
49	Contractor to search cause of failure of work					
50	Delay damages					

Part III Effects of Claim (Tick your appropriate response in the box given)

- 1) There are different effects of claim in road construction projects. Please indicate level of impact the following effects of claim have on road projects as very low (1), low (2), medium (3), high (4), and very high (5) in the following table.

Sr.no	Effects of claim	Level of Impact				
		very low	low	medium	high	Very high
		1	2	3	4	5
1	Cost overrun					
2	Time overrun					
3	Stranded relation between contracting parties					
4	Damage business relationship					
5	Disputes					
6	Project abandonment					
7	Compromise of quality due to suspension					
8	Lower profitability					
9	Extra expense due to litigation					
10	Suspension of work					

11	Negative social impact					
12	Idling resources					
13	Additional expense in managerial and administrative					
14	Extended or more complex award process					
15	High tender price					
16	Rework and relocation of resources					

Appendix 2 Lists of Road Projects for the Study

Central Region Construction Projects Management Directorate

Lists of Road Projects under Construction

Sr.no	Project Name	Length in KM
1	Construction Works of Bole Junction - Waterdino Horticulture and Bole - Abomsa	30.50
2	Construction Works of Debre Birhan - Ankober	42.00
3	Design and Construction Works of Efeson (Ataye) - Mehal Meda Road Project	60.68
4	Construction Works of Guguftu - Were Ilu - Degolo Road Project	74.06
5	Construction Works of Iteya - Robe	75.60
6	Construction Works of Melkasa - Sodere - Nuraera - Metehara	94.00
7	Construction Works of Muketuri - Kokebmesk	58.80
8	Construction Works of Sansusi - Tatek Kella	13.56
9	Construction Works of Tulu Bolo - Kela Design and Build Road Project	79.90
10	Construction Works of Sodo –Tericha Road Upgrading Project, Contract 2: Omo River - Tercha	102.57
11	Construction Works of Alemketema - Degolo	85.00
12	Construction Works of Bilalo - Kersa - Arsi Negele	92.24
13	Construction Works of Bishoftu - Chefe Donsa	55.14
14	Construction Works of Bulbula Alage Design and Build Road Project	29.08
15	Construction Works of Degolo - Kelela	71.38
16	Construction Works of Ginchi - Shikute	62.20
17	Construction Works of Menebeghna - Fincha - Shambu	67.79
18	Construction Works of Sayo - Shanan - Gudar	91.80
19	Construction Works of Shikute - Chulute	63.20

20	Mehalmeda - Gasherabiel - Mekoy - Milamile: Contract 1: Mehalmeda - Tormesaya	65.50
21	Construction Works of Ambo - Gudar	18.50
22	Construction of Ankober - Awash Arba Road Project, Contract 2: Dulecha - Awash Arba	53.13
23	Construction Works of Kelela-Akesta	40.13
24	Construction Works of Kokebmesk - Alem ketema	47.70
25	Construction Works of Koshe-Mito-Werabe Design and Build Road Project	72.91
26	Construction Works of Mintamir - Metehabila - Metehara	77.36
27	Construction Works of Robe - Gasera- km 60+000	60.00
28	Construction Works of Tarmaber - Meleya - Molale, Meleya - Sefedmeda	118.87
29	Construction Works of Km 60+000 - Km 120+870 (Gindhir	60.84
30	Construction Works of Arsi Robe - Agarfa - Ali: Contract 2: Arsi Robe - Wabe River bridge	121.80

Appendix 3 T- table

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
Z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

Appendix 4 Correlation table

Critical Values of the Spearman's Ranked Correlation Coefficient (rs)

Taken from Zar, 1984 Table B.19

$\alpha(2):$	0.50	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
$\alpha(1):$	0.25	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
n									
4	0.600	1.000	1.000						
5	0.500	0.800	0.900	1.000	1.000				
6	0.371	0.657	0.829	0.886	0.943	1.000	1.000		
7	0.321	0.571	0.714	0.786	0.893	0.929	0.964	1.000	1.000
8	0.310	0.524	0.643	0.738	0.833	0.881	0.905	0.952	0.976
9	0.267	0.483	0.600	0.700	0.783	0.833	0.867	0.917	0.933
10	0.248	0.455	0.564	0.648	0.745	0.794	0.830	0.879	0.903
11	0.236	0.427	0.536	0.618	0.709	0.755	0.800	0.845	0.873
12	0.217	0.406	0.503	0.587	0.678	0.727	0.769	0.818	0.846
13	0.209	0.385	0.484	0.560	0.648	0.703	0.747	0.791	0.824
14	0.200	0.367	0.464	0.538	0.626	0.679	0.723	0.771	0.802
15	0.189	0.354	0.446	0.521	0.604	0.654	0.700	0.750	0.779
16	0.182	0.341	0.429	0.503	0.582	0.635	0.679	0.729	0.762
17	0.176	0.328	0.414	0.485	0.566	0.615	0.662	0.713	0.748
18	0.170	0.317	0.401	0.472	0.550	0.600	0.643	0.695	0.728
19	0.165	0.309	0.391	0.460	0.535	0.584	0.628	0.677	0.712
20	0.161	0.299	0.380	0.447	0.520	0.570	0.612	0.662	0.696
21	0.156	0.292	0.370	0.435	0.508	0.556	0.599	0.648	0.681
22	0.152	0.284	0.361	0.425	0.496	0.544	0.586	0.634	0.667
23	0.148	0.278	0.353	0.415	0.486	0.532	0.573	0.622	0.654
24	0.144	0.271	0.344	0.406	0.476	0.521	0.562	0.610	0.642
25	0.142	0.265	0.337	0.398	0.466	0.511	0.551	0.598	0.630
26	0.138	0.259	0.331	0.390	0.457	0.501	0.541	0.587	0.619
27	0.136	0.255	0.324	0.382	0.448	0.491	0.531	0.577	0.608
28	0.133	0.250	0.317	0.375	0.440	0.483	0.522	0.567	0.598
29	0.130	0.245	0.312	0.368	0.433	0.475	0.513	0.558	0.589
30	0.128	0.240	0.306	0.362	0.425	0.467	0.504	0.549	0.580
31	0.126	0.236	0.301	0.356	0.418	0.459	0.496	0.541	0.571
32	0.124	0.232	0.296	0.350	0.412	0.452	0.489	0.533	0.563
33	0.121	0.229	0.291	0.345	0.405	0.446	0.482	0.525	0.554
34	0.120	0.225	0.287	0.340	0.399	0.439	0.475	0.517	0.547
35	0.118	0.222	0.283	0.335	0.394	0.433	0.468	0.510	0.539
36	0.116	0.219	0.279	0.330	0.388	0.427	0.462	0.504	0.533
37	0.114	0.216	0.275	0.325	0.383	0.421	0.456	0.497	0.526
38	0.113	0.212	0.271	0.321	0.378	0.415	0.450	0.491	0.519
39	0.111	0.210	0.267	0.317	0.373	0.410	0.444	0.485	0.513
40	0.110	0.207	0.264	0.313	0.368	0.405	0.439	0.479	0.507
41	0.108	0.204	0.261	0.309	0.364	0.400	0.433	0.473	0.501
42	0.107	0.202	0.257	0.305	0.359	0.395	0.428	0.468	0.495
43	0.105	0.199	0.254	0.301	0.355	0.391	0.423	0.463	0.490
44	0.104	0.197	0.251	0.298	0.351	0.386	0.419	0.458	0.484
45	0.103	0.194	0.248	0.294	0.347	0.382	0.414	0.453	0.479
46	0.102	0.192	0.246	0.291	0.343	0.378	0.410	0.448	0.474
47	0.101	0.190	0.243	0.288	0.340	0.374	0.405	0.443	0.469
48	0.100	0.188	0.240	0.285	0.336	0.370	0.401	0.439	0.465
49	0.098	0.186	0.238	0.282	0.333	0.366	0.397	0.434	0.460
50	0.097	0.184	0.235	0.279	0.329	0.363	0.393	0.430	0.456

A Relationship Model for Cause and Effect of Claim in Roads Construction Projects: A case of Central Directorate of Ethiopian Roads Administration

$\alpha(2):$	0.50	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
$\alpha(1):$	0.25	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
n									
51	0.096	0.182	0.233	0.276	0.326	0.359	0.390	0.426	0.451
52	0.095	0.180	0.231	0.274	0.323	0.356	0.386	0.422	0.447
53	0.095	0.179	0.228	0.271	0.320	0.352	0.382	0.418	0.443
54	0.094	0.177	0.226	0.268	0.317	0.349	0.379	0.414	0.439
55	0.093	0.175	0.224	0.266	0.314	0.346	0.375	0.411	0.435
56	0.092	0.174	0.222	0.264	0.311	0.343	0.372	0.407	0.432
57	0.091	0.172	0.220	0.261	0.308	0.340	0.369	0.404	0.428
58	0.090	0.171	0.218	0.259	0.306	0.337	0.366	0.400	0.424
59	0.089	0.169	0.216	0.257	0.303	0.334	0.363	0.397	0.421
60	0.089	0.168	0.214	0.255	0.300	0.331	0.360	0.394	0.418
61	0.088	0.166	0.213	0.252	0.298	0.329	0.357	0.391	0.414
62	0.087	0.165	0.211	0.250	0.296	0.326	0.354	0.388	0.411
63	0.086	0.163	0.209	0.248	0.293	0.323	0.351	0.385	0.408
64	0.086	0.162	0.207	0.246	0.291	0.321	0.348	0.382	0.405
65	0.085	0.161	0.206	0.244	0.289	0.318	0.346	0.379	0.402
66	0.084	0.160	0.204	0.243	0.287	0.316	0.343	0.376	0.399
67	0.084	0.158	0.203	0.241	0.284	0.314	0.341	0.373	0.396
68	0.083	0.157	0.201	0.239	0.282	0.311	0.338	0.370	0.393
69	0.082	0.156	0.200	0.237	0.280	0.309	0.336	0.368	0.390
70	0.082	0.155	0.198	0.235	0.278	0.307	0.333	0.365	0.388
71	0.081	0.154	0.197	0.234	0.276	0.305	0.331	0.363	0.385
72	0.081	0.153	0.195	0.232	0.274	0.303	0.329	0.360	0.382
73	0.080	0.152	0.194	0.230	0.272	0.301	0.327	0.358	0.380
74	0.080	0.151	0.193	0.229	0.271	0.299	0.324	0.355	0.377
75	0.079	0.150	0.191	0.227	0.269	0.297	0.322	0.353	0.375
76	0.078	0.149	0.190	0.226	0.267	0.295	0.320	0.351	0.372
77	0.078	0.148	0.189	0.224	0.265	0.293	0.318	0.349	0.370
78	0.077	0.147	0.188	0.223	0.264	0.291	0.316	0.346	0.368
79	0.077	0.146	0.186	0.221	0.262	0.289	0.314	0.344	0.365
80	0.076	0.145	0.185	0.220	0.260	0.287	0.312	0.342	0.363
81	0.076	0.144	0.184	0.219	0.259	0.285	0.310	0.340	0.361
82	0.075	0.143	0.183	0.217	0.257	0.284	0.308	0.338	0.359
83	0.075	0.142	0.182	0.216	0.255	0.282	0.306	0.336	0.357
84	0.074	0.141	0.181	0.215	0.254	0.280	0.305	0.334	0.355
85	0.074	0.140	0.180	0.213	0.252	0.279	0.303	0.332	0.353
86	0.074	0.139	0.179	0.212	0.251	0.277	0.301	0.330	0.351
87	0.073	0.139	0.177	0.211	0.250	0.276	0.299	0.328	0.349
88	0.073	0.138	0.176	0.210	0.248	0.274	0.298	0.327	0.347
89	0.072	0.137	0.175	0.209	0.247	0.272	0.296	0.325	0.345
90	0.072	0.136	0.174	0.207	0.245	0.271	0.294	0.323	0.343
91	0.072	0.135	0.173	0.206	0.244	0.269	0.293	0.321	0.341
92	0.071	0.135	0.173	0.205	0.243	0.268	0.291	0.319	0.339
93	0.071	0.134	0.172	0.204	0.241	0.267	0.290	0.318	0.338
94	0.070	0.133	0.171	0.203	0.240	0.265	0.288	0.316	0.336
95	0.070	0.133	0.170	0.202	0.239	0.264	0.287	0.314	0.334
96	0.070	0.132	0.169	0.201	0.238	0.262	0.285	0.313	0.332
97	0.069	0.131	0.168	0.200	0.236	0.261	0.284	0.311	0.331
98	0.069	0.130	0.167	0.199	0.235	0.260	0.282	0.310	0.329
99	0.068	0.130	0.166	0.198	0.234	0.258	0.281	0.308	0.327
100	0.068	0.129	0.165	0.197	0.233	0.257	0.279	0.307	0.326

Appendix 5 T-test analysis result

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Design error	58	3.59	1.044	.137
Differing site condition	58	3.52	1.080	.142
Variation Order	58	3.98	.927	.122
Adverse weather condition	58	3.45	.994	.131
Strike of labor	58	3.21	.969	.127
Change in scope of work	58	3.71	1.124	.148
Inadequate bid information	58	3.22	1.185	.156
Faulty and late owner supplied material and equipment	58	2.90	1.266	.166
Inadequate drawing and specification	58	3.05	1.130	.148
Insufficient time for bid preparation	58	2.98	1.100	.144
Disruption as causes of claim	58	3.83	.841	.110
Lack of access to construction site	58	3.24	1.113	.146
Acceleration of work	58	2.88	1.125	.148
unbalanced bidding and under estimation	58	3.21	1.056	.139
Difference in contract interpretation	58	2.93	1.090	.143
Late issue of instruction or clarification	58	3.33	.980	.129
Termination or suspension of work	58	3.24	1.218	.160
Delay in inspection	58	2.95	1.067	.140
Ambiguties in contract clauses	58	2.97	.917	.120
Insufficient design document	58	3.03	1.169	.154
Delay in granting possession of site	58	4.40	.877	.115
Late pyment	58	3.78	1.044	.137
Poor workmanship	58	3.24	1.014	.133
Delay in work progress	58	3.83	.994	.130
Poor planning	58	3.59	1.124	.148
Late mobilization	58	3.55	1.095	.144

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Poor site management	58	3.38	1.226	.161
Unforeseen ground condition	58	3.43	1.011	.133
Change in legal regulation	58	3.07	1.122	.147
Inflation(material cost fluctuation)	58	3.91	1.144	.150
Inadequate project duration	58	3.10	1.103	.145
Construction related accident due to poor safety management	58	2.66	1.035	.136
Shortage of labor	58	2.84	1.005	.132
Cash flow problem	58	3.81	1.083	.142
Shortage of project managers and construction professional	58	2.98	1.221	.160
Poor communication among contracting parties	58	3.17	.976	.128
Shortage of construction material	58	3.62	1.023	.134
Shortage of equipment and spare parts	58	3.45	1.079	.142
Technical inadequacy of contractor	58	3.14	1.235	.162
Unrealistic expectation	58	2.95	1.220	.160
Security problem (hostilities, war)	58	3.79	1.120	.147
Forces of nature (Pandemic)	58	3.09	1.113	.146
Work in congested area	58	2.79	1.072	.141
Errors in setting out information	58	2.76	1.048	.138
Interference with test on completion	58	2.78	1.009	.133
Late commencement of project	58	3.21	1.295	.170
Fossils, archeological and geological findings	58	2.71	1.155	.152
Taking over parts of work	58	2.81	1.017	.133
Contractor to search causes of failure of work	58	2.79	.951	.125
Delay damages	58	3.21	.932	.122

	One-Sample Test					
	Test Value = 3					
	t	N-1	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Design error	4.278	57	.000	.586	.31	.86
Differing site condition	3.647	57	.001	.517	.23	.80
Variation Order	8.074	57	.000	.983	.74	1.23
Adverse weather condition	3.434	57	.001	.448	.19	.71
Strike of labor	1.626	57	.109	.207	-.05	.46
Change in scope of work	4.789	57	.000	.707	.41	1.00
Inadequate bid information	1.440	57	.155	.224	-.09	.54
Faulty and late owner supplied material and equipment	-.622	57	.536	-.103	-.44	.23
Inadequate drawing and specification	.348	57	.729	.052	-.25	.35
Insufficient time for bid preparation	-.119	57	.905	-.017	-.31	.27
Disruption as causes of claim	7.498	57	.000	.828	.61	1.05
Lack of access to construction site	1.652	57	.104	.241	-.05	.53
Acceleration of work	-.817	57	.417	-.121	-.42	.18
unbalanced bidding and under estimation	1.493	57	.141	.207	-.07	.48
Difference in contract interpretation	-.482	57	.632	-.069	-.36	.22
Late issue of instruction or clarification	2.545	57	.014	.328	.07	.59
Termination or suspension of work	1.509	57	.137	.241	-.08	.56
Delay in inspection	-.369	57	.713	-.052	-.33	.23
Ambiguties in contract clauses	-.286	57	.776	-.034	-.28	.21
Insufficient design document	.225	57	.823	.034	-.27	.34
Delay in granting possession of site	12.122	57	.000	1.397	1.17	1.63
Late payment	5.662	57	.000	.776	.50	1.05
Poor workmanship	1.813	57	.075	.241	-.03	.51
Delay in work progress	6.343	57	.000	.828	.57	1.09

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Poor planning	3.970	57	.000	.586	.29	.88
Late mobilization	3.837	57	.000	.552	.26	.84
Poor site management	2.357	57	.022	.379	.06	.70
Unforeseen ground condition	3.248	57	.002	.431	.17	.70
Change in legal regulation	.468	57	.641	.069	-.23	.36
Inflation(material cost fluctuation)	6.084	57	.000	.914	.61	1.21
Inadequate project duration	.714	57	.478	.103	-.19	.39
Construction related accident due to poor safety management	-2.536	57	.014	-.345	-.62	-.07
Shortage of labor	-1.176	57	.245	-.155	-.42	.11
Cash flow problem	5.696	57	.000	.810	.53	1.10
Shortage of project managers and construction professional	-.108	57	.915	-.017	-.34	.30
Poor communication among contracting parties	1.346	57	.184	.172	-.08	.43
Shortage of construction material	4.621	57	.000	.621	.35	.89
Shortage of equipment and spare parts	3.164	57	.002	.448	.16	.73
Technical inadequacy of contractor	.851	57	.398	.138	-.19	.46
Unrealistic expectation	-.323	57	.748	-.052	-.37	.27
Security problem (hostilities, war)	5.392	57	.000	.793	.50	1.09
Forces of nature (Pandemic)	.590	57	.557	.086	-.21	.38
Work in congested area	-1.470	57	.147	-.207	-.49	.08
Errors in setting out information	-1.754	57	.085	-.241	-.52	.03
Interference with test on completion	-1.691	57	.096	-.224	-.49	.04
Late commencement of project	1.217	57	.229	.207	-.13	.55
Fossils, archeological and geological findings	-1.933	57	.058	-.293	-.60	.01
Taking over parts of work	-1.421	57	.161	-.190	-.46	.08
Contractor to search causes of failure of work	-1.657	57	.103	-.207	-.46	.04
Delay damages	1.691	57	.096	.207	-.04	.45

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Cost overrun	58	4.19	.736	.097
Time overrun	58	4.36	.641	.084
Stranded relation between contracting parties	58	3.28	.914	.120
Damage business relationship	58	3.28	.894	.117
Disputes	58	3.76	.885	.116
Project abandonment	58	3.34	1.148	.151
Compromise of quality due to suspension	58	3.22	1.044	.137
Lower profitability	58	3.55	.940	.123
Extra exoense due to litigation	58	3.22	1.044	.137
Suspension of work	58	3.45	1.029	.135
Negative social impact	58	3.60	.954	.125
Idling of resources	58	3.74	.870	.114
Additional expense in managerial and administrative	58	3.29	1.026	.135
Extended or more complex award process	58	2.90	.912	.120
Higher tender price	58	3.22	1.109	.146
Rework and relocation of resources as effect of claim	58	3.52	.922	.121

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	One-Sample Test					
	Test Value = 3					
				Mean	95% Confidence Interval	
	t	N-1	Sig. (2-tailed)	Difference	Lower	Upper
Cost overrun	12.303	57	.000	1.190	1.00	1.38
Time overrun	16.191	57	.000	1.362	1.19	1.53
Stranded relation between contracting parties	2.299	57	.025	.276	.04	.52
Damage business relationship	2.349	57	.022	.276	.04	.51
Disputes	6.530	57	.000	.759	.53	.99
Project abandonment	2.288	57	.026	.345	.04	.65
Compromise of quality due to suspension	1.636	57	.107	.224	-.05	.50
Lower profitability	4.471	57	.000	.552	.30	.80
Extra exoense due to litigation	1.636	57	.107	.224	-.05	.50
Suspension of work	3.318	57	.002	.448	.18	.72
Negative social impact	4.817	57	.000	.603	.35	.85
Idiling of resources	6.492	57	.000	.741	.51	.97
Additional expense in managerial and administrative	2.175	57	.034	.293	.02	.56
Extended or more complex award process	-.864	57	.391	-.103	-.34	.14
Higher tender price	1.539	57	.129	.224	-.07	.52
Rework and relocation of resources as effect of claim	4.271	57	.000	.517	.27	.76