American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

# Determinants of Infrastructure Project Delays and Cost Escalations: The Cases of Federal Road and Railway Construction Projects in Ethiopia

Yenealem Fentahun Kassa*

*P.o.Box 54108, Addis Ababa, Ethiopia*
*Email: yfkw22@gmail.com*

**Abstract**

Construction project objective achievement measured by whether, or not the projects are completed on time and budget. Most of the road and rail construction projects in Ethiopia exposed to extreme time and cost overruns. It becomes difficult to complete projects on time and budget. To fill gaps, the study was conducted causes of infrastructure project delay and cost escalation in the federal road and rail construction projects. Data gathered in purposive sampling technique from the targeted population of the client, contractor, and consultant of managers and engineers who have experienced delay and cost overruns. In the total of 73 questionnaires were collected, and 18 senior engineers interviewed in mixed research approaches and analyzed data using applied and descriptive statistics by aided in SPSS and RII . To investigate the real extent of time and cost overruns of the road and railway construction projects, secondary data collected from 25 roads and 3 railways projects construction completed from 2014 to May, 2018 and analyzed by using Microsoft Office Excel 2007. From the investigation, it found that 88% of the road and 100% railway construction projects suffered time performance, and 80% of the road and 100% of the railway construction projects also cost overruns from initially expected. Project delay and cost overrun can be minimized only when their causes are indentified. To analyze the major causes of time and cost overrun of the road and railway construction projects, the study classified determinants into time overrun (technical, overconfidence bias and strategic misrepresentation), and cost overrun. The top-ranked five delay factors found incomplete to study before project approval, poor project management & coordination, the right of way issues, inaccurate forecasting of schedule, psychological biases, and political interests. Inflation of material cost, the scope change with the change order, incomplete study project approval, poor bill of quantity & design, and poor project performance monitoring among top ranked cost overrun determinants. The correlation between time overrun variables/or determinants, and time & cost overrun determinants directly affecting the other time and cost overrun variables in the same project.

---

* Corresponding author.

The research findings suggested that the project stakeholder makes sure that the road and rail projects carrying out on time and within estimated budget. Otherwise, it has found time and cost overruns, this damages client and contractor reputation, loss of profit and investment opportunities, inability to deliver the value of money and inefficient use of time, disposing of business activities and create the burden for taxpayers. The study also reminds for decision-makers and practitioners to address the road and railway construction project delay and cost overrun by rewarding well-performed contractors, improve the capacity of staff, make selective public-private-partnership, enhance performance monitoring and information sharing, and use innovative project cost and time forecasting techniques and tools.

***Keywords:*** determinant; federal road and rail construction project; planned and actual completion time and cost; project stakeholder, and Time and cost overrun.

## 1. Introduction

Public-sector infrastructure projects are seen as an economic and social engine for sustainable community development which promotes the well-being of residents. Government purpose to spend money on public infrastructure projects enhancing the social and economic activities of a country. However, insufficient or underdeveloped infrastructure presents one of the biggest obstacles to economic growth and social development of the country [1]. Some studies argue that in Africa, underdeveloped infrastructure continues to be a binding constraint on sustainable development [2] and the poor state of infrastructure is one of the major obstacles preventing economies in Sub-Saharan Africa from their current economy status into modern industrial economy [2-4]. Sub-Saharan Africa ranks consistently at the bottom of all developing regions in terms of infrastructure performance, and an increasing number of observers point to deficient infrastructure as a major obstacle of growth and poverty reduction across the region [3-5].

Ethiopia is a predominantly rural country, infrastructure development still considered to be very low when it compared to the standards of the Sub-Saharan Africa countries [6].The consequences of poor infrastructure lost growth and retarded human development [7]. To improve the standards of public infrastructure the government of Ethiopia investing huge amount of capitals in many-mega projects. However, a very common problem which is affecting almost all infrastructure projects is the failure to meet the construction planned schedule and estimated cost. Most of projects in Ethiopia for instance, road and rail projects, integrated housing development program, sugar factories, fertilizer plants, irrigation Dams, power megaprojects and others which were not meet project objectives. The achievement of time, cost and quality is used to measure whether the execution of a project is successful or not [8, 9]. During the construction of the infrastructure projects in particularly the road and railway constructions, delay and cost escalation considered as one of the most frequently recurring problems observing form every projects [10].

Delay and cost overrun of the road and rail construction projects occurred in different project stages and depends on project size, construction length, contract volume, and technical and managerial know-how [10-14]. Some projects happen to be late for a few days and overruns in millions, and the other projects delayed for years and overrun billions from the estimated. Extensive study of cost overrun was observed over the courses of 70

years covering 258 transport infrastructure mega projects in 20 nations across the five continents worth approximately US$90 billion. The researcher considered average cost overrun for rail 45%, for tunnels and bridges 34%, and for roads 20%, the average cost escalation of all projects is 28%. The study concluded that incidence of cost escalation had not declined and it appears no learning seemed to have taken place [13].

The project cost overrun is a challengeable to wasteful allocated and further resources. One might consider possibilities that the bigger and complex the projects, the problem is also bigger which would have larger percentage cost escalations than smaller projects, because of other things being equal, implementation phases would be longer for larger projects with resulting increases in cost escalation, this destabilize the finances of a whole country [12]. Special projects with high technical complexity interims of meeting the performance specifications are disposed to high frequency and magnitude of overruns [15]. Cost escalation appears more pronounced in developing nations than developed, and projects lack the transparency, accountability and public control have more cost overruns [12]. On the other hand, more routine construction and maintenance projects the cost estimates for this type of work tend to be more accurate [16]. The researcher understands the studies time and cost overruns are a persistent problem on high technical complexity or megaprojects than smaller/routine projects conducted by government and private sectors.

### *1.1. Statement of the problems*

Construction industry particularly the road and rail projects are very important for the development and economic growth for developed and developing countries. It facilitates the mobility of goods and services, and business activities in the vicinity areas. Investigator [17] indicates Eastern Province of Saudi Arabia completing projects on time and budget is an indicator of efficiency, but construction process is subject to many variables and unpredictable factors which resulted from many sources. It's difficult to see completed within the specified time and initially allocated budget. So, delay in the completion of construction projects is a worldwide problem [18].

Ethiopia's Growth and Transformation Plans I and II identify infrastructure as a key driver of structural transformation leading to the prioritization of public infrastructure spending [19]. Investment in the federal road and rail construction and expansion accounted for 77.6% and 100%, respectively of the total road and rail investment capital in 2017/18 [20]. However, according to Global Competitiveness Index (GCI) 2017 report, the infrastructure pillar has remained below the standard of Sub-Saharan African average of 2.9 [19]. Projects delay and cost escalation is one of the hindering problems to improve road and railway infrastructure standards of the country.

The causes of project delay and cost escalation could be anticipated and controlled, but one might expect that budgeting and scheduling would improve over time to manage mega projects rather than to gain more experience from past problems. Construction of projects in the country's carried out without taking into account some factors that are causing a variety of problems during project development and management. These factors led to delay and cost escalation in the completion of projects within expectation period and allocated budget. Due to this problem, the researcher assessed policy implications, standard, and guideline of the country. The

assessment indicates that there is no clear and integrated guideline and policy document to address recurring problems of cost escalations and schedule delays of infrastructure projects. Such risks are typically ignored in decision making process [13].

Many researchers studied and discussed for decades but the delays and cost overruns still happening in every road and rail construction projects. Most previous studies conducted research on the technical determinants of the road and rail construction project of cost and time overruns. If cost and time overruns were merely caused by technical problems of project delivery, then the size and frequency of cost and time overruns gradually decline over time as forecasting and project delivery methods which should improved. However, data from thousands of projects show that time and cost overruns are a consistent feature of large infrastructure project delivery, suggesting that other factors are playing. They ignored the study combination of technical, political interest and psychological bias. To fill this gap, the researcher conducts study as a combination of technical, overconfidence bias, and strategic misrepresentation determinants of time and cost overruns on the federal road and railway construction projects of Ethiopia.

### *1.2. Objectives of studies*

#### *1.2.1. General objectives*

This research is aimed to determine factors influencing time and cost overrun of the federal road and railway construction projects in Ethiopia's.

#### *1.2.2. Specific objectives*

a) To establish common understanding of determinants influencing road and rail infrastructure investment cost escalation and time extension
b) To analysis the magnitude of the actual cost and time overrun selected road and railway construction projects construction completed from 2014 to May, 2018
c) To conduct comparative statistical analysis dataset among projects and between road and rail projects sectors based on the actual time and cost with the initially planned
d) To provide inputs to decision makers and practitioners to address the major determinants of the road and railway projects schedule delay and cost escalation beyond the initial completion date and budget

### *1.3. Research questions*

The research questions ultimately initiation from observation of the actual situation of the projects and the investigation of available literatures. This paper answers the following five questions:

a) What are the major causes behind cost and time overruns of the road and railway construction projects?
b) In what extent of actual cost and time overruns the federal road and railway projects construction completed since 2014 to May, 2018?
c) Which construction project sectors overtake more time & cost beyond initial schedule time and

estimated budget in comparing with the road and railway projects sectors?

d) What are the strategies to address problems of delay and cost escalation on the road and railway construction projects?

### *1.4. Scope of the study*

The research examines the Federal road and rail project that meets the following requirements:

a) The study includes new constructed and reconstructed projects construction completed from 2014 to May, 2018. The roadway construction project only included study's Asphalt Concretes (AC)
b) Existing projects data collected and reviewed construction completion reported to the Head Office of the respective agencies (ERA and ERC).
c) Construction completed projects have sufficient data requirements in order to analyze cost and time overruns
d) Delay and cost overrun occurred because of the projects missed one or more letting milestones
e) The study focused on a total project investment greater than 150 million birr/local currency
f) Consultants and contractors included in the study which have involved construction of one or more complex Federal road and rail projects and Head Office are based on Addis Ababa City

### *1.5. Limitation of the study*

At the time of collecting secondary data, it was difficult to get well-organized and easily accessible data coordinated by a central department. The road construction projects data collected from each regional division department in the Head Office of project administrated engineers. The cost overruns of the road and railway construction projects in both agencies hidden for stakeholders and public views, except a few experts they administrated and coordinated the projects. In this case, some experts were showing unwillingness to provide necessary project completion data and take a longer period of time to clarify the objectives of the study and reach consensus. Poor data administrating systems and limited public expose of project history adversely impacts the researcher's data collection time and effort; it takes longer than planned.

## 2. Litreture review

### *2.1. Operational terminologies*

Project is a temporary endeavor undertaken to create a unique product or service. Any project must have a starting point and an ending point, and it must have a deliverable product or service [14]. Federal road and rail construction project is a project financed and administrated by the federal government networking the center of the nation to the regions, or region to region across the country. These projects didn't include regional and municipality financed and administrated roads and railways. The common definition of project overrun in most studies identified a change in cost or schedule relative to the final estimate provided when the approval made until construction is completed "Project stakeholder defined as in this study an individual or group with a direct or indirect interest or influence, involvement, or investment at the time of a project phases. It includes client, contractor, consultant, politician, project beneficiary or harmful community, and others [15].

A delay is an action or condition that results in finishing a project later than stipulated in the contract. A delay claim can be either an extension of time in the contract or monetary compensation or both [16]. Project delay and cost escalation mean estimating the difference between planned and actual project completion date and cost. The project completion date is the date from the notice to proceed plus the number of days/or months or years allowed for construction /or the actual completion date [17]. The implementation schedule commences from the date of project approval by the main financiers and the key decision-makers to the project come to full commercial operation [18].

Cost overrun can be simply defined as the difference between the final completed cost of a project job completion and its initial cost estimated at the planning time [19]. Other researches cost overrun defined as the difference between actual project cost at completion and budget estimate at project approval [20, 21]. The two most important data variables in this research are the estimated and actual costs. Actual costs defined as real accounted costs determined at the time of project completion. Estimated costs defined as budgeted or forecasted construction costs determined at the time of formal decision to build [22]. Delay or cost overrun is an amalgamation of two or more isolated causes happening at the same time or separately [23, 24]. The road and rail projects not necessarily considered and built on contracted price and schedule. Either a client or contractor or both are responsible for such causes.

### *2.2. Magnitude of time and cost overrun*

#### *a) Schedule delays*

The majority of infrastructure projects in India are affected by time overruns. The overruns vary from a few months to more years [25]. Texas Department of Transport investigated 868 highway projects of this 49% (424) projects delay concurred [17]. A desk study conducted of 10 completed road construction projects in Addis Ababa city the result shows 100% of projects suffered timely performance. The rate of time overrun ranges from 25% to 264.38% of the initial contract period [26]. Another study [27] indicates Addis Ababa City Administration almost 80% of the road construction projects were completed beyond their planned completion periods. In Malaysia State of Perak 10 road construction projects investigated, 100% projects delayed, the duration of delay between 30-100 days [28]. 100% of projects face schedule delay in Saudi Arabia road construction projects. The average schedule delay was 58.24% [29]. One of the factors which caused construction projects to delay in Ethiopia was all team of the projects were not participating actively at the beginning stages [30]. In the Oromia Region of Ethiopia, 100% of building construction projects suffered both time and cost performance [31].The effects of construction delays identified as time and cost overrun, disputes, litigation, and total leave behind implementation of projects [32-34].

#### *b) Cost overruns*

Comparing actual the magnitude of cost overruns among the estimation is an interesting and useful trend to evaluate performance objectives of projects. As the study described the U.S., majority of transport projects experienced cost overruns and the overrun amounts vary among the projects [35]. The extents of cost overrun

depend on the volume of contract, length of performance, and technical and managerial know-how of stakeholders [10-13, 36]. In Federal road projects of Ethiopia, 80% of projects experienced in cost overrun [37]. The researchers conducted 74 road and 21 rail transport projects in China from 1984–2008, of this 75% of projects suffered a cost overrun. The average overruns 30.6% higher than estimated costs, from the analysis seven out of 10 roads and nine out of 10 rail projects went over budget [38]. In the Southern District of Ethiopia selected road construction projects conducted the study the average magnitude of cost overrun was 21.52% [39]. Many projects were experiencing cost overruns of 50 to 100% [12]. Project cost overruns are a significant problem in developing countries than developed [40]. Cost overruns are obvious effects for the key stakeholders in particular, and on the construction industry in general. To the client, cost overrun implies added costs over and above those initially agreed upon resulting in fewer returns on investment [41]. The author [42] identified the effects of cost overruns were a firm liability to insolvency, over-utilization of resources, and increased project cost due to extension of time. Cost overrun misplaced investment, overspending, financial problem and less transparency [11]. Longer project duration means that more resources will need to be allocated to the project then increases the project costs and leave project implementation behind.

### *2.3. Factors contributing to project delay and cost escalation*

Causes of schedule delay and cost overruns factors lead to construction projects not being finished within estimated time and allocated budget. Previous studies investigated schedule delay and cost escalation can result from numerous factors, sources and delay can happen at any time during project construction. Time and cost overrun challenges of developing countries classified into engineering challenges, human development challenges, managerial and political challenges, and sustainability challenges [43]. Construction project delay factors in Ethiopia classified into pre-construction, construction, and post construction stages [44]. Common delays affecting construction projects categorized as critical and non-critical delays, exclusive and non exclusive delays, compensable and non-compensable, concurrent and non-concurrent delays (45). The other researchers [11,46] indentified factors influencing project cost over-runs broadly classified as technical, optimism bias, and strategic deception and misrepresentation challenges. This researcher classified the causes of project time and cost overruns of previous studies into technical, overoptimistic bias, and strategic misrepresentation factors.

#### *2.3.1. Technical determinants*

##### *a) Inefficient planning and inaccurate forecasting of projects*

Improper planning and scheduling of the project indicates as one of the significant factor causing construction project delay and cost escalation. Forecasting problems include the use of inappropriate methods or inaccurate underlying assumptions due to incomplete data. In the Malaysian construction industry survey ranked ineffective planning and scheduling of the project as the 5th significant cause of project delay [47]. Project cost underestimation at the planning stage arising from poor forecasting techniques often misleads decision makers to buy-in on inferior projects with high overruns and low benefit [11]. Others researchers ranked ineffective planning and scheduling also one of the most important causes of project delay in Malaysian and Vietnam highway project contractors [48, 49]. Inadequacy project planning and inaccurate cost estimation considering as

one of the top factors caused project delay and cost escalation in Asian Countries highway projects and Addis Ababa City road construction projects [27, 50]. Ineffective project planning and scheduling, improper project feasibility study, late design, unclear and inadequate details and specification of design identified as top caused of construction projects delay in Ethiopia [44].

***b) Insufficient work efforts***

Insufficient work effort includes a shortage of skilled, semi-skilled & unskilled workforces, shortage of equipment and materials, and inefficient time usages and unproductive labors. A consistent supply of materials is imperative to the success of every construction project [51]. However, the inadequacy supply of materials can create a lot of inconveniences for contractors which may eventually delay the project. Missed or late/slow deliveries of materials can negatively impact on project completion time in Iran, Zambia, Palestine, and Chain projects [52-56]. The ability of a supplier to deliver promptly is one of the major criteria for selecting a supplier in the procurement process [57]. However, unreliable suppliers can be a factor in material shortages [51, 58].

The use of own plant or equipment helps to sustain progress construction of the project because plant or equipment will always be available for use. But, the initial capital injection makes it extremely difficult for contractors to venture into owning efficient equipment and plant. These difficulties caused a delay in road construction projects in Malawi and Malaysia [28, 59]. Construction equipment and plant leasing or hiring are inadequate to meet the demand of Nigerian contractors [60]. A factor that affects delay of road construction project delivery in the State of Perak Malaysia, Southern District of Ethiopia and Cape Coast Metropolis of Ghana was construction material inadequate and delay of resources [25, 39, 61]. Unavailability of utilities at site, shortages, low efficiency, and productivity of equipment are the top causes of construction project delay in Ethiopia [44].

Every construction project needs a certain level of technical professionals, skilled, semi-skilled and unskilled workers. The shortage of manpower caused a delay in construction projects in Ethiopia, Jordan, and Malaysia [48, 62, 63]. Currently, 20% of the labourers in the Malaysian construction industry were foreign workers [64]. The location of some projects makes it difficult to attract manpower. For instance, labourers prefer living in places where living standards are low [65, 66]. Lack of workers was one of the top causes of the road construction project delay in Malaysia State of Perak [28]. In the future infrastructure sector, expected to have a shortage of around three million project professionals in 2020 Asian countries [67]. Lack of skilled professionals and low productivity of labour were top-ranked factors causing construction delay in the Southern District of Ethiopia and Malaysia [39, 47]. So, different studies have shown that without enough equipment, materials, and workforce to complete the construction of projects in stated dates impossible. The completion date ends up being extended by several months and the contractor submits a delay claim.

***c) Inflations***

Inflation is defined as an increase in expenditure levels resulting from a considerable and prolonged rise in prices and other costs through time without changes in project scope. Since most projects take on average

between 3 and 6 years to complete, inflation plays an important role in the planning process [61]. During this time, the value of the dollar changes, even though the project's estimate remains the same. The longer the expected construction period, the more account will need to be taken off the expected inflationary price. Material price inflation is one of the most significant factors that influence the cost performance of road projects in the Southern district of Ethiopia [25]. Escalation of material prices was the first ranked by the client and 7th ranked by the contractor in causes of cost escalation [21]. Material price increase one of the top causes of cost overrun highway projects of Texas, Malaysia, Southern District of Ethiopia and Ghana [17, 25, 39,61]. In September 2010, the currency devaluated by 16.7 %, major foreign currencies resulted in price inflation rising into the double-digits on both imported and local construction materials [68]. Again in 2017, Central Bank of Ethiopia devaluation birr by 15%, the price of construction materials in the country was sharply increasing [69].

***d) Financial difficulties***

Causes of delay in road construction projects in Malaysia state of Perak, Palestine, and Malawi were difficulties financing capacities by contractors or/and clients [28, 55, 59]. The bad financial state of a contractor impacted adversely on project implementation in the Klang Valley of Malaysia [63]. The researchers [27, 70] pointed out delay factors of projects by constructors in honoring payment by the client, low-profit margins, and insufficient capital or excessive debt in both Ghana and Addis Ababa City in Ethiopia. Difficulty in financing projects and problems in accessing bank accounts considered the most significant contributor to construction project delay in Makkah city Malaysia and Cape Coast Ghana [71, 72]. The client's delay in progressive payment is one of the most important causes of project delay in Ethiopian and Malaysian constructions [10, 47]. The client needs to release payment on time unless contractors impair the ability to finance the work [49]. Financial difficulties faced by clients and contractors are the top significant causes of delay in construction project delivery [73, 74]. Contractor financial problems and progress payment delay by the owner were the top causes of project delay under Addis Ababa City Administration of Ethiopia [27].

***e) Late third parties issues***

Late third parties issue includes right-of-way acquisition, mandatory reviews, utility accommodation (water, power, telecommunication, and other related property rights). Causes of delay in Indian transportation infrastructure projects were the delay of land acquisition and environmental related issues [75]. Delay in the subsequent land acquisition was the single largest factor causing project delays in India's transport projects [25]. Moreover, project schedule delays can result from right-of-way complications in the Virginia Department of Transportation Highway report [76]. The right of way acquirement and lack of attention for the utility leading to project schedule delayed and cost escalated for road construction projects in the Southern District of Ethiopia [39]. Change rules and regulations were the most important and highly ranked factors for delay large construction projects in Pakistan [47]. Under Addis Ababa City Administration of Ethiopia, slow site clearance was the major cause of the road construction project delay [27]

***f) Poor project management and coordination***

It includes inadequate communication, ineffective decision-making, poor contract preparation and administration, inexperienced management team, poor risk identification management, and response strategy. Lack of coordination and communication of stockholders through project phases can be detrimental to project success. All stakeholders have a responsibility to project delivery on time and estimated budget. Effective site management is a challenge to a contractor. This problem persists because most stakeholders lack the requisite experience and managerial skill to manage the project team [77]. The major cause of delay in Indian transportation infrastructure projects for a contractor is poor site management and supervision [78]. A poorly managed site affects operations, overall outcomes and contributing to project delay in the UAE [79]. Inadequate project management leads to the failure of resources to achieve the project goal, either in terms of cost or time or both [80]. Poor site management and performance affects not only delays, but also defects, disputes, and cost overrun in Malaysian construction industries [48, 81].Inadequate review of contract documents, lack of coordination at the design phase, poor project reporting and performance monitoring identified the top cost overrun determinants of the road construction project in Ethiopia and Malaysia [39,71].

Communication failure is often at the root of troubled project implementation. There may be a lack of communication between the top executives and the project management team, and communications also may break down between the owner's project management team and the designer and contractors [67, 82]. Project schedule delays can result in complications or disagreements with the designer, contractor/or builder, and inspectors in the Virginia Department of Transportation Highway reports [76]. Another factor in troubled projects is slow decision making. If the authorized executive fails to sign off on a decision a project can languish. Or sometimes if a decision is not forthcoming from the owner's team, a contractor may move ahead with an inappropriate and costly solution to a problem [67]. On the contrary, proactive risk identification, timely decision-making, recruiting qualified site managers, allocating an optimal number of supervisors, and integration of knowledge management processes help for project success [50]. An effective risk management process is critical for project managers to monitor risks and identify when they need to put a mitigation plan in place to actively manage it [67]. Facilitating Transparency, clear accountability with responsibility and a meaningful audit trail to project stakeholders are used to make sure people are performing their required roles effectively and efficiently.

### *2.3.2. Stakeholders over-confidence bias/wishful thinking*

The problem of estimation bias stemming from being overly optimistic about the prospect of a project in terms of cost and time is one of the major factors causing cost overrun and schedule delay in infrastructure procurements. Political and psychological wishful thinking directly impacts cost and time overruns of project more than technical challenges [11]. Political, psychological and competitive pressures on projects incentivize by project promoters, developers, politicians, and other stakeholders are deemphasize project costs, construction time, and risks while overemphasizing project benefits. The concepts of optimism bias in project cost and time estimation were inspired by the seminal work on decision-making under uncertainty [83]. Most people often suffer from planning fallacy and optimism bias in that they tend to be delusional about their prospects and over exaggerate the outcome in an investment.

Over-optimism biases are caused by project developers at planning stages by overestimating their skills, capacities, and recourses to take personal credit for positive outcomes [15]. This is especially true for public sector construction which has gained notoriety for large overruns. According to [11], over-optimism often arises from cognitive biases in the information processing mechanism of the human mind thereby leading to poor project forecasts and wrong estimates stemming from technical and physiological bias. Poor estimation and forecasting techniques, as well as incomplete and unreliable data, caused to optimism bias. According to [67] investigation optimism bias is one of the leading causes of troubled project performance. A better understanding of the technicalities, as well as social and political dimensions of infrastructure procurement, helps to reduce the incidence of optimism bias.

#### *2.3.3. Stakeholders strategic misrepresentation/ deception and delusion*

Stakeholder self-interest issue was ranked set forth by scholars and policymakers as one of the leading causative factors of project cost overruns and schedule delay [84]. Systematic deception and misrepresentation /or self-interest issues speak to the possibility that project cost overruns and schedule delay may stem from a deliberate misrepresentation of facts and realities of the project by a project stakeholders ,/or parties with the sole intent to deceive [15, 85]. This means strong incentives for proponents to strategically misrepresent initial budgets and schedule to get a project approved funding, and to start construction early [86]. The public projects deliberately deception planning stages underestimated costs, schedule and environmental impacts, and overestimated revenues and local development effects [11]. This type of mistaken notion is one of the factors causing project overruns. Project delusion not only faced in planning and development stages but also ambiguity in contract terms and conditions can also derail projects. Transparency, accountability and contract provisions should delineate the roles and responsibilities of the various parties [67].

## 3. Research approach and methodology

### *3.1. Research design*

The study was carry-out an inductive approach as it initiated from the general observation of existing problems of delays and cost overruns, and to find out new or old facts by scientific ways to develop an existing theory or its application for real problems of the road and rail construction projects. The research also categorized as applied and descriptive type. It was applied because of the research is initiated from observation of practical problems and finds whether there exist time and cost overrun or not in actually completed projects. It was descriptive because it tray to describe the actual rate of time and cost overruns and the major variables causing time and cost overruns in the projects. The research strategy adopted mixed approach to achieve the objectives mainly focused on the primary data survey conducted through questionnaires and interviews presented physically in the respondent offices and construction sites. The researcher used quantitative approach for structural questionnaire distributed to the project managers and engineers the data measurements and variables play an important role. On the other side, a qualitative approach used to collect data measurements and variables do not carry much significance. Secondary data gathered from the project completion report of the Ethiopian Railway Corporation (ERC) and Ethiopian Road Authority (ERA) developed simple tubular formats.

### *3.2. Applicable variables*

Variables can be measured directly or indirectly through appropriate indicators. This research was applied both directly measurable variables and indirectly measurable concepts (feelings and judgments) together to identify causes and effects of delay and cost overrun of the road and railway construction projects.

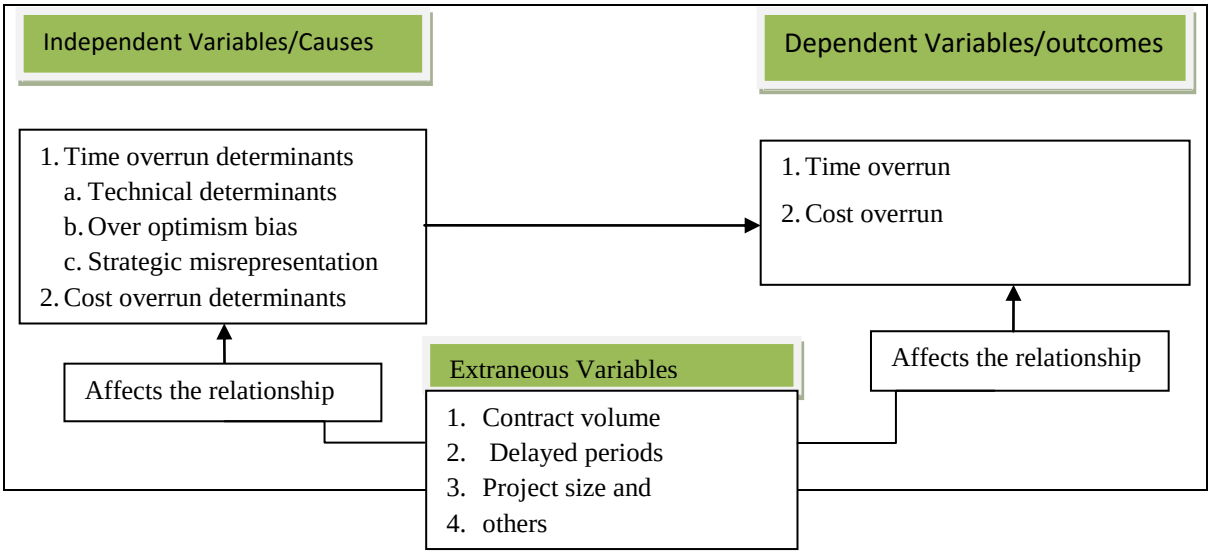


**Figure 1:** Independent, dependent and extraneous variables in a causal relationship

Three sets of variables operated: independent, dependent, and extraneous. Change variables are independent variables which cause of time and cost overruns of the road and rail construction projects. Outcome /or effect variables are also called dependent variables, the outcome or change brought by the introduction of an independent and external variable. External variables that work both ways may increase or decrease the magnitude or strength of the relationship between independent, and dependent variables. It includes project size, location of construction site, contract volume, project duration and others may change. All of the variables may cause time and cost overruns of the road and rail construction projects. To conduct study's the researcher was given more emphasis on independent and dependent variables.

### *3.3. Sampling method*

The research population it does not mean that all members (employees) of the road and rail construction project working construction sites and offices possible respondents for the questionnaires and interviews. Rather, the questionnaires distributed and interview requested to/for senior managers and engineers who are familiar with the road and rail construction projects delay and cost overrun. Contractors and consultants selected based on experience and the volume of contract they involved in the constructions of the road and rail projects. Purposive sampling technique applied to select primary respondents from the road and railway construction agencies, consultants, and contractors. Purposive sampling was a useful method that allows a researcher to get information from a sample of the population that one thinks knows most about the subject matter of the road and railway construction projects delay and cost escalation problems. In the case of secondary data, the researcher

considered only newly constructed and upgraded asphalt concert road and railway projects the construction completed from 2014 to May 2018.

The asphalt concrete road projects included in the study's only necessary data available and the amount of contract volume more than 150 million birr, /or local currency. The reason for selected new and upgraded asphalt concrete roads based on trends and experiences, the larger the volume of contract and more complicated the projects, high opportunities of missing estimated cost and deadlines.

### *3.4. Sample size*

In the total of 98 practitioners; 65 from two client agencies (ERC and ERA), 23 from five contractors, and 10 from three consultants chose in purposive sampling techniques and distributed closed-ended questionnaires. The questionnaire was designed from a literature review and validated through the pilot study. In each categorized determinant of time and cost overrun have two questions; the first question requested respondents to choose more than one answers from the listed key determinants that influencing cost and time overruns and; the second question, rank the chosen determinants in question one based on the influence of cost and time overruns.

The researcher also interviewed and discussed in face-to-face 18 senior managers and engineers for further detail information and explanation in questionnaires and top-ranked determinants. Secondary data in total of 45 asphalt road and 3 railway projects construction completed from 2014 to May 2018 assessed in the study. From these completed road and rail projects in the study period, the researcher included in the study only twenty-five (25) concrete asphalt roads and three (3) rail projects. Because of 5 road projects less than scope limitation (less than 150 million Birr), and 15 road projects were incomplete data to undertake the study. In a total of 20 road projects construction completed in specified study period didn't include the research. In the case of railway projects, all new construction completed projects included in the sample size, due to the reason for a limited number of projects available and constructed from 2014 to May 2018.

### *3.5. Data analysis and findings*

Collected data analyzed through combination of Statistical Package of Social Science (SPSS), Relative Importance Index (RII), and Microsoft Window Excel 2007 models. SPSS and RII are favorable models to analyze reliability test of data, indentify index of determinants and correlation coefficients of variables. Microsoft Window Excel 2007 used to find out the actual magnitude of cost escalation and schedule slippage of each,/or in total road and rail projects construction completed from 2014 to May 2018.

The reliability of data tested in advance Cronbach's Alpha (α) and the relationships of categorized variables measured Pearson's Correlation Coefficient (r). The analyzed data communicating and display through in the form of text, graph, chart, and table**.**

## 4. Result and discussion

### *4.1. Magnitude of time and cost overruns of the road and rail construction projects*

**Table 1:** completion report of federal road and rail projects construction completed from 2014 to May, 2018

| **Roadway construction projects** | | | | | | | |
|---|---|---|---|---|---|---|---|
| No | List of projects | Length in (km) | Date of commencement | Planned completion date | Actual completion date | Initial planned cost in ETB | Actual completion cost in ETB |
| 1 | Aposto-Irbamoda | 94.1 | Apr 28,2009 | Apr 27,2012 | Jun 29,2014 | 660,938,029.10 | 837,522,641.78 |
| 2 | Sawla-Kako Lot 1 | 22.6 | Sep 12,2011 | Mar 14,2014 | Oct 31,2016 | 163,067,816.45 | 189,205,163.25 |
| 3 | Dessie-Kutber | 67.5 | May 20,2014 | May 5,2017 | May 19,2018 | 1,545,557,747 | 1,877,782,018.19 |
| 4 | Sanja-Keraker | 49.2 | Mar 17,2014 | Sep 14,2016 | May23,2017 | 786,796,666.46 | 848,256,431.96 |
| 5 | Abiadi-Hawzen-Fireweyni | 100.9 | Feb 23,2012 | Feb 23,2015 | May 9,2016 | 874,321,450.10 | 995,767,290.60 |
| 6 | Tegede Jun-KetemaNigus | 22.83 | Nov 30,2012 | Nov29,2014 | Jun 6,2016 | 516,442,158.68 | 473,717,943.53 |
| 7 | Dansha - Abrafi – Maykadra | 118.75 | Dec 24,2013 | Dec 24,2016 | Dec 24,2016 | 1,607,687,055.79 | 1,762,084,263.14 |
| 8 | Mekelle - Seret Village | 64.56 | Apr 28,2009 | Apr 17,2014 | Mar 2,2016 | 482,679,383.60 | 658,041,659.26 |
| 9 | Zagora-Gassay | 44.5 | Jun 25,2014 | Jun 24,2016 | May28,2017 | 485,177,003.27 | 492,026,476.27 |
| 10 | Turmi-Omorutie | 91 | May29,2013 | May 28,2016 | Dec 7,2016 | 794,855,085.00 | 770,218,600.00 |
| 11 | Otolo-Sawla | 59.62 | Sep 1,2011 | Sep 7,2014 | Nov 252016 | 358,972,228.46 | 765,602,420.01 |
| 12 | Agremariam-Yabelo | 94.5 | May 11,2011 | Nov 21,2015 | Mar 4,2016 | 740,685,321.21 | 850,597,255.17 |
| 13 | Maga-Moyale | 109.3 | Sep 1,2013 | Aug16,2016 | Jan 30,2018 | 1,146,905,005.89 | 1,631,337,357.34 |
| 14 | Mazoria-Hadero | 36 | Aug 25,2015 | Aug 24,2016 | July 28,2017 | 288,252,845.07 | 400,446,579.64 |
| 15 | Jimma-Bonga | 110 | Apr 21,2008 | Feb 20,2011 | Feb 28,2014 | 742,938,243.00 | 1,052,507,574.00 |
| 16 | Bonga-Mizan | 119 | Apr23,2008 | Feb 22,2011 | Feb 28,2016 | 686,102,036.00 | 925,107,589.00 |
| 17 | Mekenajo-Ayra | 52.06 | Apr7,2011 | Apr 4,2014 | Mar 31,2016 | 633,534,840.56 | 656,801,471.56 |
| 18 | Ayra-Chanka | 70.55 | Apr7,2011 | Apr 4,2014 | Dec 15,2015 | 669,143,993.96 | 805,369,526.05 |
| 19 | Chanka-Dembidolo | 65.5 | Apr7,2011 | Apr 4,2014 | Jul 28,2016 | 648,548,842.21 | 702,162,129.67 |
| 20 | Addis -Adama Experess | 84 | Apr 1,2010 | Apr 21,2014 | Apr 20,2014 | 8,012,199,960 | 8,211,209,893.04 |
| 21 | Kombolcha-Burka | 60.03 | Sep 5,2013 | Sep 4,2016 | Mar 10,2018 | 1,588,240,440.60 | 1,595,391,558.46 |
| 22 | Burka-Mile | 73.07 | Sep 2,2013 | Sept 1,2016 | Mar 15,2018 | 1,285,666,666 | 1,297,718,902 |
| 23 | Mile and logiya Twon | 21.37 | Jan 10,2013 | Jan 11,2015 | Jan11,2015 | 773,359,132.05 | 705,359,132.05 |
| 24 | F2 - F1 – Hana | 37.14 | Nov 14,2013 | Nov 13,2015 | Dec 16,2016 | 651,111,223.66 | 651,111,223.66 |
| 25 | Azezo –Goregora | 52.7 | Jan 23,2013 | Aug 29,2015 | Apr 13,2017 | 730,706,949.39 | 730,706,949.39 |

| **Railway construction projects** | | | | | | | |
|---|---|---|---|---|---|---|---|
| No | List of Projects | Length in (km) | Date of commencement | Planned completion date | Actual completion date | Initial planned cost in USD | Actual completion cost in USD |
| 1 | Addis Ababa LRT | 34.2 | Jun 1,2012 | Jan 31,2015 | Mar 31,2016 | 475,000,000.00 | 494,052,200 |
| 2 | A.A to Meiso | 339 | Oct 25,2011 | Apr 25,2015 | Jan 1,2018 | 1,841,470,000 | 2,043,908,591 |
| 3 | Meiso to Dwenlie | 317.25 | Jun 1,2011 | Dec 25,2015 | Jan 1,2018 | 1,401,000,000 | 1,605,400,000 |

Comparison between actual project completion time and cost with estimated one is necessary to understand

whether the project completed on estimated time and budget or not. The extent of time and cost overrun of the road and railway construction projects depends on project size, complexity, implementation phase, contract volume, geographical site, and technical and management capabilities of a project parties,/or stakeholders.

### *4.1.1. Roadway construction projects*

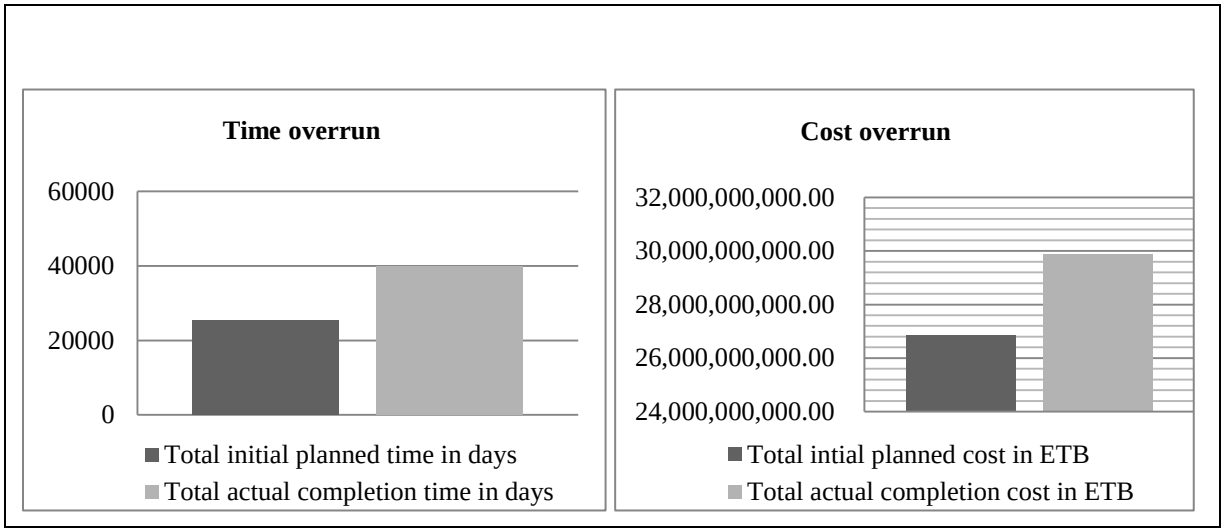


**Figure 2:** comparison of in total completion time and cost with estimated among the roadway projects

In figure 2 only 12% of road projects completed on planned schedule, but 88% completed beyond on planned schedule. Delays extended from 6 % to 63% /or 103 to 1831 business days. While the average percentage rate of time overrun was nearly 38% higher than the estimated scheduled. This caused delayed both client and contractor schedule around 661 business days, which almost equivalent to one year and eight months. In other side, only 8% of the road projects completed initial estimated cost, but 80% of projects completed beyond initial planned cost, and 12% of projects also completed below initial estimated cost due to the reason of change in designed and decreased estimated road sizes. The actual magnitude of cost overruns laid between 0.45% and 53%, and/or in amounts between 6.8 million to 485.4 million birr /local currency. The average cost overrun percentage rate of the roadway projects 15% higher than estimated costs. This overrun expensed client more than 157 million birr from each project, which is significant amounts compared to the number of projects and the resources generation capacity of the country.

### *4.1.2. Railway construction projects*

In figure above the railway projects 100 percent completed beyond initial scheduled time and estimated cost. The extension of the time among the projects extended from 29 to 43 percents/424 to 948 business days/. The average percentage rate of time overrun was 37 percent higher than the estimated. This extended the client and contractor schedule to 682 working days which is equivalent to one year and nine months. The magnitude of cost overrun among the railway projects extended from 3.86 to 12.73 percent, in amounts between 19 million to 204.4 million USD. The average rate of cost overrun nearly 8.83 percent of total completion costs. This added to the cost of the client nearly 142 million USD in each project.

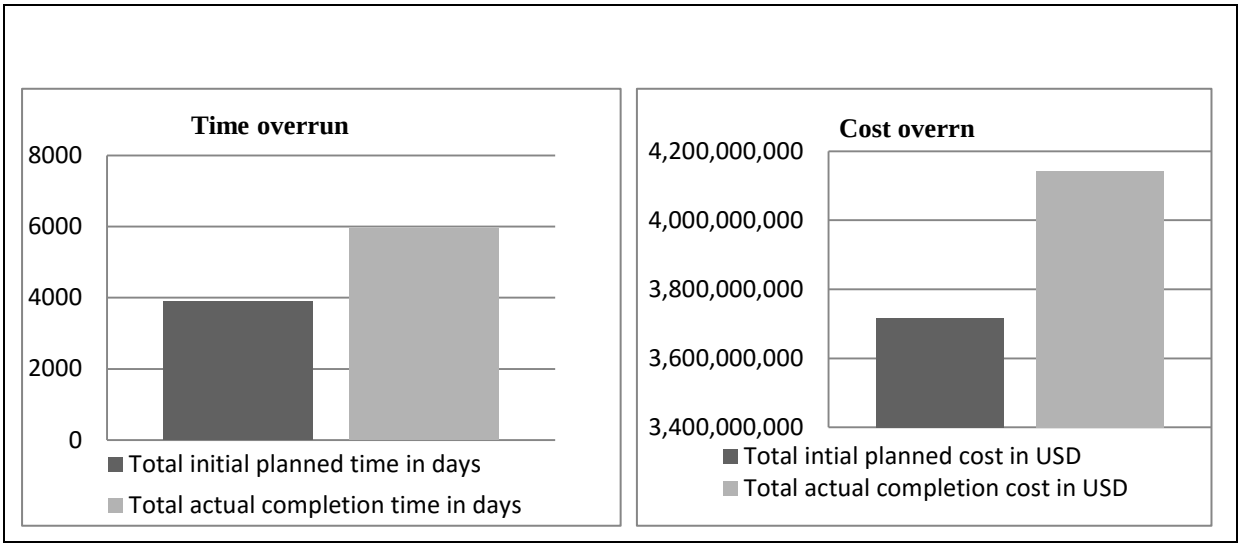


**Figure 3:** Comparison in total completion time and cost with estimated one among the railway projects

### *4.1.3. Comparative analysis among road and railway construction projects*

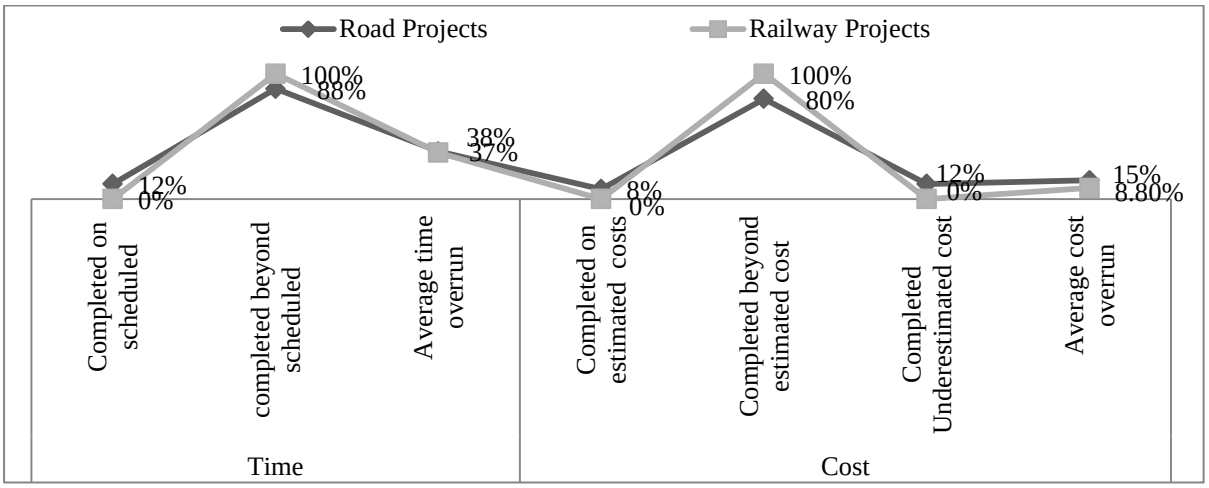


**Figure 4:** shows that comparison of time and cost overrun between the road and railway construction projects

A comparison is necessary for the researcher to understand time and cost overrun between the road and rail project sectors. In figure 4, the road construction projects better completion on time and estimated cost than rail projects, the percentage rates 12% and 8% respectively, but railway construction projects 100% cost and time overruns. The average time and cost overruns of the road projects higher than the rail projects; 38% and 15% in road projects, and 37% and 8.8% in railway projects respectively. The extent/or structural flows of time and cost overruns not statistically different for rail and road projects. In another side, 12% of the road projects completed underestimated cost, but not happened in the railway projects.

### *4.2. General backgrounds of primary data survey*

Primary data survey is important to indentify causes of the road and railway construction projects delay and cost

escalation. The following are response rates of the general background of practitioners:

**Table 2:** The result of the respondent rate

| Respondent Parties | Questionnaire | | | Percentage (%) | |
|---|---|---|---|---|---|
| | Distributed | Returned | Valid | Returned from distributed | Valid from returned |
| Clients | 65 | 55 | 52 | 85 | 94 |
| Contractors | 23 | 17 | 15 | 74 | 88 |
| Consultants | 10 | 6 | 6 | 60 | 100 |
| Total | 98 | 78 | 73 | 80 | 94 |

In table 2, ninety-eight (98) engineers in the road and rail construction projects were selected in purposive sampling techniques and distributed questionnaires to client, contractor and consultant engineers. In total, 80% of distributed questionnaires returned, from the returned 94 percent were valid responses.

**Table3:** the respondent rate of educational level

| Level of education | Frequency | Percentage (%) |
|---|---|---|
| Degree holders | 42 | 57.5 |
| Master specialized | 31 | 42.5 |
| Total | 73 | 100 |

In table 3 shows that 57.5 percent of the respondents were B.Sc. /or Bachelor degree holders, and the remaining 42.5 percent of the respondents M.Sc. /or Master degree specialized.

**Table 4:** Respondent rate of professional qualification

| Professional qualification | Frequency | Percentage (%) |
|---|---|---|
| Chief officers (dep't head) | 6 | 8.2 |
| Project Engineers | 44 | 60.3 |
| Office Engineers | 5 | 6.8 |
| Operational /technical engineers | 18 | 24.7 |
| Total | 73 | 100.00 |

In table 4 the respondents requested their current involving professional duties. The result shows that 8.2 percent

of respondents chief officers, 60.3 percent of the respondents' project engineers (project managers, project designers, material engineers, and other engineers), 6.8 percent of the respondents' office engineers, and 24.7 percent of the respondents are operational/or technical engineers.

**Table 5:** the respondent rate of current professional duties relevant to their field of graduation

| Degree of respondent | Frequency | Percentage (%) |
|---|---|---|
| Totally relevant to field of graduation | 45 | 61.6 |
| Moderately relevant to field of graduation | 21 | 28.8 |
| Slightly relevant to field of graduation | 4 | 5.5 |
| Not at all related to field of graduation | 1 | 1.4 |
| Missed to answer | 2 | 2.7 |
| Total | 73 | 100 |

In table 5 the respondents were requested whether or not current professional duties relevant to their field of the studies. From the analysis, 61.6 percent of respondents are working in the field of graduated, 28.8 percent partially similar duties, 5.5 percent slightly relevant to field of graduation, 1.4 percent of respondent consider their current jobs irrelevant to the field of graduation, and 2.7 percent missed to response the question.

**Table 6:** the respondents rate of job duties and filed of graduation mismatched contribute to project delay

| Degree of respondents | Frequency | Percentage (%) |
|---|---|---|
| Totally contributed to project delay | 3 | 11.5 |
| Moderately contributed to project delay | 12 | 46.2 |
| Slightly contributed to project delay | 5 | 19.2 |
| Not at all contributed to project delay | 6 | 23.1 |
| Total | 26 | 100.0 |

In table 6, twenty-six (26) respondents requested again those who answered in table 5 their current involving professional duties moderately, slightly and not at all relevant to their field of studies, whether or not caused to the road and rail construction project delay. From the analysis, 11.5 percent of respondents expected at totally contribute to project delay, 46.2 percent respondents answered moderately contributed to project delay, 19.2 percent of respondents slightly contributed to project delay, and 23.1 percent of respondents expected not at all contributed to project delay. Therefore, most of the road and railway construction projects delay causes not related to the field of study and job occupation mismatched. So, the background of the study indicates that there are other factors which causing delay of the road and rail construction projects in the country.

### *4.3. Determinants of time and cost overruns of the road and railway construction project*

Statistical Package of Social Science (SPSS) tastes and analyzes the reliability of data and the relationships of each categorized determinant. The Relative Importance Index (RII) model also used to analyze the index of factors that causes time and cost overruns in the federal road and rail construction projects. The Relative Importance Index (RII) result ranges between 0 and 1. The formula established as follows:

$$RII = \frac{\sum R_i}{(\sum Fi \times W_n)} = \frac{R_1 + R_2 + R_3 \ldots\ldots\ldots + R_n}{(F_1 + F_2 + F_3 \ldots\ldots\ldots\ldots + F_n) \times W_n}$$

$$R_1 = (F_1 \times W_n),\ R_2 = (F_2 \times W_{n-1}),\ R_3 = (F_3 \times W_{n-2}), \ldots\ldots R_n = (F_n \times W_{n-i})$$

$$\sum_{i=1}^{n} R_i = \sum (F_i \times W_i) = (F_1 \times W_n) + (F_2 \times W_{n-1}) + (F_3 \times W_{n-2}) \ldots\ldots\ldots + (F_n \times W_{n-i})$$

$$RII = \frac{\sum (F_i \times W_i)}{(\sum F_i \times W_n)} = \frac{(F_1 \times W_n) + (F_2 \times W_{n-1}) + (F_3 \times W_{n-2}) \ldots\ldots\ldots + (F_n \times W_{n-i})}{(F_1 + F_2 + F_3 \ldots\ldots\ldots\ldots + F_n) \times W_n} - - - - - - - - - - - - *$$

Where:

RII= Relative Importance Index

$R_i$ = the ranks *($R_1$, $R_2$, $R_3$……$R_n$)* assigned to selected determinant in the given question; ($R_1$ is the highest rank, $R_n$ the lowest rank and $\sum R$ is the sum of ranks).

$F_i$ = the frequency ($F_1$, $F_2$, $F_3$……$F_n$) of respondents counted in $i^{th}$ ranks from chosen determinant in the given question; ($F_1$ is the frequency of first ranked determinant, $F_n$ the frequency of the last ranked determinant, and $\sum F$= Sum of the frequency).

$W_i$ = the weight assigned to the $i^{th}$ rank ($W_n$, $W_{n-1}$, $W_{n-2}$, $W_{n-3}$ ……$W_{n-i}$) based on the number of determinants in each question; ($W_n$ = the highest weight assigned to the highest rank ($R_1$) in the selected determinant in the given question, $W_{n-i}$ = the lowest weight assigned to the lowest rank ($R_n$) in the selected determinant from the given question).

#### *4.3.1. Reliability test*

Reliability test to confirm data collected is reliable for analysis or not. Cronbach's alpha (α) was used to analyze categorized determinants by SPSS packages. Cronbach's alpha reliability coefficient normally ranges between 0 and 1.The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the variables. In the table 7 shows Cronbach's alpha reliability value of each category determinant ranges from 0.711 to 0.807, the overall value of time and cost overrun determinants was 0.784, which higher than the value compared to acceptable 0.7 [87, 88]. Therefore, the collected data are reliable and analyzable.

**Table 7:** the result of reliability test in categorized determinants of the road and railway projects

| Categories of determinates | Cronbach's alpha (α) |
|---|---|
| Technical determinants | 0.807 |
| Over optimism determinants | 0.759 |
| Strategic misrepresentation determinants | 0.711 |
| Cost overrun determinants | 0.784 |
| Overall | 0.784 |

### *4.3.2. Time overrun determinants*

Schedule delay is one of the challenges for successful completion of the road and rail construction projects in the country. According to secondary data analysis in this research article 4.1.1 and 4.1.2, the road and railway construction projects 88% and 100%, respectively time overruns. To analyze causes of time overrun determinants, the researcher general grouped into technical, over-optimism bias, and strategic misrepresentation.

#### *a) Technical determinants*

**Table 8:** result of frequency, weight, RII, and rank of technical determinants

| **Technical determinants** | **∑F** | **∑(W*F)** | **$W_n$** | **RII** | **Rank** |
|---|---|---|---|---|---|
| Incomplete studies prior to project approval | 52 | 525 | 12 | 0.8413 | 1st |
| Poor project management and coordination | 56 | 559 | 12 | 0.8318 | 2nd |
| Right- of-way acquisition issues | 62 | 606 | 12 | 0.8145 | 3rd |
| Inaccurate forecasting of project schedule | 48 | 463 | 12 | 0.8038 | 4th |
| Shortage of equipment and materials | 47 | 450 | 12 | 0.7979 | 5th |
| Financial difficulties | 32 | 267 | 12 | 0.6953 | 6th |
| Utility accommodation issues | 25 | 202 | 12 | 0.6733 | 7th |
| Shortage of skilled professionals. | 23 | 170 | 12 | 0.6159 | 8th |
| Bad weather conditions | 29 | 212 | 12 | 0.6092 | 9th |
| Difficult site conditions | 41 | 294 | 12 | 0.5976 | 10th |
| Mandatory reviews of Federal or state legislation | 17 | 93 | 12 | 0.4559 | 11th |
| National/or State events and holidays | 12 | 46 | 12 | 0.3194 | 12th |

In table 8, range of relative importance index of technical determinants lay between 0 and 1, which fitted with standard expectation. From, the twelve ranked factors caused the road and railway construction projects delay, the most five top one discussed as follows:

Respondents ranked incomplete studies before project approval as the most influential factor of the road and rail construction project delay, which is the relative importance index (RII) of 0.8413. The problem caused by the government often speeds up the progress of approvals to get urged projects started quickly, or to make project announcement to meet program funding deadlines or politicians to star construction project before election timelines try to response public interests. These leads to project design change during the construction period, and create confusion the scope of work to project parties.

Inefficient project management and coordination ranks the second determinant of the project construction delay and the relative importance index (RII) is 0.8318. Poor project management and coordination are the administrative failures of all level of project managers and stakeholders. It occur lack of planning and coordination of activities, failure to identify the problem and unable to give a timely solution for the problem, inadequate communication between project stakeholders, and weak accountability of all levels of parties involving in the construction of projects. Delay of the right-of-way acquisition and clearance of the construction site is the third technical determinant of project construction delay, the relative importance index (RII) of 0.8145. Most of the road and railway construction projects in the country started construction before complete clearance of the right of way of the property owners. Sometimes raised legal issues due to lack of clear compensation policy for property owners across the government levels. The amount of compensation paid sometimes not agreed until the end of the project, especially if the property owner appeals against the original valuation. The fourth determinant is inaccurate forecasting of the project schedule, the relative importance index (RII) of 0.8038. Since large projects are complex take place in a context of uncertainty and needs accurate data and estimation technology. Forecasting problems include the use of inappropriate methods or inaccurate underlying assumptions and unforeseen, these dramatic shifts into inaccurate forecasting of final project schedule. The fifth determinant of project delay is the shortage of construction equipment and material (RII=0.7979). Material and equipment shortages commonly faced problems in Ethiopian construction sectors. It occur unavailability of required material in local market, weak financial capacities of contractors, and shortages of foreign currency to import materials and equipments which have not locally available.

***b) Over-confidence bias/wishful thinking***

**Table 9:** The results of frequency, weight, RII, and rank of over-confidence bias determinants

| **Stakeholders overconfidence bias determinants** | **∑F** | **∑(W*F)** | **$W_n$** | **RII** | **Ranks** |
|---|---|---|---|---|---|
| Over-confidence of politicians | 58 | 284 | 6 | 0.8161 | 1st |
| Over-confidence of project planners /developers | 54 | 250 | 6 | 0.7716 | 2nd |
| Over-confidence contractors /implementers | 48 | 216 | 6 | 0.7500 | 3rd |
| Over-confidence of project beneficiaries | 54 | 203 | 6 | 0.6265 | 4th |
| Over-confidence of project sponsors | 41 | 154 | 6 | 0.6260 | 5th |
| Over-confidence consultants | 12 | 16 | 6 | 0.2222 | 6th |

Based on respondents response rate in table 9, the relative importance index of over-confidence of politicians, project developer/owners, contractors, communities, project sponsors and consultants ranked first (RII=0.816),

second (RII=0.7716), third (RII=0.7500), fourth (0.6265), fifth (RII= 0.6260) and sixth (RII= 0.2222), respectively. The rage of RII of over-confidence bias determinants lay between 0 and 1, which fitted with standard expectation.

The project stakeholder overconfidence bias is another leading cause of project delay, due to the reason of human behavior has found that prone to planning fallacy. When people to start on big projects, they often put on rose-colored glasses; which are overestimating project benefits and underestimating the complexity of the task at hand, simply assuming things are going to proceed smoothly without problems. By this case, the project developers/politicians or other project stakeholders tend to reflect over-optimism bias in their abilities, talents, skills, and resources to complete the construction projects. They are quickly taking personal credits for positive outcomes or wishful thinking, at the same time attributing failure to achieve project objective due to unexpected challenges or events.

***c) Strategic misrepresentation determinants***

**Table 10:** result of frequency, weight, RII, and rank of strategic misrepresentation determinants

| **Project stakeholder interest determinants** | **∑F** | **∑(W*F)** | **$W_n$** | **RII** | **Ranks** |
|---|---|---|---|---|---|
| Interest of politicians | 55 | 172 | 4 | 0.7818 | 1st |
| Interest of clients/project developers | 61 | 184 | 4 | 0.7541 | 2nd |
| Interest of contractors/sub-contractors | 50 | 138 | 4 | 0.6900 | 3rd |
| Interest of project sponsors/tax-payers | 49 | 95 | 4 | 0.4847 | 4th |
| Interest of consultants /Sub-consultants | 43 | 83 | 4 | 0.4825 | 5 th |

Based on the respondents response rates in table 10, interest/interference of politicians (RII=0.7818), project planner/developers (RII=0.7541), contractors (RII=0.6900), financial sponsors (RII=0.4847), and consultants (RII=0.4825) ranked first, second, third, fourth and fifth, respectively. The range of Relative Importance Index (RII) of strategic misrepresentation determinants lay between 0 and 1, which matched with the standard of expectation.

Strategic misrepresentation speaks to the possibility that project schedule delay may stem from a deliberately misleading of the project facts and realities by planners, promoters, politicians, financial sponsors and others stakeholders in the project phases. The project schedule time is deliberately underestimated and missing project facts in order to increase the chances of project acceptance/ personal interests. It occurs both the principal (project sponsors/tax payers) and project agent (project planners, promoters, consultants and contractors, etc), due to the presence of information asymmetry, organizational and political pressure, lack of coordination & long term commitment, divergent to self-interest, and differences in risk preferences.

The implications of project deception and delusion are manipulation of forecasts of schedule (over or under), missing facts or realities of the projects by overestimated revenues and development effects, and underestimated

environmental impacts to achieve political and business interests. The project approval in most cases depends on these factors. Decision-makers have little information and dependents on the information obtained from forecasts. The project forecasters /or other stakeholders involving project development and implementation have higher opportunity to misrepresent information of the projects.

### *4.3.3. Cost overrun determinants*

Cost overruns are one of the challenges successful completions of the federal road and rail construction projects in the country. According to secondary data assessment in this study article 4.1.1 and 4.1.2, cost overrun of the road and rail construction projects were 80% and 100% respectively. The following 15 cost escalation determinants ranked by practitioners based on the influence of cost overruns.

**Table 11:** result of frequency, weight, RII, and rank of factors contributing cost overrun

| Cost escalation determinants | ∑F | ∑(W*F) | $W_n$ | RII | Rank |
|---|---|---|---|---|---|
| Inflation of material cost | 57 | 741 | 15 | 0.8667 | 1st |
| Scope change with change order | 53 | 653 | 15 | 0.8214 | 2nd |
| Incomplete study to before project approval | 45 | 527 | 15 | 0.7807 | 3rd |
| Poor specification/or bill of quantity and design | 46 | 516 | 15 | 0.7478 | 4th |
| Poor project performance monitoring | 43 | 469 | 15 | 0.7271 | 5th |
| Shortages of currency to import construction inputs | 41 | 439 | 15 | 0.7138 | 6th |
| Devolution of value of Ethiopian Birr | 54 | 573 | 15 | 0.7074 | 7th |
| Shortages of financial resource | 36 | 383 | 15 | 0.7074 | 7th |
| Late clearance /or dispute for third party issues | 35 | 340 | 15 | 0.6476 | 8th |
| Unforeseen project sites | 45 | 425 | 15 | 0.6296 | 9th |
| Incompetent bidding process | 26 | 221 | 15 | 0.5667 | 10th |
| Faulty contract administration | 35 | 268 | 15 | 0.5105 | 11th |
| Unfavorable weather condition | 29 | 217 | 15 | 0.4989 | 12th |
| Shortages of skilled professionals in the sector | 27 | 186 | 15 | 0.4593 | 13th |
| Litigation/or contractual agreement problems | 24 | 120 | 15 | 0.3333 | 14th |

Range of relative importance index of cost escalation determinants lay between 0 and 1, which fitted with standard expectation. From table 11 fifteen ranked factors, the five most significant factors caused on project cost escalation discussed detail as follows:

The first ranked determinant is inflation of materials cost, the relative importance index (RII) of 0.8667. International construction trend shows that project completion takes longer than expected construction periods, many mega infrastructure projects under-construction, and having inadequate marketing system in the country, then the key construction material dramatically increasing above predicted level. Initial cost estimates need to allow for the value that will be paid at the time the project actually goes ahead. Obviously any other factor that

delays a project will expose the project to the risk of further inflationary costs. The second ranked determinant is scope change with change order, the relative importance index of 0.8214. The specifications of the project are changed following the "go decision," leading to escalating costs. Scope changes include major alterations to a road and rail projects. On large and complex projects, hundreds of change order may requests by the various stakeholders, all of which have to be negotiated and approved between the client and the contractors. Politicians often initiate these significant changes to ensure that their constituents benefit from a project, or that the harm to adjacent communities is mitigated. In other side, change orders may take the form of contractor-initiated variations to correct errors and make minor variations to change finishing materials or facility layouts to meet the evolving desires of the client. This change order can be a costly and sometimes contentious process.

Respondents ranked incomplete study's prior to project approval is the third most influential factor of the road and rail construction project cost overrun, the relative importance index (RII) of 0.7807. Project approval and construction of the road and railway projects often proceed before all technical feasibility and engineering studies completed this leading to escalating costs as more details about the project are confirmed. The problem caused by government officials often speed up the progress of approvals to get urged projects started quickly, or to make project announcement to meet program funding deadlines. Incomplete studies before project to approval leads to project design change during construction period. This also escalating cost beyond initial estimated to complete the construction.

The forth determinant ranked in cost overrun is inadequate specification/or bill of quantity of the project, the relative importance index of 0.7478. Without detail bill of quantity and design precede procurement process of a project leads to design and quantity variation during construction period. These types of procurement process is unattractive highly performed contractors in the business competition practices, this leads the value of contract to higher than the market price and increase a chance to inexperienced and bad contractors to win a project contract. Inadequate specification and low bid leads to contract negotiation during actual construction periods and sometimes may interrupt first procurement process and forced again rebidding process.

The fifth ranked determinant is poor project performance monitoring and evaluation, the relative importance index of 0.7271. The government may not have the decision-support systems in place to track contractor performance as the job progresses or to select contractors who have a strong record of delivering quality projects on budget and schedule. Monitoring the activities and evaluation of the results in the project phases are the most important instruments to help decisions on time and to achieve desire outcome. It helps to avoid unethical practices in the construction of public infrastructure, which has serious implications for the country. Most overruns are foreseeable and avoidable that existed due to a lack of forward looking risk management.

#### *4.3.4. Correlation relation of variables /or determinants*

Pearson's correlation coefficient (r) is the most widely used correlation statistical to measure the degree of the relationship between two variables. Different studies show that the correlation coefficient of two variables greater than 0.8 or $P<0.05$ or $P<0.01$ is generally described as a strong relationship, whereas correlation less than 0.5 or $P>0.05$ or $P>0.01$ is weak relationship between categorized variables. When $P < 0.01$ or $P<0.05$ level

means, there is 1% or 5% from in a 100% chance of there no relationship in variables, but the difference is P-value less than 0.01 stronger than P-value less than 0.05 using single-tailed probability values. The following table in 4.12 and 4.13 shows the correlation between categorized variables.

***a) Correlation between time overrun categorized variables***

**Table 12:** result of correlation coefficient and P-values in the time categorized variables

| Categories of variables | Correlation coefficient (r ) | P-value (1-tailed) |
|---|---|---|
| Technical and over-confidence bias | 0.978 | 0.000** |
| Technical and Strategic misrepresentation | 0.957 | 0.022* |
| Strategic misrepresentation and over-confidence bias | 0.975 | 0.013* |

** Correlation is significant at the 0.01 level (1-tailed) -statistical highly significant

*Correlation is significant at the level 0.05 (1-tailed) - statistical significant

The Pearson's correlation coefficient(r) of technical and overconfidence bias variable is 0.978, then the P-value is 0.000 which less than the specified standard ($p<0.01$) statistically highly significant and strong correlation between time overrun variables. When technical & strategic-misrepresentation, and strategic-misrepresentation & over-confidence bias correlation coefficient are 0.975 and 0.957, then the p-value also 0.013 and 0.022 respectively, which are less than the specified standard ($P<0.05$) the study was significant and the relationship between variables really exists.

From the above time overrun correlation determinants, one determinate of time overruns variables directly affect (positive result) to the other time overrun variables in a project. In the stated above correlation there is an association between time determinants variations. Therefore, correlation is positive the more variation in the schedule of one category variable, the more schedule variation added to the other category variable in a project.

***b) Correlation between time and cost overrun categorized Variables***

**Table 13:** the result of correlation coefficient and p-values of cost and time overrun variables

| Categories of variables | Correlation coefficient (r) | P-values (1-tailed) |
|---|---|---|
| Cost and Technical | 0.970 | 0.000** |
| Cost and over-optimism bias | 0.958 | 0.001** |
| Cost and strategic- misrepresentation | 0.978 | 0.011* |

** Correlation is significant at the 0.01 level (1-tailed)-statistical highly significant

*Correlation is significant at the level 0.05 (1-tailed)-statistically significant

The correlation coefficient(r) of cost & technical, and cost & overconfidence bias are 0.970 and 0.958, then the

P-value 0.000 and 0.001 respectively, which is less than the specified standard ($p<0.01$).The result shows statistically highly significant and strong correlation between cost and time overrun variables.

The correlation coefficients of cost & strategic misrepresentation determinants is 0.978, then the p-value also 0.011 which is less than the specified standard ($P<0.05$). Then, the study indicates significant correlation and the relationship between variables exists. In the stated correlation there is an association between schedule variation and budget variation. Because of the correlations are positive the more variation in the scheduled time reflects the more budget variation in a project.

## 5. Conclusion and recommendation

### *5.1. Conclusion*

Based on the results of primary and secondary data analysis, conclusions were drawn. Time and cost overruns are extreme challenges for Federal road and railway construction projects in the country. Twenty-five asphalt concrete roads and three railway projects construction completed from 2014 to May, 2018 conducted in the study. The result shows that 88% of the road and 100% of railway construction projects were time overruns beyond their planned completion periods.

The average time overrun of the road and rail construction projects were 38% and 37%, respectively. Almost 80% of the road and 100% of the railway construction projects also cost overruns beyond their estimated completion cost. The average cost overruns of the road and rail construction projects were 15% and 8.83%, respectively. From the study, road construction projects better completion on time and estimated cost than rail projects and the average time and cost overruns of the road projects higher than the rail projects. This also showed that both Federal road and rail projects time and cost overruns are a common phenomenon in Ethiopian road and rail construction projects.

Time overrun is not only the result of technical challenges associated with the delivery of road and railway construction projects, but also deep psychological and political economy factors. The political and business interest and psychological bias of project parties and stakeholders are hidden factors which are highly affects project time overruns beyond the initial planned. The major contributor to project delay and cost escalation factors selected and ranked by respondents.

Twenty-three project delay factors incorporated into three categorized questions: technical, over-confidence bias, and self-interest of project stakeholders. The topmost time extension determinants were the incomplete study to project approval, poor project management and coordination, the right of way acquisition issue, inaccurate forecasting, project stakeholder's overconfidence bias and self- interest of project stakeholders, and inefficiency capacities of contractors. Also fifteen key cost overrun determinants also incorporated in a single question and ranked by respondents. Inflation of material cost, scope change with the change order, incomplete study before project approval, poor specification and bill of quantity, and poor project performance monitoring and evaluation among top factors of cost overruns**.**

During the project implementation when fact overcomes fiction. The consequences are huge cost and time overruns of the road and rail construction projects, these adversely impact on the parties of a project and the socio-economy of the country. Time and cost overrun added estimated time and cost over initial agreed-upon set resulting in less return to investment, damaging the reputation, inability to deliver value for money and inefficient uses of time, created burdens for taxpayers, loss of other investment opportunities, and crippling debt.

### *5.2. Recommendations*

As verified and concluded the study, time and cost overrun of the road and rail construction projects are persistent problems in the country due to varieties of the complex in technical, psychological and political-economy factors. To response the problems, the following strategic approaches are indentified as follows:

#### *a) Reward well-performed contractors*

Long term and sustained improvements in the performance of project incentive reward individuals or firms achieved what they are expected while, penalizing those that fail to meet performance expectation. One approach that has gained international interest is the implementation of the formal prequalification system. This system will give firms or individuals' good track record improved chance of obtaining future contracts. Such a system should use to drive up the quality of road and rail project procurement. Rank each firm or individual based on results from previous projects implementation, i.e., time and cost overruns.

#### *b) Enhancing project management capability of staffs*

Enhancing staff capacity is important to manage competitive tender processes and to select firms based on best value rather than the lowest bid. Drafting enforceable contracts that clearly transfer the risk of budget and time expectation which are not met or change orders are requested by the contractor or client. It helps to use conflict resolution approaches when tensions between partners arise, and to develop effective risk management tools to address the key issues facing project stakeholders. To improve outcomes of the road and railway infrastructure projects, it should need upgrading staff potential abilities, empowerment capacity of local contractors, assigns clear responsibility and accountability for each individual and group.

#### *c) Make selective Public-Private-Partnerships (PPPs)*

This partnership approaches increase construction competency and minimize government inefficiencies in the construction projects. PPPs contain two prominent features to develop incentive system on-time and budget project delivery. First, they combine multiple aspects of project delivery, like design, construction, operation, and maintenance into a single contract. Second, pay-for-performance contracts in which the private-sector institutions finance all or a portion of the initial construction costs of the project. The private-sector partner is repaid its initial investment in the project by the government or through user fees over the entire life of long-term operating periods.

#### *d) Enhance performance monitoring and information sharing*

Data collected should be coordinated by a central department and conducted through a single software application. Project managers should be required to input time and cost details of each project in the software program when it is initially approved and at the substantial completed. These data used to learn previous experience and to develop prediction models to estimate time and cost overruns to avoid similar cases in the future and to identify early warning of projects. During project development and construction periods avoid optimistic assumptions and political interests, need better understanding of technical, as well as the social and political dimension of infrastructure procurement of the country. Every effort should be made to conduct preparation, planning, evaluation, project organization and management to minimize risk of delay and cost escalation.

***e) Strengthen the linkages and give policy concerns***

Linkages of construction industries, training institutions, and governmental sectors should be important for project implementation for delivering on time and budget, and to fulfill the need of industry and training gaps. The policy implications are clear: Decision-makers and planners should be concerned about sluggish planning and implementation of large transport infrastructure projects.

The researcher is confident that the research and its recommendation would be useful for policymakers, public and private sectors, project developers and other key stakeholders to promote successful implementation of project time and cost overruns to a great extent within the scheduled time and cost.

**References**

[1] Frank, Beckers, et al. “A Risk-Management Approach to a Successful Infrastructure Project Initiation,Financing, and Execution”.Mckinsey Working Papers on Risk, Number 52, Singapor, 2013.

[2] Drive Fairbairn And Pleasant, Mount.“Infrastructure Developmentand Financing in Sub-Saharan:Toward a Framework for Capacity Enhancement”**.** The African Capacity Building Foundation,P. No. 25, 2016, Harare.

[3] César, Calderón and Luis, Servén. **“**Infrastructure and Economic Development in Sub-Saharan Africa.**”** Journal of African Economies, Policy Research Working Paper 4712 of World Bank, Weshgton DC, 2008.

[4] Tito Y., Pierce J., and Foster V. **“**Making Sense of Sub-Saharan Africa’s Infrastructure Endowment: a Benchmarking Approach**”**. Policy Research Working Paper 4912, World Bank, Washington, DC , 2009.

[5] Gutman J., Amadou Sy, Soumya C**.** “Financing African Infrastructure: Can the World Deliver? **”** Brookings Institution, Washington, D.C , 2015, http:// www.brookings.edu/africagrowth

[6] Foster V. and Morella E**. “**AICD, Ethiopia’s Infrastructure:A Continental Perspective**”**. World Bank

Washington, DC , 2010.

[7] African Development Bank. "African Economic Outlook 2018." htts://www.afdb.org

[8] Majid, Ibnu Abbas. "Cuases and Effects of Delays in Aceh Construction Industry". M.A. thesis, Universiti Teknologi, Malaysia, 2006.

[9] Sun M., Olawale Y. "PCIM- Project Control and Inhibiting-Factors Management Model". Journal of Management in Engineering, 2013, Vols. 29(1), PP.60–70.

[10] Mahamid, I., Bruland, A. and Dmaidi, N. "Delay causes in road construction projects". Journal of Management in Engineering, Vols. 28 (3), PP 300-310, 2012.

[11] Flyubjerg, Bent. "Design by Deception: the Politics of Mega Project Approval". Harvard Design Magazine, 2005. PP 50-59, uploaded on 30 May 2014.

[12] Flyvbjerg B., Holm M. K. S. and Buhl S. L. "What Causes Cost Overrun in Transport Infrastructure Projects?". Transport reviews, Vols.24, no.1, Jan., 2004, pp. 3-18.

[13] Flyvbjerg, B., Holm M.K. S. and Buhl S.L.. "How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?". Transport reviews, 2003b, Vols. 23, pp. 71-88.

[14] Mubarak Saleh."Construction Project Scheduling and Controlling, Third edition". John Wiley & Sons, Inc. Hoboken, New Jersey, 2015.

[15] Siemiatycki M. "Cost overrun on Infrastructure Projects: Patterns, Causes and Cures". Institute on Municipal Finance & Governance Munk School of Global Affairs, University of Toronto, 2015.

[16] Flyvbjerg, Bruzelius B., N., RothengatteW. R. "Megaprojects and Risk: An Anatomy of Ambition", Cambridge: Cambridge University Press, 2003a.

[17] Curtis B., David E., Jon E., Brianne G., Nicolas N., Bill S.. "Assessing the Costs Attributed to Project Delays." Texas Department of Transportation, 2011.

[18] Ansar A., Flyvbjerg B., Budzier A., Lunn D. "Does infrastructure investment lead to economic growth or economic fragility? Evidence from China." Oxford Review of Economic Policy, Vol. 32 (3), 2016, pp.360–390.

[19] Turochy, R. E., Hoe L. A. l, Lacy L. A., Robert S. Doty. "Highway Project Cost Estimating Methods Used". Virginia Department of Transportation, 2001.

[20] Merrow, E.W. "Industrial Megaproject. Concepts, Strategies and Practices for Success". John Wiley & Sons, Incorporated, Hoboken, 2011.

[21] Love Peter E.D. Ahiaga-Dagbui D. D., Irani, Z. "Cost overruns in transportation infrastructure projects: Sowing the seeds for a probabilistic theory of causation."Trans. Res. Part A, vol. 92(C), pp.184-194,2016.

[22] Flyvbjerg, B., N. Bruzelius and W. Rothengatter. "Megaprojects and Risk: An Anatomy of Ambition", Cambridge University Press, 2003a.

[23] Mubarak Saleh. "Construction Projects Scheduling and Controlling, John Wiley & Sons, Inc., Hoboken, New Jersey, 2015.

[24] Theodore J. T. Jr, William A. M., J. S.L., Mark F. N., Brian J. F. "Construction Delays: Understanding Them Clearly, Analyzing Them Correctly." Second Edition, Elsevier Inc, London, 2009.

[25] Project Management Institute (PMI). "Study on Project Schedule and Cost Overruns". India, Nov., 2012.

[26] Abubeker J. "Factors Affecting Time and Cost Overrun in Road Construction Projects in Addis Ababa." MSc Thesis Addis Ababa University, Ethiopia, 2015.

[27] Tesfa S. Y. **"**Analysis of Factors Contributing to Time Overruns on Road Construction Projects under Addis Ababa C ity. Administration.**"** IJSR, 2016, Vol. 5, PP. 2181-2187.

[28] Wafa S. M. F., Signh B. "Delays in Road Construction Projects in the State of Perak Malaysia". Faculty of Civil Engineering, Universiti Teknologi, Malaysia, 2017, pp. 53-66.

[29] Ibrahim M. "Schedule Delay in Saudi Arabia Road Construction Projects: Size, Estimate, Determinants and Effects". International Journal of Arc., Eng. and Con., Vol. 6, No 3, pp.51-58, Sep., 2017.

[30] Werku, K. and K. N. Jha. **"**Investigating Causes of Construction Delay in Ethiopian Construction Industries.**"** Journal of Civil Construction, 2016, Vols. 1, pp. 18-29.

[31] Yada, Abera Legesse and Yadeta, Fekadu Takele. **"**Factors Affecting the Performance of Construction Project under Oromia Industry and Urban Development Bureau, Ethiopia.**"** ABC Research Alert, 2016, Vol. 4, No 2.

[32] Pourrostam T. and Ismail A. "Significant Factors Causing and Effects of Delay in Iranian Construction Projects." Australian Journal of Basic and Applied Sciences, 5(7): pp.450-456, 2011.

[33] Aibinu, A.A. & Jagboro, G.O. "The effects of construction delays on project delivery in Nigerian construction industry." International Journal of Project Management, vol.20 (8), pp.593–599, Nov, 2002.

[34] Motaleb O., Kishk, M. "An investigation into causes and effects of construction delays in UAE." In: Egbu, C. (Ed) Procs 26th Annual ARCOM Conference, 6-8 September 2010, Leeds, UK, Association of Researchers in Construction Management, pp. 1149-1157.

[35] Shane J., Molenaar K. R. , Anderson S., Schexnayder C. "Construction Project Cost Escalation Factors."Journal of Management Engineering, 2009, 25(4): pp.221-229.

[36] Nyangwara, Peter Orero and Datche, Evelyn.**"**Factors Affecting the Performance of Construction Projects: A Survey of Construction Projects in the Coastal Region of Kenya.**"** International Journal of Scientific and Research Publication, Vol. 5, pp.1-42, 2015.

[37] Turkey Wakjira. "Risk Factors Leading to Cost Overrun in Ethiopian Federal Road Construction Projects and its Consequences." M.Sc. Thesis, Addis Ababa University, Ethiopia, 2011.

[38] Ansar A., Flyvbjerg B., Budzier A., Lunn D. "Does infrastructure investment lead to economic growth or economic fragility? Evidence from China." Oxford Review of Economic Policy, Vol., 32 (3), pp.360–390, 2016: https://doi.org/10.1093/oxrep/grw 022.

[39] Belachew A. S., Mengesha W. J., and Mohammed M. **"**Causes of Cost Overrun in Federal Road Projects of Ethiopia in Case of Southern District.**"** American J. of Civil Engineering, Vol. 5, No. 1, pp. 27-40,2017.

[40] Rosonfold Y. "Root-Cause Analysis of Construction-Cost Overruns." Journal of Construction Engineering and Management, vol.140, No(1), Jan, 2014.

[41] Fetene N.. "Causes and Effects of Cost Overrun on Public Building Construction Projects in Ethiopia". MSc. Thesis, Addis Ababa University, Ethiopia, 2008.

[42] Eshofonie F. P. "Factors Affecting Cost of Construction in Nigeria." M.Sc. Thesis, University of Lagos, Nigeria, 2008.

[43] Othman Ayman A. E. "Challenges of mega construction projects in developing countries." Organization, technology and management in construction, Vol.5 (1), 2013.

[44] Gebrehiwet T., Luo H. **"**Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient:Empirical Study." Procedia Engineering 196 (2017), PP.366–374.

[45] Muhammed T. A."Delay of Construction Projects." American University of Iraq, Sulaimani, Jan., 2015.

[46] Siemiatycki Matti. "Cost overrun on Infrastructure Projects: Patterns, Causes and Cures." Institute on Municipal Finance & Governance Munk School of Global Affairs, University of Toronto, 2015.

[47] Al-Emad N., Rahman I. A., Nagapan S., Gamil Y. "Ranking of Delay Factors for Makkah's Construction Industry." MATEC Web of Conferences 103, 03001 (2017).

[48] Sambasivan M., Soon Y. W. "Causes and effects of delays in Malaysian construction industry." International Journal of Project Management, Volume 25, Issue 5, pp, 517-526. Jul., 2007.

[49] Assaf S. A., Sadiq Al-Hejji. "Causes of Delay in Large Construction Projects." International Journal of Project Management, 2006, vols. 24, pp. 349–357.

[50] Project Management Institute (PMI). "Study on Project Schedule and Cost Overruns", India, Nov., 2012.

[51] Dada, M., Petruzzi, N. C.,Schwarz, L. B. " A news vendor's procurement problem when suppliers are unreliable." Manufacturing and Service Operations Management, Vol. 9(1), pp. 9-32, 2017.

[52] Ruiz-T., Alex J., Mahmoodi F. "A supplier allocation model considering delivery failure, maintenance and supplier cycle costs." International Journal of Production Economics, vol. 103(2), pp.755-766, Oct., 2006.

[53] Fallahnejad, M. H. (2013). "Delay causes in Iran gas pipeline projects." International Journal of Project Management, vol.31 (1), pp.136–146, 2013.

[54] Kaliba, C., Muya, M., Mumba, K. "Cost escalation and schedule delays in road construction projects in Zambia." International Journal of Project Management, vol. 27(5), pp. 522-531, 2009.

[55] Enshassi A., Al-Najjar J., Kumaraswamy M.. "Delays and cost overruns in the construction projects in the Gaza Strip." Jo. of Fin. Magm. of Property and Construction : Vol. 14 . No. 2, pp. 126-151, 2009, Gaza.

[56] Zou P.X. W, Guomin Z, Jiayuan W. "Understanding the key risks in construction projects in China." Journal of the International Project Management Association, vol. 25, 6, pp. 601-614, 2007.

[57] Rhee B., Verma R., Plaschka G. "Understanding trade-offs in the supplier selection process: The role of flexibility, delivery, and value-added services/support." Int. Jour. of Prod. Eco., 120(1), pp. 30-41, 2009.

[58] Aibinu A. A., Odeyinka H. A. "Construction delays and their causative factors in Nigeria." Journal of construction engineering and management, 132(7), pp.667-677, 2006.

[59] KamangaMJ , Steyn Wynand JvdM. "Causes of delay in road construction projects in Malawi." Journal of the South African Institution of Civil Engineers, vol.55 (3), pp.79-85, Oct., 2013.

[60] Nwanyanwu, L. A.. "Hire Purchase Strategy of Physical Capital Investment and Financial

Performance of Construction Companies: Illustrating from the Nigerian Stock Exchange." Interdisciplinary Journal of Research in Business, vol.2 (4), pp. 8-20, 2012.

[61] Mustapha Z. "Accelerated Factors of Delays on Project Delivery in Ghana: A Case Study of Cape Coast Metropolis." Journal of Applied Sciences & Environmental Sustainability, vol.1 (1): pp.54-61, 2013.

[62] Sweis G. HammadA.A., SweisR.J., Shboul A. "Delays in construction projects: The case of Jordan." International Journal of Project Management, vol.26 (6):pp. 665-674, 2008.

[63] Ali A. S., Smith A., Pitt M., Choon C. H. "Contractors' Perception of Factors Contributing to Project Delay: Case Studies of Commercial Projects in Klang Valley Malaysia", Jul, 2010.

[64] Malbex. "Market Watch- Construction Industry," Kuala Lumpur Exhibition Center Report, pp.1-8, 2005.

[65] Nesan, L. J. "Project finance model for small contractors in USA." Australasian Journal Construction Economics," vol.6 (1), pp. 25-41, 2006.

[66] Ejohwomu O. A. "Modeling the Supply and Demand for Construction and Building Services Skills in the Black Country," PhD Thesis University of Wolverhampton, 2007.

[67] Walcroft D., Caletka A. "Correcting the course of capital projects: Plan ahead to avoid time and cost overruns down the road," Pwc-2013, pp.1-15: available at www.pwc.com.

**[**68**]** Zewde. Ameha. "The Effect of Birr Devaluation on Public Building Construction, Case Study on Sub-City Office Building Projects in Addis Ababa," Thesis MSc. Addis Ababa, University, 2018.

[69] Bienen, D., Ciuriak, D., & Nihretu, M. "Birr Devaluation-Will it correct Ethiopia's trade deficit problem?" Addis Ababa, Ethiopia, Addis Fortune, Sept., 2010.

[70] Fugar, F.D.K. and Agyakwah-Baah, A.B. "Delays in Building Construction Projects in Ghana." Australasian Journal of Construction Economics and Building, vol.10, pp.103-116, 2010.

[71] Al-Emad N. "Structural Relationships Model of Delay Factors in Makkah Construction Industry," MSc thesis, Universiti Tun Hussein Onn Malaysia, 2016.

[72] Akomah B. B., Jackson E. N. "Contractors' Perception of Factors Contributing to Road Project Delay." International Journal of Construction Engineering and Management, vol.5 (3): PP.79-85, 2016.

[73] Akinsiku O. E., Akinsulire A. "Stakeholders' Perception of the Causes and Effects of Construction Delays on Project Delivery.' Journal of Con.Eng. And Project Management, pp.25-31 Vol.2, No.4, Dec., 2012.

[74] Oluwabunmi A. C, Ayo B. A.. "Cost and Time performance of construction projects under the due process reform in Nigeria." International Journal of Engineering and Science, vol.3; No. 6 pp. 01-06, Aug., 2013.

[75] Patil S.K., Gupta A.K., Desaid. B., Sajane A.S. "Causes of Delay in Indian Transportation Infrastructure Projects," International Journal of Research in Engineering and Technology. Vol. 02, pp.71-80, 2013.

[76] Turochy, R. E., Hoe L. A. l, Lacy L. A., Robert S. Doty."Highway Project Cost Estimating Methods Used," Virginia Department of Transportation, 2001.

[77] Kadir M.R. A., Lee W.P. , Jaafar M.S., Sapuan S. M. "Factors affecting construction labour productivity for Malaysian residential projects", vol. 23(1):pp. 42-54, 2005.

[78] Patil S.K., Gupta A.K., Desaid. B., Sajane A.S. "Causes of Delay in Indian Transportation Infrastructure Projects." International Journal of Research in Engineering and Technology. Vol. 02, pp.71-80, 2013.

[79] Faridi, A., El-Sayegh, S. "Significant Factors Causing Delay in the UAE Construction Industry". Construction Management and Economics, vol. 24, pp.1167-1176, 2006.

[80] Jha K. N., Lyer K. C. "Critical Factors Affecting Schedule Performance: Evidence from Indian Construction Projects." Journal of Construction Engineering and Management 132(8), Aug, 2006.

[81] Abdul-Rahman H., Berawi M. A., Berawi A. R., Mohamed O. Othman M. and Yahya I. A. "Delay Mitigation in the Malaysian Construction Industry". Journal of Con. Eng. and Mag., vol. 132, 2006.

[82] Discenza, R. & Forman, J. B. "Seven causes of project failure: how to recognize them and how to initiate project recovery," North America, Atlanta, Project Management Institute, 2007.

[83] Kahneman D. and Tversky A. "Prospect Theory: An Analysis of Decision under Risk." Econometrica, Vol. 47, No. 2 pp. 263-291, Mar., 1979; http://www.jstor.org/stable/1914185

[84] Flyvbjerg, B., Holm, M.S. and Buhl, S.L. "Underestimating Costs in Public Works Projects: Error or Lie?" Journal of the American Planning Association, vol.68, pp.279-295, 2002.

[85] Gbahabo P., Samuel, A. O.. "Effects of Infrastructure Project Cost Overruns and Schedule Delays in Sub- Saharan Africa," 11th Int. Conf. on S. Sciences Helsinki, 20-21 Jan., 2017 Pr. Volume II, pp.1-21.

[86] Altshuler A.A., Luberoff D.F.. Mega-Projects: the Changing politics of Urban Public Investment,"Booking Institution Press, Washington, D.C., 2003.

[87] Tavakol Mohsen, Dennick Reg. "Making sense of Cronbach's alpha." International Journal of

Medical Education, vol., 2:pp.53-55, 2011

[88] Gliem J.A. and Gliem R.R. "Calculating, interpreting, and reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales," Midwest Research to Practice Conference in Adult, Continuing, and Community Education, Columbus, 2003, pp. 82-88.

**Acknowledgement**

The author to thank Filmon Hanadro (Ph.D), Assistant Professor of Development Management, Addis Ababa University for valuable help in advising this article.