
# ASSESSMENT OF CAUSE AND IMPACTS OF LOCAL CONTRACTORS' TIME AND COST PERFORMANCE IN ETHIOPIAN ROADS AUTHORITY PROJECTS

**BY**

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**A Thesis Submitted to School of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil Engineering (Construction Technology and Management)**

**December, 2016**

**Addis Ababa, Ethiopia**


**AAiT, Addis Ababa University**

**School of Civil and Environmental Engineering**

**Construction Technology and Management Stream**

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# ACKNOWLEDGEMENTS

Above all, I praise Almighty God who has blessed my work with His Mother and for giving me the health, strength and endurance until this time.

In the preparation of this thesis many have contributed priceless data, idea, resource books as well as moral support. First and foremost, my deepest gratitude goes to my advisor, Dr.-Ing. Abebe Dinku, for his valuable and constructive ideas as well as all his precious time spent in reviewing and improving the quality of the thesis work.

I am deeply grateful to all who have given me assistance in obtaining the information and data related to this work. Particular thanks also go to the experts and staff at the Ethiopian Roads Authority for their willingness to provide me with all the necessary data so that the research work could be carried out. I am also indebted to those people, especially professional Engineers from the contractor and consultant, who took time out of their busy schedules to fill the questionnaires.

The moral support from my family and friends will never be forgotten and this work is dedicated to them.

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# ABSTRACT

Infrastructure projects, such as road constructions, are one of the most important projects in Ethiopia. Growth in this sector is critical for growth in national income as it is among the largest sectors that generates employment within the country as well as a key driver for economic development of Ethiopia. Ethiopian Roads Authority has administered many projects at the federal level involving local contractors on the projects. However, projects executed by contractors are facing critical problems with respect to time and cost performance. There are several factors that are contributing to these time and cost performance problems of local contractors.

Accordingly, this research attempts to identify the major causes of poor time and cost performance of local contractors, consequential impact in the Ethiopian road construction industry; which can serve as the way forward for future work in coping with this performance problem. A thorough literature review and desk study was done, through which a number of time and cost performance factors were identified in global and local construction industry scenarios.

To obtain expert opinions from the sector, in total forty nine (49) factors and 15 possible impacts were identified and made part of the survey questionnaire and the survey was conducted with stakeholders from contractors, client, and consultants. In addition, case study/desk study of 6 completed road construction projects at federal level were investigated.

As a result of the study, inadequate planning and scheduling, poor project management system by contractor and late possession of site by the client are identified as the most important factors causing poor time and cost performance of local contractors. Among the subsequent impact of these local contractor poor time and cost peformnace on the construction industry; it discourages investment on road construction projects by the public authorities and it creates adversarial relationship among the stakeholders are identified as the most likely.

It is also recommended that the client (ERA) gives due attention to grant contractors timely possession of site and local contractors to deploy experienced professionals in the area of project management.

Key Words: Time and Cost Performance, local Contractors, Client, Consultants, Construction.

# ABBREVIATIONS

| | |
|---|---|
| AC | Asphalt Concrete |
| AACRA | Addis Ababa City Roads Authority |
| ADB | African Development Bank |
| BADEA | Bank of Arab for Economic Development in Africa |
| DB | Design-Build |
| DBB | Design- Bid- Build |
| DBST | Double Surface Treatment |
| ERA | Ethiopian Roads Authority |
| ETB | Ethiopian Birr (Ethiopian currency) |
| ETCA | Ethiopian Transport Construction Authority |
| EU | European Union |
| FDRE | Federal Democratic Republic of Ethiopia |
| FIDIC | Federation International Des Ingenieurs Conseils |
| GC | General Contractors |
| GDP | Gross Domestic Product |
| GOE | Government of Ethiopia |
| IDA | International Development Association |
| KPI | Key Performance Indicator |
| IHA | Imperial Highway Authority |
| MoFED | Ministry of Finance and Economic Development |
| MoWUD | Ministry of Works and Urban Development |
| NDF | Netherlands Development fund |
| OECD | Organization for Economic Co-operation and Development |
| OPEC | Organization of Petroleum Exporting Countries |
| PMBOK | Project Management Body of Knowledge |
| PMI | Project Management Institute |
| RC | Road Contractors |
| RII | Relative Importance Index |
| ROW | Right of Way |
| RRAS | Regional Roads Authorities |

| | |
|---|---|
| RSDP | Road Sector Development Program |
| URRAP | Universal Rural Road Access Program |
| VAT | Value Added Tax |
| WB | World Bank |
| WRO | Woreda Road Office |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Introduction

The construction industry constitutes an important element of Ethiopian economy that the Ethiopian government spends around 70% of the capital budget on infrastructure.

Road transportation is a key component of the economic and social development process, often absorbing a high proportion of the national budget. Most, if not all, business economies, personal economies, and public economies are the result of this transportation system.Road transport system of a developed or developing country represents a major part of that country's infrastructure significance both in terms of investment made in creating the highway network and its effect on the country's economic development.

In the context of Ethiopia's geography, patterns of settlement and economic activity, road transport plays a vital role in facilitating economic development as 95% of the movement of people and goods are still carried out by road transport. Road transport provides the means for the movement of peoples and agricultural products from rural to urban areas and movement of industrial goods, modern agricultural inputs and peoples from urban areas to rural areas. Road transport also provides a means for the utilization of land and natural resources, improved agricultural production and marketing, access to social services, and opportunities for sustainable growth (ERA, 2014).

Recognizing the importance of the road transport in supporting social and economic growth and its role as a catalyst to meet poverty reduction targets, the Government of Ethiopia has placed increased emphasis on improvement of the quality and size of road infrastructure in the country. However, there are challenges to achieve the required quality and size of the road infrastructure. Thus, to address constraints, mainly low road coverage and poor condition of the road network the Government formulated the Road Sector Development Program (RSDP) in 1997. The RSDP has been implemented over a period of sixteen years in four successive phases.

From the vague objective of the RSDP is increasing the Capacity of local Contractors. However, the performance of those local contractors has faced challenges and the immediate consequence of their performance is that increase in project costs than originally budgeted and delay, among others (ERA, 2014).

There are several factors that are contributing to the performance of local contractors. This research attempts to identify the major factors which affect time and cost performance of local contractors inthe road construction sectorin Ethiopia and can serve as the way forward for future work in how to enhance local contractors' performance and propose recommendation in setting the responsibilities of stakeholders in enhancing the construction industry by domestic contractors.

## 1.2 Structure of Road Construction Industry in Ethiopian

Road design and construction works were used to be executed mainly by government owned enterprises until the introduction of free market economic policy in 1991. The change of the centrally planned economy to market based has allowed many private contractors and engineering consultants to emerge in the road sector. The road construction sector in Ethiopia is comprised of the client, consultants, contractors, financiers and financial institutions which have been described as follows;

### a) The Client

Generally there are three major Clients in the construction sector: The Public Sector, Developers either private or public and Private owners. In developing Countries like Ethiopia, the Public sector is the major Client particularly for large and complex projects. Accordingly, the Ethiopian Roads Authority (ERA) is a federal government office, is the Client, responsible for evaluating proposals of regional states and other government ministries for upgrading and new constructions of roads. This involves, but not limited to identification and prioritization of projects, procurement of service and works contracts, contract administration of projects and preservation of the road asset through maintenance.

### b) Consultants

The first two pioneer government owned consultants in road and building sector in Ethiopia were the former Design Division and Contract Administration Divisions of governmental offices, Ethiopian Building Construction Authority (EBCA) and Ethiopia Roads Authority (ERA). Consultancy services were used to be monopolized by these two firms until the privatization period whereby private companies emerged in the market and created a competing environment.

The majority of domestic consultancy firms in Ethiopia is established by a group of founding professionals who have different expertise. Predominantly, consulting firms run with minimum permanent employees to ensure their economic viability by limiting their fixed overhead cost to the least. The general trend in consultancy service is to give a package of studies to one firm that takes full accountability of delivering the whole services. Moreover, most consultants are multidisciplinary, providing services in Building works, Road works, Geotechnical studies, Waterworks and Management services taking the broadening of their market share in the construction sector (Bezawit, 2010).

**c) The Contractor**

The main Contractors participating in road construction works are the previous ERA own force and the current Ethiopia Road Construction Corporation, local private contractors and international contractors. The record on a number of projects since 1997 indicates that out of the 985 contracts (both construction and consultancy) awarded over the last sixteen years of the RSDP (ERA, 2013).

**d) Development Partners (Financers)**

Several funding agencies are involved in the road sector development program as part of bilateral and multilateral relationships with the government. Local Sources of Finance include Government Treasury (GOE) and the Road Fund Office. Foreign financial sources, including Governments and International Financial institution which have major contributors in the form of grant aid, credit, and loans (ERA, 2014).

The Government of Ethiopia has been a major financier of RSDP followed by the Road Fund Office. The following are the development partners involved in the Ethiopian road construction sector Development partners such as;

- The World Bank (WB), European Union (EU), African Development Bank (ADB), Nordic Development Fund (NDF), Bank of Arab for Economic Development in Africa (BADEA), OPEC Fund for International Development (OFID) and the Kuwait.
- The Governments of Japan, Germany, U.K, Ireland, the Saudi Fund for Development, Fund and the Government of China have been involved in financing the Program.
- The recent donor which joined this effort is the Abu Dhabi Fund.

The involvement of financers is not limited to, financing matters, but they also involve in introducing best practices that enhance the capacity of the domestic construction industry as a way forward to ensuring sustainability of the projects they finance. The Road Sector Development Plan is an ideal means of handling integrated plan in the road sector involving financing plans (ERA, 2014).

**e) Financial institutions**

In all construction activities, costs occur earlier than the payments. Hence, contractors in developing countries often obtain the capital resources to finance the costs of construction (Melese, 2006). The financial institutions (Banks and Insurances) contribute a vital role in a construction industry by providing different services and facilities. According to the study by (Melese, 2006) all local banks are providing the following services and facilities for the construction firms:

- Construction loans,
- Insurance coverage,
- Bonds and Guarantees,
- Overdraft facilities and
- Truck/ equipment loans.

## 1.3 Statement of the Problem

Successful construction industry plays an important role of a country's economic development. For the past few years, the construction industries have developed in size, complexity and high demand by client, causing construction project more difficult for the project objective of time, and cost to be achieved.

There were few local contractors working in the industry at the start of the RSDP from the 1997. Those contractors who were available were constrained by lack of experience in managing construction projects, lack of skilled man power, shortage of capital and equipment. Local contractors were not in a position to compete with international contractors and their involvement in RSDP I was less. However, the road sector program (RSDP) has an objective of increasing local contractor's involvement in the road construction industry, among other vague objective, the participation of local contractors has progressively increased and the participation has reached 42% of cost of contracts awarded starting from

1998-2014. Encouraging those local contractors in the road construction industry has a vital importance in the growth and development of the country (ERA, 2014).

ERA, Road Sector Development Program 16 Years Performance Assessment, October 2014, mentioned that a delay in work projects leads to cost increases and delay in benefit of the project to the economy. Those projects which are handled by local contractors are suffering to cost and time overrun and there are various reasons for this. Their low performance would have a negative impact on the growth and development of the road construction industry as whole and affects the effective and efficient use of resources by the client.

Therefore, this research will assess the causes of local contractors' poor time and cost performance and its impact on the proper accomplishment of projects in depth.

## 1.4 Objective of the Research

The general objective of this study is to assess cause and impact of local contractors' time and cost performance in the road construction projects administered by ERA.

The specific objectives of the research are:

- To assess causes of local contractors'time and cost performance
- To identify the impacts of local contractors' time and costperformance in the construction industry
- To recommend management strategies to contractors, consultants as well as the client (ERA) in how to enhance local contractors' performance in the Ethiopian road construction industry.

## 1.5 Methodology

Assessment of the causes and impact of local contractor time and cost performance has been investigated from a review of relevant literature. The literature review mainly focused on previously carried out researches in relation to performance indicators, cost and time overrun, and its impact in the road construction projects as a whole have been carefully identified. Furthermore, a questionnaire survey has been conducted to rank the problems in their order of significance and to seek any additional variables beyond those found out from the literature review.

The questionnaire survey respondents were selected to represent the client (ERA), contractors and consultants who have been involved in the road sector development program.

The questionnaires have been developed to address the research objectives in three main parts in order of sequence as follows:

- The first set of questions was to categorize respondents to different parties in the road construction industry. That is to classify them under the role of client, consultants and contractor. The purpose was to determine the answers they provide based on the role they play in the construction sector.
- Background information – collecting the personal data of respondents, their experience in the road construction industry.
- General perception of time and cost performance of local contractors. The set of questions under this section was to meet the aforementioned research objectives.

Certain cases have also been investigated to demonstrate how serious the problem in the road construction sector is. The purpose of the case study is simply to substantiate the existence of the problem and its extent by presenting the status of some of the major road construction projects recently completed.

## 1.6 Scope and Limitations of the Study

Although the Ethiopian government through its implementing agencies: the Ethiopian Roads Authority (ERA), Addis Ababa City Roads Authority (AACRA), and Regional Rural Roads Authorities have started a major road sector development program to increase the road network in the country which includes new, upgrading and rehabilitation projects, this study has focused on only on the Federal road projects undertaken by the Ethiopian Roads Authority (ERA).

Time and cost certainty is known to be the top priorities of construction clients. Although affected by many internal and external factors, construction time and cost is considered a good and measurable indicator of project performance and it is one of the most important contractor performance criteria for clients' satisfaction. Therefore, among different key performance indicator, Time and cost are considered in this research.

All participants selected for data collection are professionals involved in road construction/maintenance projects implemented in Ethiopia. In addition, representative corridor had been selected for the case study handled by the Ethiopia Road Authority (ERA).

## 1.7 Organization and Contents of the Research

The research comprises of five chapters. Chapter one is the introductory chapter, which provides basic information about the study, including background and statement of the research problem, research objectives and scope and limitations of the research.

Chapter two presents theories and discussions related to the major functions of key performance indicator, performance management, potential factors that leads to poor performance, emphasis on time and cost, the impacts of contractors' performance and managing project cost and time. A brief discussion on performance management trend is also included under this chapter.

Chapter three covers the research methodology followed in order to achieve the objectives of the study. It presents an overview of the research design, sources of data and research instruments, research population and sampling, sample size distributions and method of analysis.

Chapter four presents analysis of the research data obtained from the questionnaire survey and the case study is discussed accordingly. The last chapter, which is chapter five, is devoted to the author's conclusions and recommendations.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.2 Introduction

In order to develop a better understanding of the research objective, a comprehensive literature review has been conducted. Hence, the purpose of this chapter is to discuss about the definition of performance practice and its indicators from road construction industry perspective. It also identifies the factors which affect performance, causes of cost and time overrun in construction projects by looking into previous studies carried out on the subject. In addition, it examines the impacts of cost and time overrun in the construction industry. The comprehensive literature review is conducted with the aim of addressing the objectives of the research.

## 2.2 Background

### 2.2.1 History of Road Construction in Ethiopia

Historic chronicles of the 17$^{th}$ and 18$^{th}$ centuries show that there were a number of small roads, trails and foot paths, in addition to the traditional shoulder porterage, animals like mules, donkeys and horses and camels were used as a means of transportation in Ethiopia.

In the 18$^{th}$ century, especially during the reign of Emperor Tewodros, although the technology was primitive it was believed that planned road construction efforts were made. (ERA website)

It is also believed that Emperor Yohannnes IV, who succeeded Tewodros, was engaged in road building. However, due to the danger of invasion by Egyptians, Derbush and Turkish the Emperor was not able to achieve his desires.

It was prior to the second Italian occupation i.e. between the years 1896 and 1936 that a great success was made in road construction. Emperor Menilik was said to be a successful road builder participating himself in the construction. In 1903 the road from Eritrea to Addis Ababa and the road from Addis to Addis Alem were built. In addition, it was during this time that the first Asphalt roads appeared in Addis. (ERA website)

During the Italian occupation roads were built by them and they were established to meet the requirements of the Military control rather than to promote the overall development of the

country's economy. In addition, the roads lacked most of the modern location, design and construction features desirable for present day high speed traffic. The roads and trails built and improved during the 5 years Italian occupation were about 6000km. Approximately 2500 km of them were given a single asphalt surface treatment, drainage structures were usually of stone masonry and at least three tunnels were built. However, when Ethiopia regained its independence, the Italians in their fleeing attempt almost undid what they created by blasting bridges and dynamiting roads.

From the time the Italian packed off home to the eventual creation of the Imperial Highway Authority (1941 to 1951) road construction or maintenance activity was almost subsided for a stagnation period of one decade because of lack of funds, equipment and expertise. (ERA website)

### 2.2.2 The Role of Transport

The transport sector is a key enabler of economic growth and transition in the region. By providing the physical networks and services upon which the economy and society depend for the movement of people and goods, transport increases the access of businesses and consumers to markets and services, promotes economic diversification and regional integration, supporting growth of the wider economy (European Bank, 2013)

From a social perspective, transport supports individual mobility so all people can benefit from access to essential public services such as health and education, and access to labour markets, which can also have important implications for economic inclusion and gender equality. It is also an enabler of international trade – in the modern global economy, no nation is self-sufficient, each relies on goods produced elsewhere – and transport provides the means for emerging markets to integrate into the global economy. This integration creates opportunities for businesses in the region to expand and develop, thereby supporting job creation. (European Bank, 2013)

Amare has mentioned that transport infrastructure is generally considered as an essential element for economic and social development as it provides the links required to make markets function. The development of economically vital sectors such as agriculture, industry, tourism, etc. is directly dependent on the existence of a working transport infrastructure system.

Transport is a key enabler of growth, providing the physical networks and services upon which the economy depends for the movement of people and goods. By connecting areas of economic activity within a country, transport increases access to markets and services. From a social perspective transport provides the individual mobility, that is critical for the people of the region, in terms of access to markets and essential services such as health and education. The provision of efficient, safe and sustainable transport is therefore fundamental for economic growth and the development of well-functioning markets.

Transport is also an enabler of international trade. In the modern global economy, where no nation is self-sufficient, transport is key to trade development, providing the means for emerging markets to integrate into the global economy. Export access is crucial for the companies in the Bank's region, increasing and maximizing opportunities for expansion and economic development.

The transport needs of the region have changed dramatically from the previous era when these countries were largely insulated from the global economy. Since then, new patterns of trade have developed, and the region now exports a significant proportion of its good and services (European Bank, 2013).

Nevertheless, despite large investment programs in many countries, the investment needs remain vast, as the existing transport networks are inadequate to support the economic aspirations of the region. Infrastructure which promotes national integration, linking suppliers with consumers and balancing national economies; and trade facilitation, integrating the countries of the region into the regional and global marketplace remains a priority. Much also remains to be done to advance sector reform, which often requires a deep and lengthy engagement with the public sector. (European Bank, 2013)

### 2.2.3 Organizational Background of ERA

Following the eviction of the Italian occupiers, the Imperial Ethiopian Government was convinced that a Road Agency solely responsible for rehabilitating/restoring and expanding the road network throughout the country had to be established. Accordingly, the Imperial Highway Authority (IHA) was established under proclamation No. 115/1951 as a semi-autonomous agency with specific duties to plan, design, construct, and maintain roads. Responsibilities for

construction and maintenance of roads remained under a single autonomous authority (IHA) for 26 years (1951-1977). The Ministry of Transport and Communication turned out to be the supervising authority of ERA. The Ethiopian Roads Authority has been reestablished under proclamation 133/1978 incorporating, among others, the Rural Roads Department in addition to the Highway Department.

In 1980, the Military Government that took power in 1974 reformed the agency into the Ethiopian Transport Construction Authority (ETCA) by proclamation No. 189/1980 and became answerable to the newly formed Ministry of Construction.The proclamation enlarged responsibility of the Authority by expanding its task to incorporate the construction of Airports, Seaports, Railways, and Municipal Roads. Following the shift from a command-based economy to a market oriented one in 1991, the ERA was reestablished by proclamation No.63/1993 with a view to providing a strong administration under the leadership of a Board. As part of its reform, the government assigned administration of rural roads to the regional self-governments and main roads to ERA as part of the Federal Government's responsibility. ERA's role regarding rural roads was then limited to rendering support such as overall network planning, training and technical assistance as required by Regional Governments.

To cope up with existing situations, ERA was again re-established by proclamation No. 80/1997 with the objective to develop and administer highways, and to ensure the standard of road construction. With the establishment of the new cabinet of Ministers in October 2001, a Ministry of Infrastructure and later on Ministry of Works and Urban Development has been formed with the responsibility of developing the infrastructure of the nation. ERA, which is one of the organizations under the Ministry of Works and Urban Development and accountable to the Board, is responsible for planning and formulating long and short term plans and programs for road construction, design, maintenance of the trunk and major link roads, as well as for the administration of contracts.

Currently, the main responsibilities of ERA are network planning; management of contract projects and force account operations. The long-term objective is to focus on policy, planning and contract administration and to pull out gradually from direct operational works.

From its year of establishment 1951, the Organization managed to undertake various physical and policy issue assignments. During its establishment the total road network amounted to 6,400 km, which was mainly built during the Italian invasion (ERA website)

### 2.2.4 Road Sector Development Program (RSDP)

The performance of the road sector plays a vital role in growing the economy of the country. The service sectors and the people rely heavily on the availability and satisfactory performance of our road network and transport services.

In the context of Ethiopia's geography, patterns of settlement and economic activity, transport plays a vital role in facilitating economic development. In particular, it is road transport that provides the means for the movement of people, utilization of land and natural resources, improved agricultural production and marketing, access to social services, and opportunities for sustainable growth (ERA, 2014).

When the Road Sector Development Program (RSDP) commenced in 1997, the challenges facing the road sector were immense. The total road network was only 26,550 km, of which over half was in a poor condition. Only 22% of the network at that time was in a good condition, finances were scarce and maintenance was all but neglected (ERA, 2011)

As mentioned above the RSDP has already been implemented over a period of seventeen years and in four successive phases, as follows:

- RSDP I - Period from July 1997 to June 2002 (5 year plan)
- RSDP II - Period July from 2002 to June 2007 (5 year plan)
- RSDP III - Period July from 2007 to June 2010 (3 year plan)
- RSDP IV - Period July from 2010 to June 2015 (5 year plan)

Over seventeen years of RSDP, physical works consisting of rehabilitation and upgrading of trunk and link roads, construction of new link roads, rural roads & district roads and maintenance of federal and regional roads have been carried out by the Ethiopian Roads Authority (ERA), Regional Roads Authorities (RRAs) and Woreda Road office (WRO) and the community and municipalities. A series of policy and institutional reforms have been implemented in the sector,

which have enhanced implementation capacity of road also projects and effectiveness of Road Asset Management (ERA, 2014).

Financing of the RSDP from the Government of Ethiopia and the Road Fund has been complemented and supported by additional contributions from various development partners including;

- The World Bank (WB), European Union (EU), African Development Bank (ADB), Nordic Development Fund (NDF), Bank of Arab for Economic Development in Africa (BADEA), OPEC Fund for International Development (OFID) and the Kuwait
- The Governments of Japan, Germany, U.K, Ireland, the Saudi Fund for Development, Fund and the Government of China have been involved in financing the Program.
- The recent donor which joined this effort is the Abu Dhabi Fund.

The involvement of financers is not limited to, financing matters, but they also involve in introducing best practices that enhance the capacity of the domestic construction industry as a way forward to ensuring sustainability of the projects they finance. The Road, Sector Development Plan is an ideal means of handling integrated plan in the road sector involving financing plans (ERA, 2014).

The seventeen years of RSDP performance have brought significant improvements in the restoration and expansion of Ethiopia's road network. Physical achievements have been matched by significant improvements in the condition of the network, strengthening of the management capacity of the road agencies and delivery on policy reform.

A total of 110,162 km of major physical road works were executed by local and foreign contractors, excluding routine maintenance was carried out, of which 29,155 km was on federal roads, 41,132 km was on regional roads construction and maintenance and 39,096 km was on URRAP roads. Overall physical accomplishment against the plan was 86% as shown in the table below. Total disbursement was about ETB 180.9 billion and this disbursement was 113% of the plan.

Table 2.1 Summary of 17 year performance of RSDP

| Program | Physical Plan Vs. Accomplishment, km | | |
|---|---|---|---|
| | Plan | Actual | % age |
| Total RSDP I | 8908 | 8709 | 98 |
| Total RSDP II | 8486 | 12006 | 141 |
| Total RSDP III | 20686 | 19251 | 93 |
| **RSDP IV (Four years)** | **90386** | **70196** | **78** |
| **Total RSDP (17 yrs)** | **128,466** | **110,163** | **86** |

Road sector construction projects in Ethiopia have an influence on the development strategies of the country. The development strategies of a country achieved through successful road projects intended to improve accessibility of the rural area; lower costs associated with transport maintenance and open more areas for development activities. Road projects, involving large amount of capital, also contribute to the total economy through job creation and in a ripple effect to other business activities. (AshenafiKiros, 2006)

Ashenafi also mentioned that despite the improvement seen in performance and productivity within the sector, there still remain problems of delay, cost overrun and poor quality of road construction projects. It is also identified that there is a need for further strengthening of institutional capacity, adoption of new construction technologies and modern project management principles, and additional regulatory reforms in order to maximize the efficiency of the Ethiopian road construction industry. To this end the industry is expected to refine its processes for efficient delivery of projects in terms of time, quality and cost.

## 2.3 Definition of Performance

Performance is one of the words which definition is very flexible as everyone have used different concept that suite the best and letting the context take care of the definition.

Salaheldin (2009) has a define performance as the degree to which an operation fulfills primary measures (performance objectives) in order to meet the needs of customers.Swanson (1995) has described performance as a valued, productive output of a system in the form of goods and

services or works with units of performance describing the actual fulfillment of the goods and services relating to performproduction, quality and or time.

According to Saleh Samir and Abu Shaban (2008) KPIs will enable a comparison between different projects and enterprises to identify the existence of particular patterns. The specialist contractors hoped that the data trends observed will provide insight into certain inefficiencies that are prevalent in the market.

## 2.4 Performance Measurement

Measurement has a comprehensive meaning in the context of performance management. Measurement is defined as a set of tools employed to establish the efficiency, utility and contribution of performance management in the enhancement of organizational and employee performance and also a vehicle that set standards of performance (OECD, 2014).

Bassioni, (2004) defines a performance measurement refers to measurement implemented by a company. Alternatively, Robinson (2005) defines performance measurement as a mechanism to focus measurements which enable organizations to implement business improvement.

According to Saleh Samir Abu Shabandefinition, it is a process of re-thinking and re-evaluation of business processes to achieve significant performance improvements on projects.

Max moullin (2007) defined performance measurement as evaluating how well organizations are managed and the value they deliver to customers and other stakeholders. Performance measurement is the process of quantifying the efficiency and effectiveness of past action (Sousa, 2006).

Takim (2003) defined performance measurement as the regular collecting and reporting of information about the inputs, efficiency and effectiveness of the construction project.

Effectiveness is the degree to which goals are achieved, making the right decisions and successfully implementing them and doing the right things.

Efficiency is using minimal resources to produce the desired volume of output, using resources wisely and in a cost-effective way, operating in such a way that resources are not wasted and doing things right at the right time.

For the purpose of this study, the definition of performance measurement as is given by the OECD will be adopted. Performance measurement is an ongoing process of ascertaining how well, or how poorly, a government program is being provided. It involves the continuous collection of data on progress made towards achieving the program's pre-established objectives. (OECD, 2014).

It is evident that performance measurement is a comparison between the desired and the actual performances.

## 2.5 Performance Indicators

Any effective performance measurement can be undertaken after developing an objective and consistent measurable criteria. Various studies have classified these measuring criteria into performance measures and indicators.

Literature review on performance measurement showed that the term performance indicator and performance measure are synonymous, their usage depending on the country. Where a distinction is made, performance measure generally has a broader meaning than performance indicator.

Performance measure indicates the direction for the performance (e.g. reduction, increase) while performance indicators are conceived more narrowly as data elements (OECD,2014)

A key performance indicator (KPI) is a measure of performance of an activity which is critical to the success of an organization (Constructing Excellence, 2009).

Saleh Samir &Abu Shabanstated that KPIs are very important in order to deliver value to stakeholders. So, companies must be sure they have the right processes and capabilities in place.

The KPIs also allows to trace which processes and capabilities must be competitively and distinctive, and which merely need to be improved or maintained. In order to define the KPIs throughout the lifetime of a project, five key stages have been identified as shown in Figure 2.1.

A. Commit to Invest: the point at which the client decides in principle to invest in a project, sets out the requirements in business terms and authorizes the project team to proceed with the conceptual design.

B. Commit to Construct: the point at which the client authorizes the project team to start the construction of the project.

C. Available for Use: the point at which the project is available for substantial occupancy or use. This may be in advance of the completion of the project.

D. End of Defect Liability Period: the point at which the period within the construction contract during which the contractor is obliged to rectify defects ends (often 12 months from point C).

E. End of Lifetime of Project: the point at which the period over which the project is employed in its original or near original purpose ends. As this is usually many years after the project's completion, this is a theoretical point over which concepts such as full life costs can be applied (Saleh Samir &Abu Shaban, 2008).

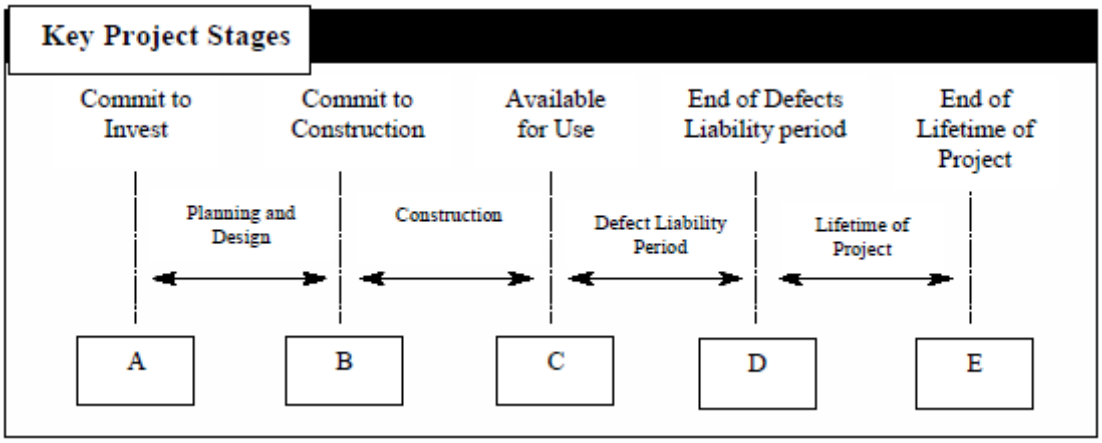


Figure 2.1 KPIs throughout the life time of a project

According to Saleh Samir Abu Shaban,Key performance indicators (KPIs) include factors such as time, cost, quality, client satisfaction; client changes, business performance, safety and health in order to enable measurement of current organizational project performance and to achieve significant performance improvements of future projects. In addition, a KPIis also quantifiable measurements that reflect the critical success factors of an organization. The traditional performance indicators are time, cost and quality.Constructing Excellence (2010), remarked eight main key performance indicators; client satisfaction, defect, predictability, profitability, productivity, safety, construction cost and construction time;

## 2.6 Selection of the Performance Indicators

A key component of the most successful road projects and programs is a well-defined set of goals and objectives. However, the use of performance indicators goes well beyond simply evaluating the degree to which goals and objectives have been achieved. The use of performance indicators by a road administration depends on the particular needs for development or improvement in performance.

- The main aspects that influence decisions on the use of performance indicators are:
- The main characteristics of the road transport vision in the country concerned.
- The position of the road administration in the process of organizational reform.
- The management style of the organization.
- The specific functions that require development or learning.
- The 15 performance indicators selected for this project are not the "ideal", or even the most important, indicators. They were selected by the Expert Group to cover the previously developed taxonomy. (OECD, 2014).

## 2.7 Project Time and Cost Performance Management

Construction project sites are generally complex because of the extensive use of sophisticated plant, equipment, modern methods of construction, multidisciplinary and multitasked aspects of its project workforce (Evelyn Ai Lin Teo, et.al, 2004). That is why management of construction project is needed to organize, arranges every function, actions and everyone involved. Management will help to settle everything in the right place (Cartin, 1993).

Project management defined as the application of knowledge, skills, tools and techniques to ensure the project is completed on time, within cost and fulfills the quality standard. George T.

Hendry in Degoff and Friedman, (1999), defines management in construction project as a group of management activities and engineering services related to a program, carried out during the pre-design, design and construction phase that contributes to the control of time and cost in a new facility.

Generally, time and cost management of construction project is defined as centralized of time and cost planning, organizing and controlling in the fieldwork or in the construction sites to meet the goals of schedule, cost and quality estimation (Ritz, 1994).

## 2.8 Factors Affect Project Performance

The construction industry is the tool through which a society achieves its goals of urban and rural development. It is one of the sectors that provide important ingredients for the development of an economy. The construction industry tends to fluctuate with the general economy, and it has a quick response to the changes in the economy (Abdullah, 2013).

The construction industry is one of the most complex, fragmented industries referred as schedule and resource driven. In construction industry timely completion of project is a major criterion of project success (Aftab,2011)

The construction industry is an essential component for driving the economy of any country. Hence, worldwide huge amounts are spent on construction development works. However, this industry is suffering from a major issue of time overrun or delay continuously for many years. (Aftab, 2014)

In construction industry one of the basic goals of practitioners is to achieve timely completion of projects within stipulated budget and required quality as each day of time overrun in the completion of any project has a direct impact on the cost of the project. In order to manage and control construction projects, there are various procurement strategies being adopted. Most popular strategies include traditional, management, integrated services and in-house teams (Aftab,2011)

Savita Sharma (2014) stated construction industries play an important role in economic growth and development of any country. Recently it has witnessed that a large number of construction projects are facing the problem of cost overrun due to various factors.

The failure of any construction project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such problems. Ogunlana et al, (1996) stated that the construction industry performance problems in developing economies can be classified in three layers: problems of shortages

or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and problems caused by contractor incompetence/inadequacies. Okuwoga (1998) identified that the performance problem is related to poor budgetary and time control. Long (2008) remarked that performance problems arise in large construction projects due to many reasons such as: incompetent designers/contractors, poor estimation and change management, social and technological issues, site related issues and improper techniques and tools.

These factors are the outcome of the uniqueness, complexity and dynamic nature of the construction activities. As it involves a large number of project participants such as, contractors, clients, consultants, etc. and as the project area and feature are different from project to project. It has been observed that risks and uncertainties involve in construction project are not being addressed and managed efficiently. Therefore, to improve the performance of the construction industry, there is a dire need to deal with this risk and uncertainty in an integrated manner to achieve the success of the project in terms of cost, time and quality. Among all the success parameters as mentioned above, the cost is considered as a very important and key parameter (Savita Sharma, 2014).

Keeping construction projects within estimated costs and schedules requires sound strategies, best practices, and careful judgment. To the dislike of owners, contractors and Consultants, however, many projects experience, extensive delays and thereby exceed initial time and cost estimates. This problem is most obvious in the traditional or the adversarial type of contracts in which the contract is awarded to the lowest bidder, which is the strategy in the majority of public projects in developing countries(Aftab, 2014).

Ismail (2012) has mentioned that time and cost performance is the fundamental criteria for success of any project. Unfortunately the construction industry in Malaysia has been regarded as industry facing poor performance leading to failure in achieving effective time and cost performance. As a consequence, most of the project facesa huge amount of time and cost overrun.

Time and cost certainty are known to be the top priorities of construction clients. Construction time and cost is considered a good and measurable indicator of project performance and it is one of the most important contractor performance criteria for clients' satisfaction (Abubeker, 2015)

### 2.8.1 Factors Affecting Project Time Performance

According to Abubeker (2015) project time has been defined as the duration that is needed to complete the work starting from site handover until finished.

Project time performance is the most important indicator of project success. Time overrun is a severe problem in the construction industry where only rare projects are completed on the estimated time.

Projects are considered as overrun in time, which are completed beyond the date of completion specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned scheduleAftab (2014).

#### *2.8.1.1 Definition Time Overrun*

Time overrun is any delay beyond the baseline construction schedule. Minimizing time and cost is the main goal in managing a construction project. However, time delay frequently occurs in all phases of a construction project and consequently increases the project total duration(Aftab, 2011).

Stumpf (2000) defined delay as an act or event that extends the time required to perform the tasks under a contract. The same way, Abubeker (2015) defines time overrun as the inability to complete a project either by the original planned time or budget, or both, ultimately results in project delay.

Time overrun is caused by various reasons such as poor site management and supervision, which can affect the productivity. Various researchers have highlighted several factors affecting time overrun. Aftab (2014)

#### *2.8.1.2 Causes of Time Overrun*

Many studies have been conducted in different countries to identify the factors affecting time overrun in construction projects.

Aftab (2011) identified in his study,

- design changes/change order,
- delay in progress payment,
- ineffective planning and scheduling of project,
- poor site management and supervision,
- Shortage of labours and Difficulties in financing project by contractor
- design changes by owner or agent during construction,
- late delivery of materials,
- unreliable subcontractors,
- delay in performing inspection and testing,
- unqualified/inexperienced workers,
- change orders,
- delay in site delivery,
- delay in approving design documents,
- delay in progress payments,
- poor communication and coordination, Poor site management,
- Unforeseen ground condition,
- Low speed of decision making, and
- Client-initiated variation and Necessary variations of works were found as the most critical factors responsible for this time overrun.

Koushki(2005) conducted a study in Kuwait to study the causes of time and cost overrun in construction projects. From the study, they concluded that the main causes of delays are change orders, owners' financial constraints, and owners' lack of experience.

Assaf and Al-Hejji (2006) discussed the delay in large construction projects in Saudi Arabia. Seventy-three factors affecting time overrun were identified in the study. They concluded that the most common factor of delay identified by the contractors, the consultants and the owners is ''change order''.

Aftab (2014) studied time overrun factor in the construction industryin Malaysia and concluded that the major causative factors contributing to construction time overrun are frequent design changes, change in the scope of the project, financial difficulties of owner, delays in decisions making and unforeseen ground condition.

On the other hand, Odeh and Battaineh (2002) found that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors of construction delay in Jordan.

Aftab, 2011 showed that ineffective planning and scheduling by contractors as a quite significant cause of time overrun. This issue seems to be true as it is highly related to cash flow and financial difficulties faced by contractors. Shortage of site workers, contractor's poor site management, inadequate contractor experience, lack of communication among construction parties, problems with subcontractors, and frequent change management are also identified to be the causes of time overrun.

AshenafiKiros (2006) stated that a number of unexpected problems and changes from original design arise during the construction phase, leading to problems in cost and time performance. It is found that poor site management, unforeseen ground conditions and low speed of decision making involving all project teams are the three most significant factors causing delays and problems of cost performance in construction projects.

Kaliba(2009) concluded from their study that the major causes of delay in road construction projects in Zambia were delayed payments, financial deficiencies on the client or contractor side, contract modification, economic problems, material procurement, changes in design drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labour disputes, and strikes. It can therefore be concluded that the most important factors vary from one region to another.

Kessing(2003) mentioned that consultants play a very important role in design-related delays as they are in charge of the design process in conjunction with the owner of the project. On the

other hand, the government plays the most important role in code-related delays. Contractors have the major responsibility for delays in construction-related delays.

Odeh and Battaineh (2002) studied the causes of construction delay in traditional contracts in Jordan, distributeda questionnaireto a random sample of 100 contractors and 50 consultants. The study illustrated that; according to contractors, labor productivity was the most important delay factor. The inadequate contractor experience, however, was the most important delay factor to consultants. All parties generally agreed on the ranking of the individual delay factors. They agreed that inadequate contractor experience, owner interference, and financing of work were among the top five most important factors.

Moreover, delays caused by subcontractors, slow decision making by owners, improper planning, and labor productivity were among the top ten most important factors for both parties.Operational factors such as labor productivity, construction methods, site management, and equipment availability and failure were important factors to contractors than consultants.

According to Amare (2008),

- inadequate investigations by the designer during the design phase,
- Delay in site mobilization,
- Ambiguities, mistakes, and inconsistencies in specifications and drawings,
- Poor site management and supervision by contractor,
- Ineffective planning and scheduling of project by contractor,
- Equipment breakdowns,
- Difficulties in financing the project by the contractor,
- Shortage of equipment required,
- Late procurement of materials by the contractor,
- Poor qualification of consultant/ engineer's staff assigned to the Project,
- Type of project bidding and award (Selection based on least evaluated bidder),
- Shortage of technical professionals in the contractor's organization, and
- Cash flow problems faced by the contractor are identified as the most severe causes of time overrun from the contractor, consultant and client point of views.

To the owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of the longer work period, higher material costs through inflation, and due to labor cost increases.

### 2.8.2 Factors Affecting Project Cost Performance

The project cost is the amount of money that is required to complete all project activities. (Abubeker, 2015).

Project cost has its proven importance as the prime factor for project success. In spite of its proven importance, it is not uncommon to see a construction project failing to achieve its goal within the specified cost. Cost overrun is a very frequent phenomenon and is almost associated with all projects of the construction industry (Turkey, 2011).

The lack of fulfillment of cost management functions often leads to project overruns producingan immediate impact on construction stakeholders.

#### *2.8.2.1 Definition Cost Overrun*

Cost overruns are defined as the excess of actual project costs over budgeted costs. The cost overburden is obtained by the estimated cost, final cost and the contract between a contractor and an owner. The difference between estimated and final cost is termed as the magnitude of the cost overrun of a project(Savita Sharma &Pradeep K. Goyal, 2014).According to Abubeker(2015) cost overrun is the amount by which actual costs exceed the baseline or approved costs.

For the purpose of this research cost overrun is defined as the positive difference between the final cost of a construction project at completion and the contract amount agreed by the client and the contractor during the signing of the contract.

#### *2.8.2.2 Causes of Cost Overrun*

There are several factors which affect the construction cost and various studies have been conducted to address these factors.

Okpala and Aniekwu (1988) studied the reasons of cost overrun in Nigeria Construction projects and found out that the price fluctuations, additional works, delays, fraudulent practices, shortening of the contract period, inaccurate estimates, were the main causes of cost overrun.

Mansfield (1994) also carried out a questionnaire survey among key stakeholders (contractor, consultant and client organizations) in Nigeria. From the study, it has been found that poor planning, shortage of materials, imported materials, changes in site conditions, design changes were the main causes of construction delays and cost overrun.

According to Long (2008), mistakes in design or poor design are caused by the low- competence designer. The approved design or drawing process becomes low quality and ineffective, especially for those with government funded projects. The unrealistic design which found after the start of the construction projects has to change and it could lead to cost overrun.

Creedy (2005) studied the main causes of cost overrun in the Australia Highway project. It has been seen that major factors influencing the cost overrun in highway projects are changing in design in various components, changes in contract tender price, quantity increased measure, latent condition, remove and replacement of unsuitable material due to faulty design and change in design.

According to Savita Sharma &Pradeep K. Goyal (2014) cost overruns are a major problem in both developing and developed countries. The trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the project.

The prime variables of cost overruns have been commonly identified as: unpredictable weather, inflationary material cost, inaccurate materials estimates, complexity of the project, contractor's lack of geographical experience, contractor's lack of project type experience, and non-familiarity with local regulations (Kaming et al 1997).

According to Frimpong (2003), improper planning and management experience limitation causes cost overrun.Poor site supervision and management and poor project management assistance contribute to the problem of cost overrun in construction projects. Poor site management reflects the weakness and incompetency of contractors. Skills and experience human resource is insufficient in site management (Long, 2008)

Fetene(2008) found that actual site conditions of a project are not usually determined until excavation is completed. It is sometimes possible that site conditions are overlooked by the initial review or conditions have changed due to change of Adverse Weather conditions or sub-

soil conditions. The unexpected conditions on sub surface, sometimes require fundamental redesign of projects with high expense. Changes of site conditions become a problem for machinery and supplies to move in and out of the site. This also increases costs required.

Chimwaso(2001) has identified 9 critical factors, as incomplete design at the time of tender, Additional work at the owner's request,changes in owner's brief, lack of cost planning/monitoring during pre-and-post contract stages, site/poor soil conditions, adjustment of prime cost and provisional sums, re measurement of provisional works, logistics due to site location and lack of cost reports during construction stage.

According to Amare (2008) the top five causes of cost overrun are price escalation, quantity underestimation, design change, delay caused by the owner and his agent.

## 2.9 Impacts of Poor Time and Cost Performance

The construction industry is one of the most complex, fragmented industries referred as schedule and resource driven. In construction industry timely completion of project with the budgeted cost is a major criterion of project success

Time and Cost overruns have obvious impact for the key stakeholders in particular, and in the construction industry in general. Delays and cost overruns in construction projects prevent the planned increase in property and service production from taking place, and this phenomenon in turn affects, in a negative way, the rate of national growth [Arditi,et al, 1985].

Different researchers have studied the impact of time and cost overruns related to time and cost performances. Aibinu and Jagboro (2002) studied the impact of construction time overrun on project delivery inthe Nigerian construction industry and identified five impacts; Cost overrun, dispute, arbitration; total abandonment; and litigation.

Fetene (2008) stated that cost overrun does not affect only those parties that are involved directly in the construction of a project, but its effects pass to the construction industry as a whole and consequently to the national economy of the country.

Mbachu and Nkado (2004) identified impacts of cost overrun and categorized the impact to those main stakeholders in the construction; to the client resulting in less returns on investment. To the

end user, the added costs are passed on as higher rental/lease costs or prices. To the professionals, cost overrun implies inability to deliver value for money and could well tarnish their reputations and result in loss of confidence reposed in them by clients. To the contractor, it implies loss of profit for non-completed, and defamation that could jeopardize his/her chances of winning further jobs, if at fault.

To the industry as a whole, cost overruns could bring about project abandonment and a drop in construction activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks. All these consequences undermine the viability and sustainability of the construction industry.

The impact of time and cost overrun are not confined to the construction industry, but are reflected in the state of the overall economy of a country. Fetene (2008) has found out twenty main effects of cost overrun which are collected from the respondents of the questionnaire survey and desk study;

- Delay,
- Supplementary agreement,
- Additional cost, budget shortfall,
- Adversarial relationship between participants of the project,
- Loss of reputation,
- High cost of supervision and contract administration for consultants,
- The contractor will suffer from a budget shortfall of the client,
- Poor quality workmanship,
- Dissatisfaction by project owners and consequently by end users,
- Negative attitude towards the construction industry by the higher public authority and by the society as a whole,
- The contribution of the construction industry to the growth of the national economy of the country will be less,
- Cost overruns on construction projects prevent the planned increase in property and service production from taking place, and this phenomenon in turn affects, in a negative way, the rate of national growth
- Weakens the growth of the construction industry by eroding mutual trust and respect,

- Pours money unnecessarily to the project at hand at the expense of other new projects,
- Distorts fair and equitable resource distribution,
- Discourage investment, the investment in building construction by public clients will be less, hence the number of projects will decrease in the future,
- Creates skeptical outlook on appraisal of other new construction projects,
- Some project owners (clients) become reluctant to effect additional payments to contractors and they view the cost overrun as a fabricated matter. This will propel to delay the project and become a source of dispute among participants of the project,
- Creates frustration on stakeholders.

Poor time and cost performance doesn't affect only stakeholders in the project, but also the road construction industry as a whole and consequently to the national economy of the country.

## 2.10 Current Participation of Local Contractors on Road projects Administered by ERA

The Ethiopian roads authority is established during the imperial government with the purpose of rehabilitating or restoring and expanding the road network program of the country. Since the establishment of the organization different types of road in rural and urban areas of the countryis constructed.

To address constraints in the road sector, related to restricted road network coverage and poor condition, the Government formulated the Road Sector Development Program in 1997.

The RSDP has already been implemented over a period of seventeen years and in four successive phases. The impact of the program on building the capacity of the domestic construction industry is encouraging. Specifically, participation of the local contracting industry has increased, in terms of both the value and number of projects, over the last seventeen years of the RSDP. Some local contractors are now taking larger contracts, with values amounting as much as ETB 2.2 billion. Participation of Contractors (from 1998-2014) shows that 58 % foreign contractors and the rest 42% Local contractors (ERA, 2014)

One of the objectives of RSDP is encouraging capacity of the domestic construction industry. Specifically, participation of the local contracting industry has increased, in terms of both the value and number of projects, over the last sixteen years of the RSDP. ERA has carried out a

small number of civil works by its previous own force account, particularly in areas where the private industry is not willing to work. The Table below depicts the cost of contracts awarded to local and foreign contractors over the period of the RSDP. (ERA, 2014)

Table 2.2 Total cost of projects awarded to local and foreign contractors
*(Value in Million ETB)*

| Year | Local Contractors | Foreign Contractors | Total |
|---|---|---|---|
| 1998 | - | 310.98 | 310.98 |
| 1999 | 180.25 | 3350.66 | 3530.92 |
| 2000 | 93.46 | 0 | 93.46 |
| 2001 | 531.3 | 513.49 | 1044.79 |
| 2002 | 252.21 | 395.58 | 647.79 |
| 2003 | 659.25 | 172.53 | 831.79 |
| 2004 | 514.12 | 286.37 | 800.49 |
| 2005 | 1052.96 | 1460.62 | 2513.58 |
| 2006 | 3773.91 | 3356.4 | 7130.31 |
| 2007 | 3266.81 | 4751.42 | 8018.22 |
| 2008 | 7527.3 | 4952.53 | 12479.8 |
| 2009 | 3088.32 | 12660.1 | 15748.4 |
| 2010 | 6428.22 | 745.4 | 7173.61 |
| 2011 | 8607.15 | 4798.36 | 13405.5 |
| 2012 | 8470.92 | 3606.23 | 12077.2 |
| 2013 | 5593.86 | 17815.5 | 23409.3 |
| 2014 | 4941.05 | 17249 | 22190 |
| **Total** | **54981.1** | **76425.1** | **131406** |
| **%age** | **42** | **58** | |

Participation of local contractors in the road sector development has steadily been increasing while the participation of Government in road construction is steadily diminishing. Until recently, the participation of the local contractors has been restricted to the construction of Federal Roads only, but now local contractors are participating in routine & heavy maintenance of roads and construction of bridges and also involve in the Universal Rural Road Access Program (URRAP) roads. Currently, more than 92 local contractors and 20 foreign contractors are participating in the construction of gravel & asphalt roads, construction and maintenance of bridges and road maintenance projects.

Over the past 17 years, construction contracts having a total price of ETB 118 billion have been awarded to local and foreign contractors, of which ETB 54.9 billion is awarded to local contractors and ETB 76.4 billion is awarded to foreign contractors.

## 2.11 Current Local Contractors Performance Evaluation under Government Financed Tenders

The performance measuring of contractors is carried out through the data collected from the regional directorates, Design and Build directorates and Road Asset management directorate regardsthe progress of each contractor on their projects against the work program based on the financial execution. The data from the regional directorate is comprised of project names, contractor's name, the original and revised contract amount, contract signing date, commencement date, duration of mobilization period, revised completion date after approved EOT as recommended by the engineer and the contract completion date. Since, the data collected and performance measurement of each contractor depends on the financial progress, the system is not indicative with regard to the quality of work done, safety, environment and other important parameters (Action Plan for ERA Modernization, 2014)

In works contracts of government financed projects, one of the major qualification criteria is a performance assessment of bidders on ongoing projects. For bidders having ongoing projects with ERA, the performance assessment will be carried out following the indicated procedure (formula).If bidders do not have projects with ERA, the performance assessment shall be carried out following qualitative assessment of bidder's performance based on writing feedback from their employers. The performance assessment is carried out every calendar month.
Under each evaluation, the performance of the bidder in the immediate previous month (from the Date/month of deadlines for submission of the tender in reference) is used for evaluation. The evaluation is made based on ERA's contractor's performance assessment framework.

The performance evaluation of contractor is set to award for good performing and to penalize them for poor performance. ERA uses history of non-performing contract and poor performance as one of measuring criteria to qualify for the project.

### 2.11.1 Performance Evaluation Formula for Local Contractors

The total contract duration is divided into three equal periods in such a way that:

- At the end of the first one third period, the minimum expected progress is **9%**.
- At the end of the second one, third period, the minimum expected progress is 38%
- At the end of the last one third period or at the end of the contract period, the minimum expected progress is 70% and
- Beyond contract period, but only up to a period of one fourth of the contract period, the project is expected to be completed 100%.
- Contractors, who fail to complete projects after the elapse of one fourth period of the contract duration, will be disqualified.

For the intermediate months, the following formulae will be used:

I. For the first one third duration of contract, the formula for the determination of expected minimum performance is, 9t1

   Where t1 = (Elapsed time in months minus mobilization time in months)/(One third of the contract period in months minus mobilization time in months)

II. For the second one, third duration of contract, the formula for the determination of expected minimum performance is, 9+29t2

   Where t2 = (Elapsed time in months minus One third of the contract period in months)/(One third of the contract period in months)

III. For the last one third duration of contract, the formula for performance evaluation is, 38+32t3

   Where t3 = (Elapsed time in months minus 2 X One third of the contract period in months)/(One third of the contract period in months)

IV. Beyond contract period, but only up to a period of one fourth of the contract period, the formula for the determination of expected minimum performance is, 70+30t4

   Where t4 = (Elapsed time in months minus contract period in months)/(One fourth of the contract period in months)

As stated above, ERA'sframework for assessment of local contractor performance is made by using only time as a performance indicator.

### 2.11.2 Expected Performance for Three or More Projects

It is clear that as the number of projects that a given contractor can handle at a time increases, it does have an impact on the technical and managerial efficiency of the contractor unless and otherwise the contractor takes some positive measures to reduce the negative impact resulted from the increase in number of new projects. On the other hand, employers would take risks in giving more new projects to the contractor; as it contributes to the contractor's inefficiency. Hence, in order to manage the risk of inefficiency due to increase in number of projects, it is suggested to raise the expected performance of a given contractor by a certain percentage if he has three or more contracts at a time. Hence the formula developed to determine the additional percentage of expected performance is: $= 2 * (1.5)^{n-3}$

Table 2.11.1 Calculation of expected performance for three or more projects

| No. Of Projects | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | n |
|---|---|---|---|---|---|---|---|---|---|
| Percentage Increase | 2 | 3 | 4.5 | 6.8 | 10 | 15 | 23 | 34 | $2 * (1.5)^{n-3}$ |

The above table indicates additional percentage of the expected performance due to additional projects. For example, if a bidder is required to have expected performance of 50% and has five projects at hand, his expected performance will be revised as 54.5% which is calculated as [50% + 4.5%].

The above framework used for evaluation of local contractors' performance doesn't consider the following;

- Other key performance indicators except time (i.e., Cost, Quality, client satisfaction, health and safety, etc.)
- the contractor's skillful professionals, equipment and their productivity on the respective construction site.
- contractor's organizational establishment and capacity to properly plan, schedule and manage projects.

## 2.12 Summary of literature review

The literature review was done through previous studies, internet, construction management books, and engineering journals. By referring to the previous literature, the information on cause of time and cost performance and impacts of poor performance in the construction industry has observed. This would be used to develop the questionnaire survey in order to collect data from the targeted respondent.

Road transportation is a key component of the economic and social development process, often absorbing a high proportion of the national budget. Most, if not all, business economies, personal economies, and public economies are the result of this transportation system. Road transport system of a developed or developing country represents a major part of that country's infrastructure significance both in terms of investment made in creating the highway network and its effect on the country's economic development.

During the construction of the road project the company has different performance related problems such as time management problem, financial related problems, quality related problems, human resource management problems, and so on. Over the last fourteen years the performance was improved time to time, but still there is a big gap for improvement. [ERA, 2014]

The failure of any construction project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such problem.

Performance is the degree to which an operation fulfills primary measures (performance objectives) in order to meet the needs of customers (Salaheldin, 2009). The performance objectives will be measured by using performance measurements. Performance measurement is an ongoing process of ascertaining how well, or how poorly, a government program is being provided. It involves the continuous collection of data on progress made towards achieving the program's pre-established objectives. (OECD, 2014)

Any effective performance measurement can be undertaken after developing an objective and consistent measurable criteria and these measurable criteria can be classified as a key

performance indicator (KPI). According to Saleh Samir, Key performance indicators (KPIs) include factors such as time, cost, quality, client satisfaction; client changes, business performance, safety and health in order to enable measurement of current organizational project performance and to achieve significant performance improvements of future projects.

Project time and cost performance are the most important indicator of project success. Many researchers have mentioned factors which affect this time and cost performance in construction projects. (Aftab, 2011) identified in his study, design changes/change order, delay in progress payment, ineffective planning and scheduling of project, poor site management and supervision, Shortage of labours and Difficulties in financing project by contractor as design changes by owner or agent during construction, late delivery of materials, unreliable subcontractors, delay in performing inspection and testing, unqualified/inexperienced workers, change orders, delay in site delivery, delay in approving design documents, delay in progress payments, slowness in decision making, poor communication and coordination, Poor site management, Unforeseen ground condition, Low speed of decision making, Client-initiated variation and Necessary variations of works were found as the most critical factors responsible for this time overrun.

According to Frimpong (2003), improper planning and management experience limitation causes cost overrun. Poor site supervision and management and poor project management assistance contribute to the problem of cost overrun in construction projects. Poor site management reflects the weakness and incompetency of contractors. Skills and experience human resource is insufficient in site management (Long, 2008).

Time and Cost overruns have obvious impact for the key stakeholders in particular, and in the construction industry in general.

The impact of time and cost performance are not confined to the contractor, but it has also a significant impact on the construction industry in such a way that the contractor and the consultant will loss reputation, negative attitude towards the construction industry by the higher public authority, discourage investment, dissatisfaction by project owners, loss of benefit to road users they get from the project, additional cost, increase political pressure and adversarial relationship between the stakeholders.

In Ethiopian context the problem of local contractors time and cost performance can nearly be noticed in federal road construction projects. This indicates that this problem didn't receive enough attentionby both researchers and responsible authorities. Even if few researches are made on project performance management in Ethiopia, these researches are focused mainly on performance of contractors. Hence, most of the local contractors have failed to complete projects with better time and cost performance. Since local contractors' performance have a significant impact on road construction industry. By taking this in toconsideration this thesis mainly focus on cause and impact of local contractors' time and cost performance in ERA projects.

# CHAPTER THREE

# RESEARCH DESIGN AND METHODOLOGY

## 3.1 Introduction

This section describes the procedures undertaken to achieve the research objectives. The procedures adopted, including all the information relevant to the data collection and where those data were obtained are discussed. In addition, data and information sources, research instruments, sample size and method of analysis are presented. The succeeding section provides a general description of the strategy adopted for the research, as well as justification of the methodology.

## 3.1 Research Design

The strategy followed in carrying out the research was started with problem identification which has been done through unstructured literature review, archival study and informal discussion with colleagues and professionals in the sector; and then the research design was formulated.

Following this data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided; and available documentary sources relevant to the research were reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress and completion reports within Ethiopian Roads Authority− the implementing agency of the road sector development program in Ethiopia.

In consideration of the nature of the research question, qualitative research method is selected for this study as the research questions relates to the personal attitude, opinion and view. The research was carried out using a three phased approach in order to achieve the aims and objectives of the research. It was attempted to collect data from the relevant population (Employer−ERA, consulting firms, and contractors) to evaluate the perception of the different stakeholders in regard to local contractor time and cost performance. Project cost and time overrun variables −causes leading to poor time and cost performance have been ranked, cost and time overrun and their impact on the construction industry is evaluated.

After a literature in-depth review and desk study, a questionnaire was designed and distributed to contractors, consultants and the employers (ERA) to get their professional opinion based on their experience.

The case study was mainly intended to collect values of cost and time overrun and quantitative research method is selected to show their degree of appearance. Causes of poor time and cost performance from some projects which was completed during RSDP I, II, III and IV has randomly selected focusing on projects with higher cost and time overrun values for further investigation ─to identify important cost and time overrun variables.

## 3.2 Sources of Data and Research Instruments

Research instruments were used for the collection of relevant information. To identify and rank the major causes leading to poor performance (cost and time overrun) and its consequential Impacts in Road construction projects in Ethiopia, a desk study approach and questionnaire survey were carried out.

The desk study was mainly carried out to obtain actual data from the source documents which included the contract documents, supplementary agreements, variation orders and progress as well as completion reports to have contextual bases on time and cost overrun in the road sector development program and assess the extent of the problem. The other instrument employed was to solicit professional opinion and relevant data through questionnaires.

Through the literature review, key performance indicator, performance management, potential factors that lead to poor performance, emphasis on cost and time overrun, the impacts of contractors' performance and managing project cost and time were identified. The review provided the basis to design the questionnaire which was distributed to professionals involved in the road sector program.

The developed questionnaires were to address the research objectives having three main parts in order of sequence as follows:

(a) The first set of questions was to categorize respondents to different parties in the road construction industry. That is to classify them under the role of client, consultants and contractor.

The purpose was to determine the answers they provide based on the role they play in the construction sector.

(b) Background information – collecting the personal data of respondents, their experience in the road construction industry.

(c) General perception on performance of local contractors. The set of questions under the section was to ask respondents about the following:

- Causes of local contractors' poor time and cost performance
- Impacts of local contractors' performance in the construction industry.
- How to enhance local contractor performance, the significance of encouraging local contractors' involvement in the construction industry and the roles of major stakeholders in the improving local contractors' performance.

For the questionnaire survey the respondents were randomly selected from the employer's organization (ERA), contractors, consultants and construction professionals who have been involved in the road sector development program. The questionnaire which consists of both open and closed ended questions was distributed among these professionals.

## 3.3 Research Population and Sampling

The research population was drawn from three agencies which are participating in federal road construction projects− owner (ERA), contractors, and consulting firms. As much as possible attempts have been made so that the samples drawn from the population are representatives. Professionals include those reputed experts engaged in the construction industry and were involved in road construction projects in the near past and are currently working out of the three agencies. The contractors included were all Category 1 and were either General Contractors (GC) or Road Contractors (RC). The list of contractors and consultants currently involved in road construction projects was obtained from the Ethiopian Roads Authority (ERA).

The respondents included in the survey comprised of a total of 54 professionals: 24 from owner, 12 from contractors and 18 from consulting offices. The numbers were determined on the basis of the time available for conducting the research work, available funding for the study and the reliability of the respondents.

### 3.4 Sample Size Distributions

Sampling as the process of selecting representative units of the population for the study in research investigation. A sample is a small portion of a population selected for observation & analysis.

Statistical equations were used in order to calculate the sample size for contractors and consultants. Equation 3.1 was used to determine the sample size of the unlimited population.

$$SS = \frac{Z^2 * P * (1-P)}{C^2} \quad \text{[Eq. 3.1]}$$

Where:

SS= Sample Size

Z = Z value (e.g. 1.96 for 95% confidence level)

P= Percentage picking a choice as a decimal (0.5 used for sample size needed)

C = Margin of Error (9%)

$$SS = \frac{1.96^2 \text{x} 0.5 \text{x}\ 1-0.5}{0.09^2} = 118.57 \approx 119$$

Correction for Finite Population

$$SSnew = \frac{SS}{1+\frac{SS-1}{POP}} \quad \text{[Eq. 3.2]}$$

Where POP is the population of the consutant, which is 34 matches,which are involved only in construction supervision of the last five years are considered.

$$SSnew = \frac{119}{1+\frac{119-1}{34}} = 26.16 \approx 26$$

The total population for contractors is 20. For the reason that the proposed classes of construction for this study is only GC-1 or RC-1 contractors. Furthermore, the study has made on contractors which are involved in construction works on the previous last five years are considered.

SSnew (contractors)=20

However, because of the total population is small the quetionner had been distributed to all contractors.

Since the client is ERA no need of calculation for sample size. I simply distribute the questionnaires for 30 engineers whom are working on contract administration and directorate level in all contract administration regional directorate.

The variables were determined on the basis of the time available for conducting the research work, available fund for the study (project), and the reliability of the respondents. The respondents included in the survey comprised of 24 from owner, 12 from contractors, and 18from consulting offices.

## 3.5 Method of Analysis

Finally, the results of the questionnaires were analyzed using statistical techniques and the results used to form the basis for recommendations as well as areas for further research. The methods of analysis used in analyzing the data were: Importance Index (RII). This was followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

The statistical techniques is a method of analysis which provides a general overview of results. Frequency distribution, which shows the frequency of observation of each response to each variable under investigation, is used to analyze the result of some questions.

In the analysis the important index method is adopted to establish the relative importance of the causes and impacts of poor time and cost performance of local contractors in ERA's projects. Rating scale is one of the most common formats for questioning respondents on their views or opinions of an event or attribute. In this regard, participants were asked to indicate the importance or level of agreement of factors (research variables) by rating them on a five point scale, (0-No Opinion, 1-Strongly Disagree, 2-Disagree, 3-Agree and 4-Strongly Agree) and it is used to calculate the importance index for each factor that is used to determine the relative ranking. Each of the factors has been assigned an importance index or severity index, to help rank them according to their importance.

The Important index for each variables of poor time and cost performance and their impact in the construction industry is computed by using the following formula;

$$\text{Importance index} = \frac{(\Sigma i=0\ Wi \times fxi)\ x100}{3n} \quad \text{.....[Eq. 3.3]}$$

Where;

Wi = weight given to ith response; i = 0, 1, 2, 3

fxi = Responses frequency

n = total No of responses (54 responses)

### 3.6 Data coding

While analyzing the questioner and the case study the author has coded factors (research variables. The coding is according the sequential arrengment on the quetionner. For Example; A1 represents, causing factor which is employer related, delays in decision making, B1 represents, causing factor which is consultant related, mistakes and Errors in design and so on.Therefore, A represents employer related causing factors, B represents consultant related causing factors, C represents contractor related causing factors, D represents external causing factors and I represents impacts of local contractor performance. Further more, in the case study project specific name had been represented by project ID; Proect I, II, III, IV, V and Project IV.

# CHAPTER FOUR

# ANALYSIS AND DISCUSSION OF RESULTS

## 4.1 Introduction

This chapter provides explanations fordata collection such as distribution of the questionnaire, collection of responses and subsequent analysis of the data acquired through the responses from professionals who are working for the client, consultants and contractors and involved in road construction sector in Ethiopia.

The principal purpose is to identify the major causes of local contractors low performance and impacts of their performance, cost and time overrun, in the construction industry and to find out the way how to enhance the performance of these local contractors.

A questionnaire survey has been conducted to gather the required information from professionals who have been involved in the road construction sector in Ethiopia working on behalf of a client, consultant or contractor; towards answering the basic research question.

A total of 76 questionnaires was sent to the selected sample of respondents which comprise of 30 from the client (ERA), 26 form consultants and from 20 contractors. A sample of the questionnaires is attached in Appendix 5. The questionnaires were also sent to stakeholders in the road construction industry that are considered to have direct relation to the objectives of the research.

## 4.2 Analysis of Questionnaire Response

A total of 76 questionnaires was sent to the three groups of respondents in the road construction industry. Out of 76 questionnaires, 54 questionnaires were collected which comprises 24 from client (ERA), 18 from consultants and 12 from contractors. This gives a response rate of 71% as shown in Table 4.1 below the breakdown of responses from the various sample groups.

### 4.2.1 The Client (ERA)

A total of 30 questionnaires were sent out to the client (ERA) to its various departments that are involved in road construction contract administration including the Design and Build

Directorateout of which 24 questionnaires were collected. This represents 80% of the total number of questionnaires sent out to the client.

### 4.2.2 The Consultants

Out of the total 25 questionnaires sent out to the consultants; 18 questionnaires were received and considered valid for analysis. This represents 72% of the total number of questionnaires sent out to the consultants.

### 4.2.3 The Contractors

Out of a total of the 20 questionnaires sent out to grade one local contractor, 12 questionnaires, which represents 60% were returned and found to be valid.

An overall response rate of 71% was achieved. This is significant for the purpose of validating the research results. The respondents were generally slow in responding to the questionnaires, but all were compiled within a reasonable time space. Table 4.1 shows summary of overall survey response levels;

Table 4.1 Summary of overall survey response level

| Group | Questionnaire Distributed | Questionnaire Returned | Percentage Returned (%) |
|---|---|---|---|
| Client(ERA) | 30 | 24 | 80 |
| Consultants | 26 | 18 | 69 |
| Contractors | 20 | 12 | 60 |
| **Total** | **76** | **54** | **71** |

## 4.3 Analysis and Discussion of Results

In this section, analysis of respondents' understanding and views on construction local contractor performance cause and impact have been considered and discussed. The responses of the various contract groups to the questionnaire (Appendix A) were analyzed and discussed in subsequent sections.

### 4.3.1. Respondents Academic Background

The purpose of section one was to know the educational and professional capability of respondents to undertake the work. The questionnaire was to be completed by respondents who

were involved in construction works, in contract administration, preparation of design document and supervision of the site work.

The survey result shows that 15 percent of the respondents have MSc. Educational qualification and the rest 85 percent BSc. DegreeEducational qualification as shown in the figure below.

The percentage distribution of the various professionals indicates that the majority of the questionnaires was completed directly by professionals involved in the road construction industry. The survey also shows that it was well represented by better qualified professionals in the construction management and these groups of respondents are expected to have plenty of knowledge on the subject matter.

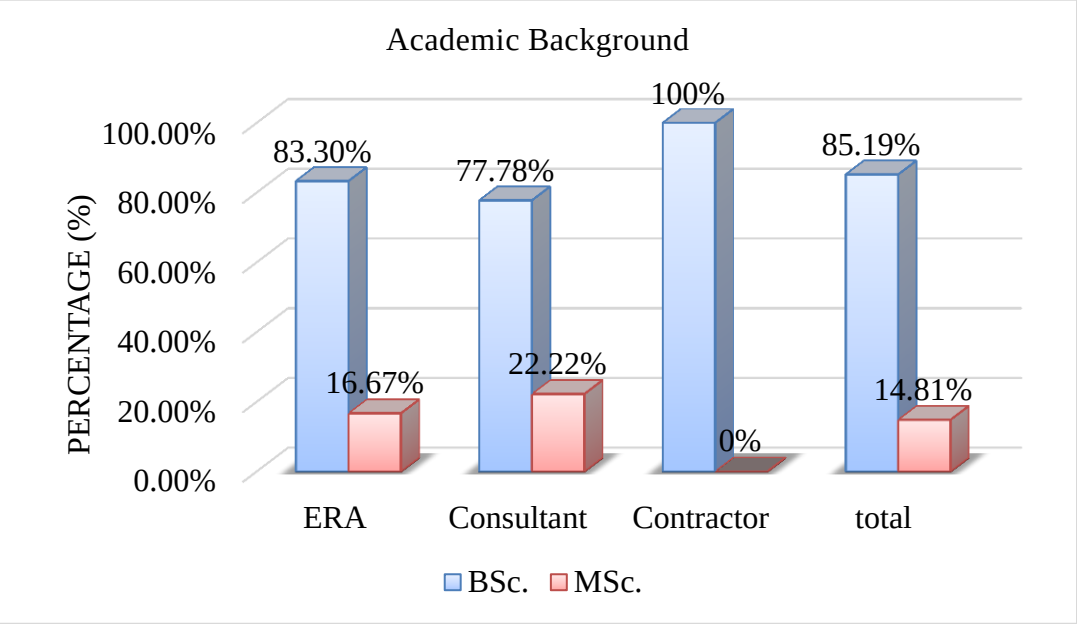


Figure 4.1. Academic background of respondents

### 4.3.2. Experience of Respondents and Their Company

Out of the 24 respondents on the client side 37.5% of the respondents had less than 5 years of working experience, 45. 8% had 5 to 10 years of experience, 4.2% had 10 to 15 years of experience and 12.5% had more than 15 years of experience.

Out of the 18 respondents by the consultant 16.7% of the respondents had less 5 years of working experience, 72.2% had 5 to 10 years of experience and 11.1% had 10 to 15 years of experience.

Out of the 12 respondents by the contractor 16.7% of the respondents had less 5 years of working experience, 16.7% had 5 to 10 years of experience, 16.7% had 10 to 15 years of experience and 50% had more than 15 years of experience.

Furthermore, 26% the survey participant companies have an experience of more than 10 years. In addition, the data show that the respondents have quite a reasonable working experience in the construction industry, considering 48% of respondents with 5 to 10 years working experience and the rest 26% have five and less years of working experience.

### 4.3.3. Local Contractor Performance in Road Projects under ERA

The respondents were asked on local contractor performance on road projects administered by ERA. The survey result indicates that no respondent has agreed on the good performance of local contractors. However, 54.2% of the respondent have indicated the project performed by local contractor as poor and the rest 45.8% of the respondent graded as fair in its performance.

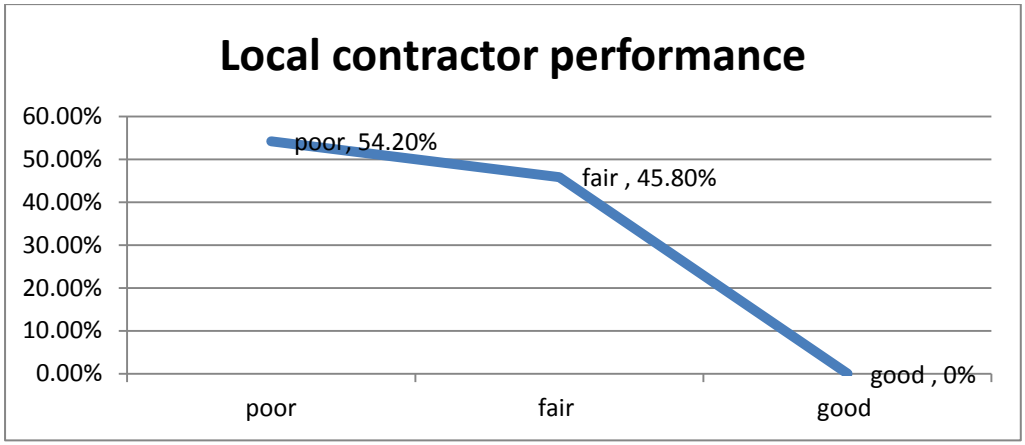


Figure 4.2 Local contractors' performance in road projects under ERA

The above graph shows that most of road projects administered by ERA and which are executed by local contractors are poorly performed.

### 4.3.4. Causes of Poor Time and Cost Performance

#### *4.3.4.1.Causes of Cost Overrun*

Tables 4.2, 4.3, 4.4 and 4.5 show that responses by client, consultants and contractors on major causes of local contractors' poor cost performance on the implemented road construction projects. These factors were ranked accordingly.

The survey shows that Change in the scope of the project, Right of way problem and Delays in decision making as the number one Employer related cause of local contractors' poor cost performance from the client, consultant and contractor's perspective respectively.

As indicatedin the table 4.2 below change in the scope of the project or variation order is ranked as themost significant employer related caue by the employer side. right of way problem and practice of assigning contract to the lowest bidder are the next ranked employer related caue by the employer side. Furthermore, theresponse form the consultant side has also similar with that of the client andthey have ranked right of way problem and practice of assigning contract to the lowest bidder as the top two once and the third ranked is change in the scope of the project or variation order.

However, the respondant from the contractor side has mentioned that practice of assigning contract to the lowest bidder by the client or employer as the top most causing factor for poor cost performance and Delays in decision making and change in the scope of the project or variation order as next ranked causes for poor cost performance.

The result from those three stakeholders shows that change in the scope of the project or variation order and practice of assigning contract to the lowest bidder by the employer are the most significant employer related factors which affects cost performance of local cotractos performance.

Table 4.2 Employer's related causes of local contractors' poor cost performance

| It. No. | Employer's related Major causes of poor cost performance or cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Delays in decision making | A1 | 2.67 | 5 | 3.28 | 4 | 3.67 | 1 |
| 2. | Change management ways | A2 | 2.08 | 9 | 2.28 | 8 | 2.92 | 7 |
| 3. | Change in the scope of the project/Variation order | A3 | 3.25 | 1 | 3.39 | 3 | 3.33 | 2 |

| It. No. | Employer's related Major causes of poor cost performance or cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 4. | High competition in bids | A4 | 1.58 | 10 | 2.28 | 8 | 2.75 | 9 |
| 5. | Delay in progress payment by owner | A5 | 2.38 | 6 | 2.78 | 5 | 3.17 | 4 |
| 6. | The practice of assigning contract to the lowest bidder | A6 | 3.04 | 3 | 3.44 | 2 | 3.33 | 2 |
| 7. | Poor coordination and communication between construction parties | A7 | 2.75 | 4 | 2.33 | 7 | 3 | 5 |
| 8. | Incompetence in contract administration | A8 | 2.38 | 6 | 2.5 | 6 | 2.67 | 10 |
| 9. | Financial difficulties of owner | A9 | 2.21 | 8 | 2.06 | 10 | 2.83 | 8 |
| 10. | Right of way problem | A10 | 3.08 | 2 | 3.61 | 1 | 3 | 5 |

As shown in the table 4.3 below, Unrealistic contract cost estimate and Mistakes and Errors in design was ranked no. 1 from the consultant, client and contractor's perspective respectively by respondents as consultant related major cause of local contractors' poor cost performance/cost overrun.

Furthermore, the responses from the contractor side shows that mistakes and errors at design stage, frequent design change and incompetent designers/ incapable inspectors/ inadequate experience are the top three causing factors for poor cost performance.

The responsese from the client, ERA, side are likely the same with the contractor which are mistakes and errors at design stage, frequent design change and inaproprate design are the top most commen factor for poor cost performance and those causing factors are related to the design consultant.

Hence, the consultant's response shows that unrealistic contract cost estimate as the most causing factor for poor cost performance and mistakes and errors at design stage and inaproprate design will follows the rank among the others.

Table 4.3 Consultant related causes of local contractors' poor cost performance

| It. No. | Major causes of cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Mistakes and Errors in design | B1 | 3.33 | 1 | 3.5 | 2 | 3.83 | 1 |

| It. No. | Major causes of cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 2. | Frequent design change | B2 | 3.04 | 2 | 3.33 | 4 | 3.67 | 2 |
| 3. | Inappropriate design | B3 | 3 | 3 | 3.44 | 3 | 2.75 | 9 |
| 4. | Incomplete design at the time of tender | B4 | 2.63 | 6 | 2.5 | 9 | 3.33 | 5 |
| 5. | Incompetent designers/incapable inspectors/ Inadequate experience | B5 | 2.88 | 4 | 3.11 | 6 | 3.58 | 3 |
| 6. | Unrealistic contract cost estimate | B6 | 2.83 | 5 | 3.72 | 1 | 3.42 | 4 |
| 7. | Late inspection/ poor supervision | B7 | 2.63 | 6 | 3.17 | 5 | 3.25 | 6 |
| 8. | Delay, Preparation and approval of drawings | B8 | 2.54 | 8 | 2.61 | 8 | 3 | 7 |
| 9. | Delay in inspection and approval of completed works | B9 | 2.33 | 9 | 2.89 | 7 | 2.83 | 8 |

As indicated in the table 4.4 below, the responses from the client, Era, shows that poor financial management and poor financial management by the contractor as the most causing factor for poor cost performance. The responses from the contractor side has ranked poor project management system, poor financial management and inadequate planning and scheduling as top causing factors which is most likely the same wih responses fron the consultant side.

Generally, the survey shows that poor financial management system, inadequate planning and scheduling and poor project management system as the major contractor related causes of local contractors' poor cost performance from the client, consultant and contractor's perspective respectively as shown in the table below.

Table 4.4 Contractor related causes of local contractors' poor cost performance

| It. No. | Major causes of poor cost performance or cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Inadequate planning and scheduling | C1 | 3.33 | 3 | 3.78 | 1 | 3.75 | 2 |
| 2. | Insufficient skilled and experienced labors | C2 | 2.83 | 12 | 3.44 | 5 | 3.5 | 8 |
| 3. | Poor project management system | C3 | 3.33 | 3 | 3.72 | 2 | 3.83 | 1 |

| It. No. | Major causes of poor cost performance or cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 4. | Labour productivity/poor workmanship | C4 | 2.71 | 13 | 3.11 | 11 | 3.58 | 5 |
| 5. | Insufficient Numbers of equipment and labour | C5 | 3 | 9 | 3.17 | 8 | 3.25 | 11 |
| 6. | lack of equipment efficiency | C6 | 3 | 9 | 3.39 | 6 | 3.33 | 10 |
| 7. | Poor site management and supervision | C7 | 3.33 | 3 | 3.5 | 4 | 3.67 | 4 |
| 8. | Construction material/Equipment unavailability and failure | C8 | 2.54 | 16 | 3.22 | 7 | 3.25 | 11 |
| 9. | Rework from poor material quality | C9 | 2.67 | 14 | 3 | 15 | 3.25 | 11 |
| 10. | Obsolete and improper construction method | C10 | 2.54 | 16 | 3.11 | 11 | 2.92 | 16 |
| 11. | Rework due to error in construction | C11 | 2.67 | 14 | 3.17 | 8 | 3.25 | 11 |
| 12. | Problems with subcontractors | C12 | 1.96 | 18 | 1.67 | 18 | 2.83 | 17 |
| 13. | Inadequate contractor experience/ Lack of experience | C13 | 2.96 | 11 | 2.33 | 17 | 2.75 | 18 |
| 14. | Unrealistic project cost frame | C14 | 3.08 | 7 | 3.06 | 14 | 3.17 | 15 |
| 15. | Poor resource management | C15 | 3.38 | 1 | 3.56 | 3 | 3.58 | 5 |
| 16. | Late delivery of materials and equipment | C16 | 3.08 | 7 | 2.72 | 16 | 3.5 | 8 |
| 17. | Cash flow and financial difficulties faced by contractors | C17 | 3.29 | 6 | 3.17 | 8 | 3.58 | 5 |
| 18. | Poor financial management system | C18 | 3.38 | 1 | 3.11 | 11 | 3.75 | 2 |

The responses from the client, ERA, has indicate that fluctuation in material price/escalation of material prices, inflation and unforeseen ground as he top three external causing factor for poor cost performance. Hence, the consultant has ranked unforeseen ground, adverse weather condition, natural disaster as the top most causing factors. As of the client, the contractor has ranked material price/escalation of material prices and unforeseen ground as the top two and acts of God as next ranked causes for local contractors poor cost performance.

In general, fluctuation in material price/escalation of material prices and unforeseen ground condition as the major causes of local contractors' poor cost performance with respect to external factors as shown in the table below. However, the consultant has ranked natural disaster as third

most causing factor for poor cost performance, which is to be occurred less in our country history.

Table 4.5 External factors cause of local contractors' poor cost performance

| It. No. | External factors that cause of cost overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Adverse Weather condition | D1 | 2.63 | 4 | 2.94 | 2 | 2.33 | 5 |
| 2. | Unforeseen ground condition | D2 | 2.71 | 3 | 3.11 | 1 | 2.92 | 2 |
| 3. | Natural disaster | D3 | 2.04 | 8 | 2.83 | 3 | 2.25 | 6 |
| 4. | Fluctuation in material price/ Escalation of material prices | D4 | 2.92 | 1 | 2.72 | 5 | 3 | 1 |
| 5. | Inflation | D5 | 2.88 | 2 | 2.5 | 6 | 2.5 | 4 |
| 6. | Accidents during construction | D6 | 1.63 | 10 | 1.67 | 11 | 1.33 | 11 |
| 7. | Laws and Regulatory Framework | D7 | 2.08 | 7 | 1.61 | 12 | 1.33 | 11 |
| 8. | Fraudulent practices and kickbacks | D8 | 2.13 | 5 | 2.80 | 4 | 2.25 | 6 |
| 9. | Acts of GOD | D9 | 1.42 | 12 | 2.5 | 6 | 2.83 | 3 |
| 10. | High interest rate charge by bank | D10 | 1.54 | 11 | 1.89 | 10 | 1.67 | 10 |
| 11. | Exchange rate fluctuation | D11 | 2.13 | 5 | 2.22 | 8 | 2.25 | 6 |
| 12. | Changing of bankers' policy for loans | D12 | 1.96 | 9 | 2.17 | 9 | 2.25 | 6 |

#### *4.3.4.2.Causes of Time Overrun*

Tables 4.6, 4.7, 4.8 and 4.9 show responses by client (ERA), consultants and contractors, major causes of poor time performance or time overrun with the implemented ERA's road construction projects.

As shown below in the survey data right of way problem, incompetence in contract administration and delays in decision making by the employer as the number one cause of poor time performance.

Additionally, the employer has ranked right of way problem as no one employer related cause of poor time performance. The consultant and the contractor has ranked the same as the second top cause. The practice of assigning lowest bidder and incomptance in contract administration and/or delay in decision making by the employer are ranked the top most causes by the consultant and contactor respectively.

Table 4.6 Employer's related causes of poor time performance/time overrun

| It. No. | Employer's related Causes of time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Delays in decision making | A1 | 2.92 | 4 | 3.17 | 4 | 3.83 | 1 |
| 2. | Change management ways | A2 | 2.42 | 9 | 2.11 | 9 | 3.33 | 6 |
| 3. | Change in the scope of the project/variation order | A3 | 3.29 | 2 | 3.11 | 5 | 3.5 | 4 |
| 4. | High competition in bids | A4 | 1.54 | 10 | 1.78 | 10 | 2.75 | 10 |
| 5. | Delay in progress payment by owner | A5 | 2.63 | 6 | 3.39 | 2 | 3.25 | 7 |
| 6. | The practice of assigning contract to the lowest bidder | A6 | 3.17 | 3 | 3.67 | 1 | 3.5 | 4 |
| 7. | Poor coordination and communication between construction parties | A7 | 2.88 | 5 | 2.56 | 6 | 3.39 | 4 |
| 8. | Incompetence in contract administration | A8 | 2.5 | 8 | 2.33 | 7 | 2 | 1 |
| 9. | Financial difficulties of owner | A9 | 2.54 | 7 | 2.17 | 8 | 3.08 | 8 |
| 10. | Right of way problem | A10 | 3.71 | 1 | 3.39 | 2 | 3.67 | 2 |

As shown in the table 4.7 below the respondants from the client side and contractor have mentioned that mistakes and errors in design as the most significant consultant related factor that affect local contractors time performance. Hence, incompetent designer and unrealistic contract duration and requirements are also the most significant factors from the contractor's perspective. The responses from the consultant indicates that unrealistic contract duration and requirements as the most significant consultant related factor for local contractors poor time performance.

Generally, mistakes and errors in design, incompetent designers, unrealistic contract duration and late inspection or poor supervision as the major consultant related causes of local contractors' poor time performance or time overrun from the client, consultant and contractor's perspective respectively.

Table 4.7 Consultant related causes of poor time performance/time overrun

| It. No. | Consultant related Major causes of time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Mistakes and Errors in design | B1 | 3.17 | 1 | 1.28 | 3 | 3.83 | 1 |

| It. No. | Consultant related Major causes of time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 2. | Frequent design change | B2 | 3 | 3 | 1.26 | 4 | 3.75 | 4 |
| 3. | Inappropriate design | B3 | 2.83 | 5 | 1.24 | 5 | 3.17 | 9 |
| 4. | Incomplete design at the time of tender | B4 | 2.54 | 9 | 0.94 | 9 | 3.42 | 8 |
| 5. | Incompetent designers/incapable inspectors/ Inadequate experience | B5 | 2.67 | 7 | 1.16 | 8 | 3.83 | 1 |
| 6. | Unrealistic contract duration and requirements | B6 | 3.08 | 2 | 1.31 | 1 | 3.83 | 1 |
| 7. | Late inspection/ poor supervision | B7 | 2.83 | 5 | 1.30 | 2 | 3.67 | 5 |
| 8. | Delay, Preparation and approval of drawings | B8 | 2.88 | 4 | 1.22 | 7 | 3.67 | 5 |
| 9. | Delay in inspection and approval of completed works | B9 | 2.67 | 7 | 1.22 | 6 | 3.67 | 5 |

As indicated in the table 4.8 below the consultant has ranked inadequate planning and scheduling, poor project management system and lack of equipment efficiency as the top three contractor related factors that affect time performance of local contractors. The response from the client side, ERA, indected that cash flow and financial difficulties faced by contractors has significant factor which affects time performance of local contractors. As of the consultant the respondants from the contractor side inadequate planning and scheduling has ranked as the most significant contractor related factor among the others.

Table 4.8 Contractor related causes of time overrun

| It. No. | Contractor related Causes of time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Inadequate planning and scheduling | C1 | 3.54 | 2 | 1.36 | 1 | 3.92 | 1 |
| 2. | Insufficient skilled and experienced labors | C2 | 3.13 | 9 | 1.2 | 7 | 3.67 | 6 |
| 3. | Poor project management system | C3 | 3.54 | 2 | 1.34 | 2 | 3.83 | 2 |

| It. No. | Contractor related Causes of time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 4. | Labour productivity/poor workmanship | C4 | 2.92 | 12 | 1.1 | 14 | 3.67 | 6 |
| 5. | Insufficient Numbers of equipment and labour | C5 | 3.38 | 5 | 1.28 | 4 | 3.58 | 8 |
| 6. | Lack of equipment efficiency | C6 | 3.38 | 5 | 1.3 | 3 | 3.58 | 8 |
| 7. | Poor site management and supervision | C7 | 3.42 | 4 | 1.24 | 5 | 3.83 | 2 |
| 8. | Construction material/Equipment unavailability and failure | C8 | 2.67 | 16 | 1.22 | 6 | 3.33 | 12 |
| 9. | Rework from poor material quality | C9 | 2.71 | 15 | 1.16 | 9 | 3.08 | 14 |
| 10. | Obsolete and improper construction method | C10 | 2.63 | 17 | 1.14 | 10 | 3.08 | 14 |
| 11. | Rework due to error in construction | C11 | 2.92 | 12 | 1.12 | 13 | 3.25 | 13 |
| 12. | Problems with subcontractors | C12 | 2.04 | 18 | 0.8 | 18 | 2.92 | 16 |
| 13. | Inadequate contractor experience/ Lack of experience | C13 | 3.08 | 10 | 1.1 | 14 | 2.92 | 16 |
| 14. | Unrealistic project cost frame | C14 | 2.83 | 14 | 1 | 17 | 2.75 | 18 |
| 15. | Poor resource management | C15 | 3.38 | 5 | 1.2 | 7 | 3.83 | 2 |
| 16. | Late delivery of materials and equipment | C16 | 3.38 | 5 | 1.14 | 10 | 3.75 | 5 |
| 17. | Cash flow and financial difficulties faced by contractors | C17 | 3.63 | 1 | 1.14 | 10 | 3.58 | 8 |
| 18. | Poor financial management system | C18 | 3 | 11 | 1.06 | 16 | 3.5 | 11 |

The survey shows that adverse weather condition, unforeseen ground condition and fluctuation in material price as the top three external causing factor for poor time performance from ERA's perspective. The consultant has also ranked adverse weather condition, unforeseen ground condition and natural disaster as the top most causing factors. The contractor has ranked unforeseen ground condition and acts of God as the top external factors that affects local contractors time performance.

In general, adverse weather condition, unforeseen ground condition as the major causes of local contractors' poor cost performance with respect to external factors as shown in the table below.

Table 4.9 External factors causing time overrun

| It. No. | External factors that causing time overrun | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|---|
| | | | II | Rank | II | Rank | II | Rank |
| 1. | Adverse Weather condition | D1 | 3.29 | 1 | 1.16 | 1 | 2.75 | 4 |
| 2. | Unforeseen ground condition | D2 | 2.83 | 2 | 1.14 | 2 | 3.17 | 1 |
| 3. | Natural disaster | D3 | 2.04 | 4 | 1.12 | 3 | 2.5 | 5 |
| 4. | Fluctuation in material price/ Escalation of material prices | D4 | 2.5 | 3 | 0.94 | 4 | 3.08 | 3 |
| 5. | Inflation | D5 | 1.79 | 8 | 0.72 | 10 | 2.08 | 7 |
| 6. | Accidents during construction | D6 | 1.88 | 6 | 0.54 | 12 | 1.42 | 11 |
| 7. | Laws and Regulatory Framework | D7 | 1.83 | 7 | 0.8 | 7 | 1.42 | 11 |
| 8. | Fraudulent practices and kickbacks | D8 | 1.92 | 5 | 0.88 | 5 | 2.42 | 6 |
| 9. | Acts of GOD | D9 | 1.54 | 11 | 0.76 | 9 | 3.17 | 1 |
| 10. | High interest rate charge by bank | D10 | 1.58 | 10 | 0.66 | 11 | 1.5 | 10 |
| 11. | Exchange rate fluctuation | D11 | 1.63 | 9 | 0.8 | 7 | 1.67 | 9 |
| 12. | Changing of bankers' policy for loans | D12 | 1.54 | 11 | 0.82 | 6 | 2.08 | 7 |

### 4.3.5. Additional Contributing Factors for Cost and Time Overrun

Additional contributing factors for cost and time overrun presented by the respondent from the respondent are discussed as follows;

Contributing factors for poor tme performance/time overrun

- Time given for design and tender document preparation is not sufficient to prepare quality documents lack of sound communication, between the owner of the company and the project manager, between the assigned project manager and the staff (both skilled and unskilled workers)
- Lack of regular site meeting by the Employer and site visit which focus on construction activities causes a cost overrun.

- Lack of in-depth review of the contractor's method of the statement by the consultant and give comments on the statements which cause cost overrun and follow up the proper implementation of the same during construction.
- Poor allocation of human resource
- Complexity of project
- Delay in supply of materials, especially imported materials
- Frequent turnover of staff
- Lack of innovative construction techniques
- Lack of transparency and modernized bidding system
- The lack of updated data base systemswithin the employer to be used as a basis for their improvement

Contributing factors for poor cost performance/cost overruns

- Knowledge and experience of local contractors in pan, organizing and coordinating all the resources don't meet the industry's requirement.
- Use of construction budget for another investment
- Interference of local community for the design improvement
- Not implementing contractual obligation and rights properly/ usually work in an unprofessional way
- Lack of organizational structure to properly manage local contractors (no system)

### 4.3.6. Impact of Local Contractor Performance in Road Construction Industry

Tables 4.10 show thatthe responses by client, consultants and contractors on the impacts of local contractor in the construction industry.

The survey shows that discouraging investment in road construction projects by government and eroding mutual trust and respectbetween the major parties involved in the construction process are the main impact of local contractors' poor performance.

Table 4.10 Impact of local contractor performance in road construction industry

| Impact of local contractor performance | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|
| | | II | Rank | II | Rank | II | Rank |
| Loss of confidence and loss of reputation of the employer | I1 | 2.54 | 13 | 2.44 | 13 | 2.42 | 12 |

| Impact of local contractor performance | Code | ERA | | Consultant | | Contractor | |
|---|---|---|---|---|---|---|---|
| | | II | Rank | II | Rank | II | Rank |
| Influence to meet, plan and program objectives of the stakeholders, especially the government. | I2 | 2.79 | 8 | 2.61 | 10 | 2.17 | 13 |
| Made the employer for additional cost and loss its investment return money lately | I3 | 2.54 | 13 | 2.22 | 15 | 2.17 | 13 |
| Loss of benefit to road users they get from the project | I4 | 2.75 | 9 | 2.72 | 8 | 2.67 | 6 |
| Additional cost on the contractor to keep its resources on the project site for a prolonged period of time (Prolongation cost) | I5 | 2.92 | 7 | 2.67 | 9 | 2.58 | 7 |
| Liquidated damage cost | I6 | 2.5 | 15 | 2.56 | 11 | 2.17 | 13 |
| Lead to poor cash flow to the contractor and lowering contractor's capacity development | I7 | 2.75 | 9 | 3 | 5 | 2.58 | 7 |
| Adversarial relationship between participants of the project, | I8 | 2.96 | 5 | 2.33 | 14 | 2.5 | 10 |
| Dissatisfaction by project owners and consequently by road users/the public, | I9 | 2.67 | 11 | 2.56 | 11 | 2.5 | 10 |
| Increase political pressure/ instability, | I10 | 2.67 | 11 | 2.89 | 7 | 2.58 | 7 |
| Impact on the overall development of the nation | I11 | 2.96 | 5 | 3.22 | 3 | 3 | 4 |
| Negative attitude towards the construction industry by the higher public authority and by the society as a whole, | I12 | 3.38 | 1 | 3.33 | 2 | 3 | 4 |
| The contribution of the construction industry to the growth of the national economy of the country will be less, | I13 | 3.17 | 4 | 3 | 5 | 3.08 | 3 |
| Weakens the growth of the construction industry by eroding mutual trust and respect, | I14 | 3.38 | 1 | 3.17 | 4 | 3.17 | 2 |
| Discourage investment in road construction projects by government | I15 | 3.29 | 3 | 3.39 | 1 | 3.25 | 1 |

### 4.3.7. The Significance of Encouraging Local Contractors' Involvement in the Road Construction Industry

The survey shows that significance of encouraging local contractor's involvement in the road construction industry as listed below;

- Creating job opportunity for professional/ skilled and unskilled manpower,
- Helps the employer to get a reasonable offer /Reduce construction cost
- Save hard currency/ Tide foreign currency
- Creates competent contractor in the construction industry/Builds capacity of local contractors
- Increase in gross domestic product (GDP) and contributes the overall development of the country which have a multiplier effect on the economy of the country
- To ensure self-sustained development of the country

## 4.4 Agreement Analysis (Concordance Test)

Kendall (1955) presented a Coefficient of Concordance, W, to evaluate the extent of agreement among a set of judges each of who ranks in entirety a set of objects. Kendall test for concordance is used to measure the degree of agreement of the rank correlation between the respondents. The Kendall test for concordance, W, between the client, consultants and contractors was measured using the formula:

$W = 12S/m\ (m2 - 1),\ 0 \leq W \leq 1.0$ ……[Eq. 4.1]

Where,

$S = \sum_{i=1}^{n}(Ri - R)^2$…… [Eq. 4.2]

m =the number of causing factors for cost and time performance

R = average of the ranks assigned to the nth factor being ranked

Ri =the assigned rank by an individual judge to one factor

n = Number of Judges

Hence, for the causes of Cost overrun

m=49; n=3; R =24.71

$S=12x\ \sum_{i=1}^{n}(Ri - R)^2$

=115,749.37

m (m2 - 1)

= 49x ($49^2$–1)

= 117,600

Therefore; W=115,749.37/117,600

W=0.98

Hence, for the causes of time overrun

m=49; n=3; R =24.82

S=12x $\sum_{i=1}^{n}(Ri - R)^2$

=116,926.89

m (m2 - 1)

= 49x ($49^2$–1)

= 117,600

Therefore; W=116,926.89/117,600

W=0.99

Hence, for the Impact of local contractors poor time and cost performance

m=15; n=3; R =7.87

S=12x $\sum_{i=1}^{n}(Ri - R)^2$

=3,260.80

m (m2 - 1)

= 15x ($15^2$–1)

= 3,360.00

Therefore; W=3,260.80 /3,360.00

W=0.97

A coefficient of W=1 indicates a perfect agreement and zero indicates no agreement. Therefore, the value of the coefficient of concordance, W=0.98, W=0.99and W=0.97 from the above analysis indicates a high degree of agreement amongst the threegroups of respondents and the calculation is depicted in appendix C.

## 4.5 Major Causing Factors Identified

The best estimate for the true ranking of n variables according to Kendall is provided where W is significant by the order of various sums of ranks. That is evidenced by the magnitude and significance of W, therefore the best true ranking is provided by the mean of the ranks. This implies that the most important factor is the highest overall ranking one.

From the analysis, the top five causing factors which were related to the employer, consultant, contractor and external factors all the groups are shown in Table 4.11 below.

Table 4.11 Summary of Major causing factors of poor time and cost performance (Using the Kendall concordance test)

| Causes of poor time performance/ time overrun | Causes of poor cost performance/cost overrun |
|---|---|
| **Employer's related** | |
| Right of way problem | Variation order/ Change in the scope of the project |
| The practice of assigning contract to the lowest bidder | The practice of assigning contract to the lowest bidder |
| Change in the scope of the project/variation order | Right of way problem |
| Delays in decision making | Delays in decision making |
| Delay in progress payment by owner | Delay in progress payment by owner |
| **Consultant related** | |
| Mistakes and Errors in design | Mistakes and Errors in design |
| Unrealistic contract duration and requirements/ Inaccurate time and cost estimate | Frequent design change |
| Frequent design change | Unrealistic contract duration and requirements/ Inaccurate time and cost estimate |
| Late inspection/ poor supervision | Incompetent designers/incapable inspectors/ Inadequate experience |
| Delay, Preparation and approval of drawings | Inappropriate design |
| **Contractor related** | |
| Inadequate planning and scheduling | Inadequate planning and scheduling |

| Causes of poor time performance/ time overrun | Causes of poor cost performance/cost overrun |
|---|---|
| Poor project management system | Poor project management system |
| Poor site management and supervision | Poor resource management |
| Lack of equipment efficiency | Poor site management and supervision |
| Insufficient Numbers of equipment and labour | Poor financial management system |
| **External Factors** | |
| Adverse Weather condition | Unforeseen ground condition |
| Unforeseen ground condition | Fluctuation in material price/ Escalation of material prices |
| Fluctuation in material price/ Escalation of material prices | Adverse Weather condition |
| Natural disaster | Inflation |
| Fraudulent practices and kickbacks | Fraudulent practices and kickbacks |

Table 4.12 Impact of local contractors time and cost performance

(Using the Kendall concordance test)

| No. | Impacts of local contractors' performance |
|---|---|
| 1 | Discourage investment in road construction projects by government |
| 2 | Negative attitude towards the construction industry by the higher public authority and by the society as a whole, |
| 3 | Weakens the growth of the construction industry by eroding mutual trust and respect, |
| 4 | The contribution of the construction industry to the growth of the national economy of the country will be less, |
| 5 | Impact on the overall development of the nation |
| 6 | Lead to poor cash flow to the contractor and lowering contractor's capacity development |
| 7 | Additional cost on the contractor to keep its resources on the project site for a prolonged period of time (Prolongation cost) |
| 8 | Loss of benefit to road users they get from the project |
| 9 | Increase political pressure/ instability |
| 10 | Adversarial relationship between participants of the project |

Studying the relative importance indices and the ranks of the various factors across the groups, reveals that all the groups rank the various factors differently; with some level of agreement among the various groups. For example, the majority of the groups ranked Poor project management system by contractors first for cost overrun and Inadequate planning and scheduling first for time overrun.

## 4.6 Summary of the Questioner Survey

The survey achieved an overall response rate of 71%. The analyses of the survey revealed the following key observations:

1. The client mostly uses time, cost and quality performance measure to manage the performance of local contractors.
2. Majority of respondents (consultant, contractor and ERA) in the road construction industry agreed that local contractors have low performance, with respect to time and cost.
3. The analysis of the study has revealed the ten major causing factors in the construction industry, according to the three main concerned parties. Accordingly, Inadequate planning and schedulingandPoor project management system by the contractors is ranked first causing factor for poor time and cost performance respectively, by client, contractor and consultants.
4. The analysis of the study has shown the impacts of local contractor poor time and cost performance is significant in Ethiopian road construction industry as well as the growth and development of the country. Hence, the client ranked eroding mutual trust and respect by the employer as the most critical impact.
5. The analysis of the study has shown that local contractor's involvement in the road construction industry has a significance in the economic development of the country in;
    - Creating job opportunity for professional/ skilled and unskilled manpower,
    - Helping the employer to get a reasonable offer /Reduce construction cost
    - Saving hard currency/ Tide foreign currency
    - Creating competent contractor in the construction industry/Builds capacity of local contractors

- Increasing in gross domestic product (GDP) and contributes to the overall development of the country which have a multiplier effect on the economy of the country
- Ensuring self-sustained development of the country
- Adopting knowledge transfer in the sector

6. By using the Kendall concordance test, the following factors as shown below were considered the 10 major causing factors for poor time performance/time overrun;

Table 4.13 The ten major causing factors for poor time performance

With respect to the road construction industry

| I.No. | Causing factors for poor time performance |
|---|---|
| 1. | Inadequate planning and scheduling |
| 2. | Poor project management system |
| 3. | Right of way problem |
| 4. | Poor site management and supervision |
| 5. | Lack of equipment efficiency |
| 6. | Insufficient Numbers of equipment and labour |
| 7. | Poor resource management |
| 8. | Cash flow and financial difficulties faced by contractors |
| 9. | Mistakes and Errors in design |
| 10. | Unrealistic contract duration and requirements/ Inaccurate time estimate |

7. By using the Kendall concordance test, the following factors as shown below were considered the 10 major causing factors for cost overruns;

Table 4.14 The ten major causing factors for poor cost performance

With respect to the road construction industry

| I.No. | Causing factors for poor cost performance |
|---|---|
| 1. | Poor project management system |
| 2. | Inadequate planning and scheduling |
| 3. | Mistakes and Errors in design |
| 4. | Poor resource management |

| I.No. | Causing factors for poor cost performance |
|---|---|
| 5. | Poor site management and supervision |
| 6. | Poor financial management system |
| 7. | Cash flow and financial difficulties faced by contractors |
| 8. | Change in the scope of the project/variation order |
| 9. | Frequent design change |
| 10. | Unrealistic contract cost estimate |

## 4.7 Analysis and Discussion of the Case Study-Cases of Road Projects Administered by ERA

### 4.7.1 Introduction

It is a common feature that local contractors in road projects are facing difficulties to complete with the time planned and within the budget for various reasons. In such circumstances, what matters a lot is the extent of the delays and additional money requirements. Obviously, the higher the time and cost overruns the severe the repercussions would be on the Client and the Contractor in particular and on the project stakeholders in general.

This chapter depicts some cases of road projects in Ethiopia that has been recently completed; with the intention to show the level of delays and cost overrun problems by comparing the originally agreed costs and time for completion of each of these projects with the respective actual figures achieved at project completion.

### 4.7.2 Case Studies

The description of the causes of each project listed below mainly focuses on the construction time and cost overruns on completed ERA Road projects. Hence, the construction those projects are excuted by local contractors.

**a) Project-I**

The purpose of the project is to construct new rural road of 86 km (81.08Km) gravel road. The project is located in Afar Zone Somali Region in South Eastern Ethiopia. The project commenced September 06, 2010 and the original completion date was September 06, 2013 with

a contract period of 1,096 calendar days. The Original contract amount was ETB 405,726,000.00.

However, this project has been substantially completed on January 17, 2015; that is after 498 days of the expected completion date, with a total project cost of ETB 405,726,000.00. This project delays by 45.44% of the original project duration and has no cost overrun.

Non availability of survey benchmarks; failure of the Employer to remove obstructions timely/ RoW problem; Contractor's poor planning and management; lack of experienced personnel on the respective delivery system; shortage of major construction equipment; were the major problems that gave rise for the aforementioned delay.

**b) Project-II**

The purpose of the project is to construct new rural road of 60 km (58.7Km) road. The project is located in Afar Zone Somali Region in South Eastern Ethiopia. The project commenced September 02, 2010 and the original completion date was September 01, 2013 with a contract period of 1,095 calendar days. The Original contract amount was ETB 428,714,511.00.

However, this project has been substantially completed on January 01, 2015; that is after 487 days of the expected completion date, with a total project cost of ETB 428,714,511.00. This project delays by 44.43% of the original project duration and has no cost overrun.

Non availability of survey benchmarks; failure of the Employer to remove obstructions timely; contractor's poor planning and management; lack of experienced personnel; shortage of major construction equipment; were the major problems that gave rise for the aforementioned delay and additional cost.

**c) Project-III**

The Project is located in SouthernNations, Nationalities and People's Regional (SNNPR) State of Ethiopia connecting towns. Construction of 58.3Km DS4 ERA Standards road was awarded to local contractors with the signing of the contract agreement on 15$^{th}$ September 2009. The total initial length of the project had increased to 67.91 Km following the addition of town access spur by variation order.

The purpose of the project is to construct new road of 58.3Km (67.91Km) of Double Bituminous Surface Treatment (DBST) standard road. Seven meters wide asphalt concrete carriageway with 1.5m shoulders on each side of the road. The project commenced October 15, 2009 and the original completion date was April 15, 2012 with a contract period of 913 calendar days. The Original contract amount was ETB 389,838,761.51.

However, this project has been substantially completed on April 25, 2014; that is after 739 days of the expected completion date, with a total project cost of ETB 451,156,689.66, which incurs additional ETB 61,317,928.15. This project is delayed by 80.94% of the original project duration and has 15.2 cost overruns.

Shortage of material, issue of variation orders, 9.64Km spur of Bonosha town access, problems on the production process of surfacing aggregate, Design problem, adverse Adverse Weather condition and failure of the Employer to remove obstructions timely/ delay in clearing ROW for Bonosha town section, Contractor's poor planning and management; lack of experienced personnel; shortage of major construction equipment; and price escalation mainly due to change in fuel, bitumen and cement costs were the major problems that gave rise for the aforementioned time overrun and additional cost.

**d) Projevt VI**

The project is located in Northern part of Ethiopia. The contract of the project had been signed on 10$^{th}$ February 2010. The total initial length of the project is 86.45 km.

The purpose of the project is to construct new road of 86.45 Km with seven meters wide asphalt concrete carriageway with 1.5m shoulders on each side of the road. The project commenced April 1, 2010 and the original completion date was March 30, 2013 with a contract period of 1094 calendar days. The Original contract amount was ETB 801,212,552.61.

However, this project has been substantially completed on August 12, 2014; that is after 500 days of the expected completion date, with a total project cost of ETB 944,079,843.21 which incurs additional ETB 142,867,290.60. This project delays by 45.7% of the original project duration and has 17.83% cost overruns.

Delay in issuance of consent on the Nominated Subcontractor for the execution of foundation investigation works for Tekeze River Bridge and delay in provision of design drawing for

Tekeze River Bridge, Delay in provision of design drawings of Dedebit Side AbutementTekeze River Bridge by the Engineer, Delay in provision of design drawings of Dedebit Side Pier No.1 and No.2 of Tekeze River Bridge by the Engineer, issue of variation orders (Increasing the road width from 6.8 to 7,Provision of additional vehicles for the Engineer and Construction of Welkait Sugar Factory road), Natural barriers such as Tekeze River and the Adiremet mountains had hindered the smooth execution of the project works, shortage of major construction equipment, frequent breakdown of key machineries for various activities (problems on the production process of surfacing aggregate), adverse Adverse Weather condition and failure of the Employer to remove obstructions timely/ delay in clearing ROW, lack of experienced personnel; and price escalation mainly due to change in fuel, bitumen and cement costs were the major problems that gave rise for the aforementioned time overrun and additional cost.

**e) Project-V**

The project is located in the Afar National Regional State, northeast part of the country. The route, which is a new construction road project with a project length of 58.7km.According to ERA's Functional Road Classification the road classified as class III-main access with traffic classification of DS5.

The project has seven meters wide Gravel wearing carriageway of the road. The project commenced January 26, 2011 and the original completion date was April 25, 2013 with a contract period of 820+365 DLP period calendar days. The Original contract amount was ETB 272, 704,620.78.

However, this project has been substantially completed on May 18, 2014; that is after 753calendar days of the expected completion date, with a total project cost of ETB**390, 016,446.50** which incurs additional ETB **117,294,598.72**. This project delays by 91.83% of the original project duration and has 43.01% cost overruns.

contractor does not give due attention to the outstanding works of the project, Lack of coordination due to the absence of project manager and other key staffs, issue of variation orders (four variation orders), adverse Adverse Weather condition and failure of the Employer to remove obstructions timely/ delay in clearing ROW, lack of experienced personnel; and price

escalation mainly due to change in fuel, bitumen and cement costs were the major problems that gave rise to the aforementioned delay and additional cost.

**f) Porject VI**

The project located in the central part of the country. The route, which is upgrading the existing road to DBST with a project long of 86.7km with 5km station equation and the actual length of the project became 81.7km.

The project has seven meters wide Double Surface Treatment carriageway of the road. The project commenced December 11, 2007 and the original completion date was June 11, 2011 with a contract period of 1278 calendar days. The Original contract amount was ETB 637,497,172.45.

However, this project has been substantially completed on May 26, 2012; that is after 350 calendar days of the expected completion date, with a total project cost of ETB 571,755,201.64 which shows negative ETB 65,741,970.81. This project delays by 27.39% of the original project duration and has decreased in cost by 10% for the reason that there is an omission of 5Km.

The late deployment of crusher plant and resources causes a considerable delay on the project, in availability and scarcity of materials such as bitumen and cement equipment breakage and irregular power interruption during normal working hours, Occurrence of landslide at high cut areas and ground water, unforeseen ground condition, Delay in some structural Design were the major problems which gave rise to the aforementioned poor time performance.

Table 4.15 Summary of the Case Study

| **Project Name** | Project I | Project II | Project III | Project VI | Project V | Project VI |
|---|---|---|---|---|---|---|
| **Project length (actual)** | 86 km | 60 km | 67.91km | 86.45km | 58.7km | 81.7km |
| **Project location** | Afar Zone Somali Region | Afar Zone Somali Region | South Region | North Region | East Region | Central Region |
| **Type of contract** | LS | | Admeasurement | | | |
| **Type project delivery** | DB | DB | DBB | DBB | DBB | DBB |
| **project financer** | GOE | GOE | GOE | GOE | GOE | |
| **Commencement Date** | 6-Sep-10 | 2-Sep-10 | 15-Oct-09 | 1-Apr-10 | 26-Jan-11 | 11-Dec-07 |
| **Contract period** | 1096 | 1096 | 913 | 1094 | 820 | 1278 |
| **Original Completion date** | 6-Sep-13 | 1-Sep-13 | 15-Apr-12 | 30-Mar-13 | 25-Apr-13 | 11-Jun-11 |
| **Actual completion date** | 17-Jan-15 | 1-Jan-15 | 24-Apr-14 | 12-Aug-14 | 18-May-15 | 26-May-12 |
| **Days of delay (%)** | 45.44% | 44.43% | 80.94% | 45.70% | 91.83% | 27.39% |
| **Original project cost** | 405,726,000.00 | 428,714,511.00 | 389,838,761.51 | 801,212,552.61 | 272,721,847.78 | 637,497,172.45 |
| **Actual cost of project** | 405,726,000.00 | 428,714,511.00 | 451,156,689.66 | 944,079,843.21 | 390,016,446.50 | 571,755,201.64 |
| **Cost overrun (%)** | 0% | 0% | 15.73% | 17.83% | 43.01% | -10.31% |

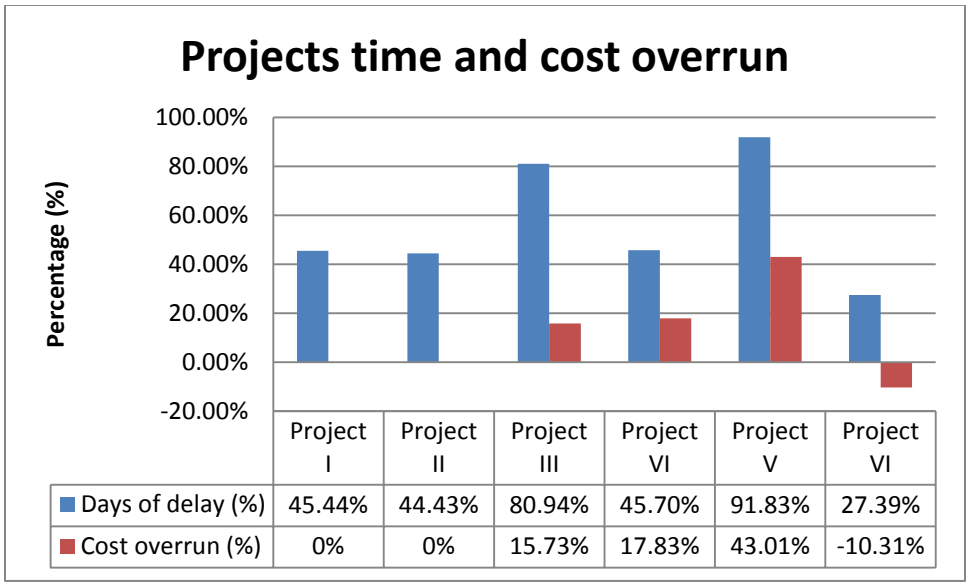


Figure 4.9 Summary of Projects time and cost overrun on the case study

### 4.7.3 Conclusion

In general the above cases could give a clear picture of the extent of severity of performance problem related to time and cost in road projects in the Country. Besides, the following points could be noted.

- All the projects used for the case study are suffering time performance.
- DB (Design and Build) delivery Projects doesn't have poor cost performance/coverrun problems for the reason that both the design and construction will be made by the contractor and no design issues had been encountered which will lead to cost impact on the project.
- For some of the projects the additional time and cost required to be even more than 40% the original contract period and the contract amount.
- Most of the major problems observed in the projects are similar, like late possession of the site (RoW problem), variation orders, contractors poor planning and management, price escalation, etc.

Basically, the extent of the problem observed from the referred cases calls for the importance of giving due attention to the issue and the need for investigating the main factors causing the problem in a wider perspective; in order to be able to substantially minimize their impacts on the upcoming projects. Furthermore, the results get from the case study is likely the same with the investigation from the questioner.

# CHAPTER FIVE

# CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

The performance of local contractors in the road sector has much significance indeveloping countries like Ethiopia; hence, their performance in the road construction industry has many impacts on the industry also. Therefore, carrying out a research in this area will have a paramount importance.

Identification of causes and impact of local contractors' time and cost performance in the road sector is a prerequisite to minimize or to avoid their poor performance and to enhance their capacity in the construction industry. The aim of this research as indicated in Chapter one is to assess the causes of local contractors' time and cost performance in road construction projects and its impact onthe development of the construction industry.

## 5.2 Conclusions

The results obtained in the analysis of the questionnaire survey and the case study have been discussed and presented in the previous Chapters in detail. Therefore, from the results of the analysis of desk study and respondents' responses the following major conclusions have been drawn:

1. Most of the respondents surveyed in the study have agreed that local contractors have poor performance rate with respect to time and cost.

2. Main causing factors for low time performance of local contractors' identified from this study are:- inadequate planning and scheduling, poor project management system, lack of equipment efficiency, insufficient number of resources, poor site and resource management, financial difficulties faced by the contractors, RoW problem, errors in design and unrealistic contract requirements by the consultant, in order of their significancy.

3. Main causing factors for poor cost performance of local contractors' identified from this study are, poor project management system, inadequate planning and scheduling, errors

in design, poor resource and site management, poor financial management system, financial difficulties faced by the contractors, variation order, frequent design change, and unrealistic contract requirements, in order of there significancy. As indicated most of the causing factors are contractor related.

4. It is revealed from the case study that there is a variation orders and RoW problem from the client side and contractors poor planning and management in most of the projects considered for the study. As a result, the Contractors' time and cost performance have been affected.

5. It is found that local contractors' performance have a great impact on the construction industry in such a way that thier poor performance will discourage investment on road construction projects by government, eroding mutual trust and respect among the parties, and it creates negative attitude towards public authority.

6. Major numbers of respondent have agreed on local contractors involvement in the road construction industry has significance in the economic development of the country mainly in a way that it creates job opportunity to the citizens which leads to Increase in gross domestic product (GDP), save hard currency and reduce construction cost.

## 5.3 Recommendations

From the study of the research paper; the following major recommendations are forwarded;

1. As Contractors are mainly responsible for the performance of projects, they are suggested to deploy experienced professionals in the area of project planning and scheduling. It is also recommended that contractors to build their capacity in the way of having a better project management system in the company at head office and project level through a different training and capacity building programs.
2. The contractor has also advised to deploy and use the resources such as; equipment, manpower, financial and time in effecent and effective way in order to achive project objectives.

3. The design consultants involved in the road construction projects are recommended to make detail investigation during the design and tender document preparation period which will eliminate frequent design change,designerrors and unrealistic contract requirement. This would help in eliminating change orders or variations in the contract and there by improving the contractors' performance.

4. Supervision consultants are suggested to hire a qualified technical staff to manage the projects appropriately, so that they would be able to overcome any poor site management and supervision. It is also advised that supervision consultants need to have high qualification to give suitable instruction at the right time and to be able to manage the construction site in efficient and effective way.

5. The client (ERA)is advised to give due attention to grant contractors timely possession of site/right of way before the construction works starts and the client has to verify all the necessary requirements for delivering the site.

6. The government of Ethiopia is suggested to create opportunities for local contractors in the construction industry to form joint venture with foreign contractors to share experience, knowledge, and technology through update policies and regulation packages.

7. The government of Ethiopia should develop better strategies and proper policy to enhance local contractors' performancein order to build up the road construction industry. This can be achived by developing policy for better access to financial facility and by providing higher margin of preference for local contractors.

8. The client (ERA) is recommended to organize training packages, workshop and skill upgrading programs, at higher, middle and lower level, for local contractors in order to upgrade and empower their project managerial skill.

## 5.4 Recommendation for Future Research

The author would like to suggest future research to be carried out on: developing strategies to improve local contractors' performance in road projects in Ethiopia. It is believed that they will contribute towards a better road construction industry and to the country's economic development as a whole.

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# APPENDICES

## Appendix A: Questionnaires

## 1) Questionnaire for Employer (ERA) and Consultant

Date: _____

Dear Sir/ Madam

This is a questionnaire designed for a research purpose in Addis Ababa Institute of Technology, School of Civil and Environmental Engineering, MSc Program in Construction Technology and Management. The questions are prepared for the **Assessment of Causes and Impacts of Local Contractors' time and cost Performance in Ethiopian Roads Authority Projects.** The main objective of this study is to assess the Cause of Local contractors' poor performance and Impact of their performance in Ethiopia Road Authority projects. Thus, your responses to the questions would be kept confidential and be used only for academic purpose.

Therefore, please be helpful and give your precise and correct answers to the questions. The responses are used for study purposes only and perhaps for further recommendations to improve similar works in the future. I would like to thank you in advance for giving your precious time.

Rahel Kassaye

Addis Ababa Institute of Technology

School of Civil and Environmental Engineering

MSc Program in Construction Technology and Management

Dear respondents,

The objective of this questionnaire is to assess Cause and Impact of Local Contractors' Performance in Ethiopian Roads Authority Projects.

This questionnaire is prepared for data collection of a research on **Assessment of Cause and Impact of Local Contractors' time and cost Performance in Ethiopian Roads Authority Projects**

**Partone: personal data**

1.1. Academic background _____

1.2. Work experience in the road sector (in years)

Less than 5 ☐ Between 10 and ☐

Between 5 and 10 ☐ Greater than ☐

**Part two: Company back ground information**

2.1. Organization you are working for

ERA ☐

Consultant

Local ☐ Foreign ☐

2.2. Working experience of the organization in the road sector (in years)

Less than 5 ☐ between 10 and ☐

Between 5 and 10 ☐ Greater than 15 ☐

**Part three: The cause and impacts of low performance leading to time and cost overrun on road projects**

3.1.Can you explicitly show the number (percentage) of Road projects executed by contractors?

Local Contractors ☐ Foreign Contractor ☐

3.2. What are the key performance indicators you used to measure the performance of the contractors?

Time ☐ safety ☐

Cost ☐ Employer satisfaction ☐

Quality ☐ Road user's satisfaction ☐

3.3. What mechanism doyou use to evaluate the above performance measures/key indicators?

_____

_____

_____

_____

3.4. How do you rate the local contractors' performance on most projects?

Good ☐ Fair ☐ Poor ☐

3.5. Do these projects suffer from cost and time overrun?

Yes ☐ No ☐

3.6. If your answer is Yes for question 3.5., which of the following are most contributing factors for local contractors' low performance leading to cost and time overrun in road projects?

Please indicate the degree to which you agree or disagree with the following statements using the following scale

0-No Opinion 3-Agree

1-Strongly Disagree 4- Strongly Agree

2-Disagree

Table 1.1 Factors causing of low performance with respect to time and cost /factors causing time overrun cost.

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| **A. Employer's related** | | | | | | | | | | | |
| 1 | Delays in decision making | | | | | | | | | | |
| 2 | Delay in commencement of works and possession of site | | | | | | | | | | |
| 3 | Change in the scope of the project/Variation order | | | | | | | | | | |
| 4 | Low competition in bids | | | | | | | | | | |
| 5 | Delay in payment progress | | | | | | | | | | |
| 6 | The practice of assigning contract to the lowest bidder | | | | | | | | | | |
| 7 | Poor coordination and communication between construction parties | | | | | | | | | | |
| 8 | Poor contract administration | | | | | | | | | | |
| 9 | Financial difficulties of owner | | | | | | | | | | |
| 10 | Right of way problem | | | | | | | | | | |
| **B. Consultant related** | | | | | | | | | | | |
| 1 | Mistakes and Errors in design | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 2 | Frequent design change | | | | | | | | | | |
| 3 | Unclear/vague specification | | | | | | | | | | |
| 4 | Incomplete design at the time of tender | | | | | | | | | | |
| 5 | Incompetent designers/Inadequate experience | | | | | | | | | | |
| 6 | Unrealistic contract duration / Inaccurate time estimate and cost | | | | | | | | | | |
| 7 | Inaccurate cost estimate | | | | | | | | | | |
| 8 | Late inspection/ poor supervision | | | | | | | | | | |
| 9 | Delay, Preparation and approval of drawings | | | | | | | | | | |
| 10 | Delay in inspection and approval of completed works | | | | | | | | | | |
| **C. Contractor Related** | | | | | | | | | | | |
| 1 | Poor project planning and scheduling | | | | | | | | | | |
| 2 | Insufficient skilled and experienced labors | | | | | | | | | | |
| 3 | Poor rate of progress | | | | | | | | | | |
| 4 | Poor workmanship | | | | | | | | | | |
| 5 | Insufficient Numbers of equipment | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 6 | Equipment unavailability and failure | | | | | | | | | | |
| 7 | Poor site management | | | | | | | | | | |
| 8 | Construction material and | | | | | | | | | | |
| 9 | Rework from poor material quality | | | | | | | | | | |
| 10 | Obsolete and improper construction method | | | | | | | | | | |
| 11 | Rework due to error in construction | | | | | | | | | | |
| 12 | Lack of specialized/ experienced subcontractor | | | | | | | | | | |
| 13 | Inadequate contractor experience/ Lack of experience | | | | | | | | | | |
| 14 | Unrealistic project cost frame | | | | | | | | | | |
| 15 | Poor resource management | | | | | | | | | | |
| 16 | Late delivery of materials and equipment | | | | | | | | | | |
| 17 | Cash flow and financial difficulties/ Shortage | | | | | | | | | | |
| 18 | Poor financial management | | | | | | | | | | |
| **D. External factors** | | | | | | | | | | | |
| 1 | Adverse Weather condition | | | | | | | | | | |
| 2 | Unforeseen physical condition | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 3 | Acts of GOD | | | | | | | | | | |
| 4 | Problems related to Utility (electricity, telephone, water and other) Companies | | | | | | | | | | |
| 5 | Inflation/Escalation of material prices | | | | | | | | | | |
| 6 | Accidents during construction | | | | | | | | | | |
| 7 | Laws and Regulatory Framework | | | | | | | | | | |
| 8 | Fraudulent practices and kickbacks | | | | | | | | | | |
| 9 | Delay and difficulties with suppliers | | | | | | | | | | |
| 10 | Poor communication among the parties | | | | | | | | | | |
| 11 | Exchange rate fluctuation | | | | | | | | | | |
| 12 | Bankers policy for loans | | | | | | | | | | |

3.7 Please write additional contributing factors for Time overrun. (if any)

_____

_____

_____

_____

_____.

3.8 Please write additional contributing factors for cost overrun. (if any)

_____

_____

_____

_____

_____

3.9 Which of the following are the major Impacts of local contractor performance, related to cost and time overrun, to the road construction industry?

Please rate the degree of impact of the following statements on the growth of road construction industry using the following scale

0-No Opinion 3-medium Impact

1-No Impact 4- High Impact

2-less Impact

Table 1.1 Impacts of local contractor performance in the road construction industry.

| Item No. | Major Impacts | Degree of impact | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 1 | Loss of confidence and loss of reputation by the employer | | | | | |
| 2 | Influence to meet, plan and program objectives of the stakeholders, especially the government. | | | | | |
| 3 | Made the employer for additional cost and loss its investment return money lately | | | | | |
| 4 | Loss of benefit to road users they get from the project | | | | | |
| 5 | Additional cost on the contractor to keep its resources on the project site for a prolonged period of time (Prolongation cost), | | | | | |
| 6 | Liquidated damage cost | | | | | |

| Item No. | Major Impacts | Degree of impact | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 7 | Lead to poor cash flow to the contractor and lowering contractor's capacity development | | | | | |
| 8 | Adversarial relationship between participants of the project, | | | | | |
| 9 | Dissatisfaction by project owners and consequently by road users/the public, | | | | | |
| 10 | Increase political pressure/ instability, | | | | | |
| 11 | Impact on the overall development of the nation | | | | | |
| 12 | Negative attitude towards the construction industry by the higher public authority and by the society as a whole, | | | | | |
| 13 | The contribution of the construction industry to the growth of the national economy of the country will be less, | | | | | |
| 14 | Weakens the growth of the construction industry by eroding mutual trust and respect, | | | | | |
| 15 | Discourage investment in road construction projects by government | | | | | |

3.10 Please write additional Impacts of local contractor performance in the road construction industry. (If any)

_____

_____

_____

_____

_____

3.11What is the significance of encouraging local contractor's involvement in the road construction industry related to the economic development of the country?

3.12 What is your professional opinion on how to enhance local contractors' performance on road construction project?

3.13 What is the main stakeholder's responsibility in improving local contractors' performance on road construction project?

Employer:

Consultant:-

Contractor:

Financial institution:

_____

_____

_____

_____

Government:_____

_____

_____

_____

3.13 Please write additional opinion on the cause and Impact of local contractor performance.

_____

_____

_____

_____

**Thank you for your cooperation**

## 2) Questionnaire for Contractor

Date: _____

Dear Sir/ Madam

This is a questionnaire designed for a research purpose in Addis Ababa Institute of Technology, School of Civil and Environmental Engineering, MSc Program in Construction Technology and Management. The questions are prepared for the **Assessment of Causes and Impacts of Local Contractors' time and cost Performance in Ethiopian Roads Authority Projects.** The main objective of this study is to assess the Cause of Local contractors' low performance and its Impact in Ethiopia Road Authority projects. Thus, your responses to the questions would be kept confidential and be used only for academic purpose.

Therefore, please be helpful and give your precise and correct answers to the questions. The responses are used for study purposes only and perhaps for further recommendations to improve similar works in the future. I would like to thank you in advance for giving your precious time.

Rahel Kassaye

Addis Ababa Institute of Technology

School of Civil and Environmental Engineering

MSc Program in Construction Technology and Management

Dear respondents,

The objective of this questionnaire is to assess Cause and Impact of Local Contractors' Performance in Ethiopian Roads Authority Projects.

This questionnaire is prepared for data collection of a research on **Assessment of Cause and Impact of Local Contractors' time and cost Performance in Ethiopian Roads Authority Projects.**

**Part one: personal data**

1.1. Academic background _____

1.2. Work experience in the road sector (in years)

Less than 5 ☐ Between 10 and 15 ☐

Between 5 and 10 ☐ Greater than 15 ☐

**Part two: Company background information**

2.1. Organization you are working for

ERA ☐

Consultant

Local ☐ Foreign ☐

Contractor

Local ☐ Foreign ☐

2.2. Working experience in the road sector (in years)

Less than 5 ☐ between 10 and 15 ☐

Between 5 and 10 ☐ Greater than 15 ☐

**Part three: The cause and effect time overrun on road projects**

3.1. How do you rate the local contractors' performance on ERA's projects?

Good ☐ Fair ☐ Poor ☐

3.2. Do these projects suffer from cost and time overrun?

Yes ☐ No ☐

3.3. If your answer is Yes for question 3.2., which of the following are most contributing factors for local contractors' low performance leading to cost and time overrun in road projects?

Please indicate the degree to which you agree or disagree with the following statements using the following scale

0-No Opinion 3-Agree

1-Strongly Disagree 4- Strongly Agree

2-Disagree

Table 1.1 Factors causing of low performance with respect to time and cost /factors causing time overrun cost.

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| **A. Employer's related** | | | | | | | | | | | |
| 1 | Delays in decision making | | | | | | | | | | |
| 2 | Delay in commencement of works and possession of site | | | | | | | | | | |
| 3 | Change in the scope of the project/Variation order | | | | | | | | | | |
| 4 | Low competition in bids | | | | | | | | | | |
| 5 | Delay in payment progress | | | | | | | | | | |
| 6 | Practice of assigning contract to lowest bidder | | | | | | | | | | |
| 7 | Poor coordination andcommunication between construction parties | | | | | | | | | | |
| 8 | Poor contract administration | | | | | | | | | | |
| 9 | Financial difficulties of owner | | | | | | | | | | |
| 10 | Right of way problem | | | | | | | | | | |
| **B. Consultant related** | | | | | | | | | | | |
| 1 | Mistakes and Errors in design | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 2 | Frequent design change | | | | | | | | | | |
| 3 | Unclear/vague specification | | | | | | | | | | |
| 4 | Incomplete design at the time of tender | | | | | | | | | | |
| 5 | Incompetent designers/Inadequate experience | | | | | | | | | | |
| 6 | Unrealistic contract duration / Inaccurate time estimate and cost | | | | | | | | | | |
| 7 | Inaccurate cost estimate | | | | | | | | | | |
| 8 | Late inspection/ poor supervision | | | | | | | | | | |
| 9 | Delay, Preparation and approval of drawings | | | | | | | | | | |
| 10 | Delay in inspection and approval of completed works | | | | | | | | | | |
| **C. Contractor Related** | | | | | | | | | | | |
| 1 | Poor project planning and scheduling | | | | | | | | | | |
| 2 | Insufficient skilled and experienced labors | | | | | | | | | | |
| 3 | Poor rate of progress | | | | | | | | | | |
| 4 | Poor workmanship | | | | | | | | | | |
| 5 | Insufficient Numbers of equipment | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 6 | Equipment unavailability and failure | | | | | | | | | | |
| 7 | Poor site management | | | | | | | | | | |
| 8 | Construction material and | | | | | | | | | | |
| 9 | Rework from poor material quality | | | | | | | | | | |
| 10 | Obsolete and improper construction method | | | | | | | | | | |
| 11 | Rework due to error in construction | | | | | | | | | | |
| 12 | Lack of specialized/ experienced subcontractor | | | | | | | | | | |
| 13 | Inadequate contractor experience/ Lack of experience | | | | | | | | | | |
| 14 | Unrealistic project cost frame | | | | | | | | | | |
| 15 | Poor resource management | | | | | | | | | | |
| 16 | Late delivery of materials and equipment | | | | | | | | | | |
| 17 | Cash flow and financial difficulties/ Shortage | | | | | | | | | | |
| 18 | Poor financial management | | | | | | | | | | |
| **D. External factors** | | | | | | | | | | | |
| 1 | Adverse Weather condition | | | | | | | | | | |
| 2 | Unforeseen physical condition | | | | | | | | | | |

| No. | Major causes | Degree of agreement/ Disagreement | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost Overrun | | | | | Time Overrun | | | | |
| | | (0) | (1) | (2) | (3) | (4) | (0) | (1) | (2) | (3) | (4) |
| 3 | Acts of GOD | | | | | | | | | | |
| 4 | Problems related with Utility (electricity, telephone, water and other) Companies | | | | | | | | | | |
| 5 | Inflation/Escalation of material prices | | | | | | | | | | |
| 6 | Accidents during construction | | | | | | | | | | |
| 7 | Laws and Regulatory Framework | | | | | | | | | | |
| 8 | Fraudulent practices and kickbacks | | | | | | | | | | |
| 9 | Delay and difficulties with suppliers | | | | | | | | | | |
| 10 | Poor communication among the parties | | | | | | | | | | |
| 11 | Exchange rate fluctuation | | | | | | | | | | |
| 12 | Bankers policy for loans | | | | | | | | | | |

3.4 Please write additional contributing factors for Time overrun. (If any)

_____

_____

_____

_____

_____.

3.5 Please write additional contributing factors for cost overruns. (if any)

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_____

_____

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_____.

3.6 Which of the following are the major Impacts of local contractor performance, related to cost and time overrun, in the road construction industry?

Please rate the degree of impact of the following statements on the growth of road construction industry using the following scale

0-No Opinion 3-medium Impact

1-No Impact 4- High Impact

2-less Impact

Table 1.1 Impacts of local contractor performance in the road construction industry.

| Item No. | Major Impacts | Degree of impact | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 1 | Loss of confidence and loss of reputation by the employer | | | | | |
| 2 | Influence to meet, plan and program objectives of the stakeholders, especially the government. | | | | | |
| 3 | Made the employer for additional cost and loss its investment return money lately | | | | | |
| 4 | Loss of benefit to road users they get from the project | | | | | |
| 5 | Additional cost on the contractor to keep its resources on the project site for a prolonged period of time (Prolongation cost), | | | | | |
| 6 | Liquidated damage cost | | | | | |

| Item No. | Major Impacts | Degree of impact | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 7 | Lead to poor cash flow to the contractor and lowering contractor's capacity development | | | | | |
| 8 | Adversarial relationship between participants of the project, | | | | | |
| 9 | Dissatisfaction by project owners and consequently by road users/the public, | | | | | |
| 10 | Increase political pressure/ instability, | | | | | |
| 11 | Impact on the overall development of the nation | | | | | |
| 12 | Negative attitude towards the construction industry by the higher public authority and by the society as a whole, | | | | | |
| 13 | The contribution of the construction industry to the growth of the national economy of the country will be less, | | | | | |
| 14 | Weakens the growth of the construction industry by eroding mutual trust and respect, | | | | | |
| 15 | Discourage investment in road construction projects by government | | | | | |

3.7 Please write additional Impacts of local contractor performance in the road construction industry. (Ifany)

_____

_____

_____

_____

_____

3.8 What is the significance of encouraging local contractor's involvement in the road construction industry related to the economic development of the country?

_____

_____

_____

_____

_____

3.9 What is your professional opinion on how to enhance local contractors' performance on road construction project?

_____

_____

_____

_____

3.10 What is the main stakeholder's responsibility in improving local contractors' performance in road construction project?

Employer:_____

_____

_____

_____

Consultant:_____-

_____

_____

_____

Contractor:_____

_____

_____

_____

Financial institution:

_____

_____

_____

_____

Government:_____

_____

_____

_____

3.11 Please write additional opinion on cause and Impact of local contractor performance.

_____

_____

_____

_____

**Thank you for your cooperation**

## Appendix-B: Response and Computation of Relative Important Index and Rank

| Part One Academic Background and work experience | | | | | | |
|---|---|---|---|---|---|---|
| Respondents | | | Question | | | |
| | | | Q1.1 | Q1.2 | Q2.1 | Q2.2 |
| Employer (ERA) | Central | 1 | BSc | 1 | 1 | 4 |
| | | 2 | BSc | 1 | 1 | 4 |
| | | 3 | BSc | 3 | 1 | 4 |
| | North | 4 | BSc | 1 | 1 | 4 |
| | | 5 | BSc | 1 | 1 | 4 |
| | | 6 | BSc | 2 | 1 | 4 |
| | South | 7 | MSc | 3 | 1 | 4 |
| | | 8 | BSc | 1 | 1 | 4 |
| | | 9 | BSc | 2 | 1 | 4 |
| | | 10 | BSc | 4 | 1 | 4 |
| | East | 11 | BSc | 2 | 1 | 4 |
| | | 12 | MSc | 2 | 1 | 4 |
| | | 13 | BSc | 2 | 1 | 4 |
| | | 14 | BSc | 1 | 1 | 4 |
| | West | 15 | BSc | 2 | 1 | 4 |
| | | 16 | BSc | 2 | 1 | 4 |
| | | 17 | BSc | 2 | 1 | 4 |
| | Design and Build | 18 | BSc | 1 | 1 | 4 |
| | | 19 | BSc | 1 | 1 | 4 |
| | | 20 | BSc | 3 | 1 | 4 |
| | Directors | 21 | MSc | 2 | 1 | 4 |
| | | 22 | MSc | 1 | 1 | 4 |
| | | 23 | BSc | 2 | 1 | 4 |
| | | 24 | BSc | 2 | 1 | 4 |
| Consultant | | 25 | BSc | 1 | 1 | 3 |
| | | 26 | MSc | 2 | 1 | 3 |
| | | 27 | BSc | 2 | 1 | 2 |
| | | 28 | MSc | 2 | 1 | 3 |
| | | 29 | BSc | 2 | 2.1 | 3 |
| | | 30 | MSc | 3 | 2.1 | 3 |
| | | 31 | BSc | 2 | 2.1 | 2 |

| Part One<br>Academic Background and work experience | | | | | |
|---|---|---|---|---|---|
| Respondents | | Question | | | |
| | | Q1.1 | Q1.2 | Q2.1 | Q2.2 |
| | 32 | BSc | 2 | 2.1 | 2 |
| | 33 | BSc | 1 | 2.1 | 3 |
| | 34 | BSc | 2 | 2.1 | 3 |
| | 35 | MSc | 3 | 2.1 | 3 |
| | 36 | BSc | 2 | 2.1 | 2 |
| | 37 | BSc | 2 | 2.1 | 2 |
| | 38 | BSc | 1 | 2.1 | 3 |
| | 39 | BSc | 2 | 2.1 | 3 |
| | 40 | BSc | 2 | 2.1 | 3 |
| | 41 | BSc | 2 | 2.1 | 2 |
| | 42 | BSc | 2 | 2.1 | 2 |
| Contractor | 43 | BSc | 4 | 3.1 | 4 |
| | 44 | BSc | 1 | 3.1 | 3 |
| | 45 | BSc | 1 | 3.1 | 2 |
| | 46 | BSc | 4 | 3.1 | 4 |
| | 47 | BSc | 4 | 3.1 | 4 |
| | 48 | BSc | 2 | 3.1 | 2 |
| | 49 | BSc | 4 | 3.1 | 4 |
| | 50 | BSc | 3 | 3.1 | 3 |
| | 51 | BSc | 2 | 3.1 | 4 |
| | 52 | BSc | 4 | 3.1 | 4 |
| | 53 | BSc | 3 | 3.1 | 4 |
| | 54 | BSc | 4 | 3.1 | 4 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| ERA | Central | 1 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| | | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 3 | 3 | 2 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 4 | 3 |
| | North | 4 | 3 | 2 | 4 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 3 | 3 | 3 |
| | | 5 | 3 | 3 | 4 | 0 | . | 4 | 3 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 2 |
| | | 6 | 2 | 3 | 2 | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 |
| | South | 7 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 |
| | | 8 | 3 | 0 | 4 | 0 | 3 | 3 | 3 | 3 | 0 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 |
| | | 9 | 2 | 2 | 1 | 0 | 3 | 4 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| | | 10 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 4 |
| | East | 11 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 |
| | | 12 | 2 | 0 | 3 | 3 | 3 | 4 | 3 | 3 | 1 | 3 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 2 |
| | | 13 | 3 | 0 | 3 | 0 | 2 | 0 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 |
| | | 14 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 2 | 2 | 2 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| | West | 15 | 3 | 2 | 3 | 2 | 2 | 4 | 2 | 1 | 1 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| | | 16 | 3 | 3 | 4 | 0 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| | | 17 | 3 | 3 | 4 | 3 | 2 | 4 | 3 | 3 | 2 | 1 | 3 | 3 | 4 | 2 | 4 | 4 | 2 | 2 | 2 |
| | Design and Build | 18 | 4 | 3 | 3 | 2 | 1 | 4 | 3 | 1 | 2 | 2 | 4 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 2 |
| | | 19 | 4 | 4 | 4 | 2 | 2 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 2 | 2 |
| | | 20 | 4 | 0 | 4 | 2 | 4 | 4 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 2 | 2 |
| | Directors | 21 | 4 | 3 | 4 | 1 | 3 | 2 | 1 | 0 | 1 | 1 | 4 | 2 | 2 | 1 | 2 | 2 | 4 | 1 | 2 |
| | | 22 | 3 | 3 | 4 | 0 | 3 | 3 | 2 | 3 | 2 | 4 | 4 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| | | 23 | 0 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 3 | 2 | 4 | 4 | 2 | 1 | 3 | 3 |
| | | 24 | 3 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 1 | 3 | 4 | 1 | 1 | 1 | 3 | 2 | 3 | 2 | 0 |
| **0** | | | 1 | 4 | 0 | 5 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **1** | | | 3 | 3 | 2 | 6 | 4 | 2 | 2 | 4 | 5 | 2 | 0 | 1 | 1 | 3 | 0 | 0 | 1 | 1 | 1 |
| **2** | | | 3 | 6 | 2 | 6 | 6 | 2 | 4 | 5 | 8 | 4 | 1 | 3 | 3 | 7 | 6 | 7 | 10 | 10 | 12 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | |
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| **3** | 13 | 9 | 8 | 4 | 11 | 9 | 16 | 13 | 8 | 8 | 10 | 10 | 11 | 6 | 11 | 10 | 10 | 12 | 9 |
| **4** | 4 | 2 | 12 | 2 | 2 | 10 | 2 | 1 | 2 | 10 | 12 | 9 | 8 | 7 | 6 | 6 | 3 | 1 | 1 |
| **total** | 24 | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| **Σ(f*s)** | 157 | 116 | 162 | 107 | 135 | 166 | 136 | 127 | 118 | 171 | 173 | 166 | 159 | 140 | 156 | 167 | 148 | 135 | 135 |
| **II** | 3.14 | 2.32 | 3.24 | 2.14 | 2.7 | 3.32 | 2.72 | 2.54 | 2.36 | 3.42 | 3.46 | 3.32 | 3.18 | 2.8 | 3.12 | 3.34 | 2.96 | 2.7 | 2.7 |
| **Rank** | 4 | 9 | 3 | 10 | 6 | 2 | 5 | 7 | 8 | 1 | 1 | 3 | 4 | 7 | 5 | 2 | 6 | 8 | 8 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Consultant | **13** | 2 | 1 | 3 | 0 | 3 | 3 | 3 | 0 | 2 | 4 | 4 | 4 | 4 | 0 | 4 | 4 | 3 | 0 | 4 |
| | **14** | 3 | 2 | 4 | 3 | 0 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 2 |
| | **7** | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 1 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| | **8** | 3 | 3 | 3 | 2 | 4 | 3 | 3 | 3 | 2 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **25** | 3 | 0 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 |
| | **26** | 2 | 2 | 2 | 2 | 2 | 4 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| | **27** | 4 | 4 | 2 | 1 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 4 | 4 |
| | **28** | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 3 | 2 | 2 |
| | **29** | 4 | 2 | 4 | 2 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 4 | 4 |
| | **30** | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 3 |
| | **31** | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 |
| | **32** | 2 | 1 | 3 | 2 | 4 | 4 | 2 | 3 | 2 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 2 | 2 | 2 |
| | **33** | 4 | 1 | 4 | 4 | 2 | 4 | 2 | 3 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 4 | 4 |
| | **34** | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 2 | 2 |
| | **35** | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 3 | 3 | 3 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| | **36** | 2 | 0 | 3 | 2 | 2 | 4 | 2 | 3 | 2 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 2 | 2 | 2 |
| | **37** | 4 | 0 | 4 | 2 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 4 | 4 |
| | **38** | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 2 |
| **0** | | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| **1** | | 0 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | | 4 | 4 | 2 | 11 | 7 | 2 | 13 | 6 | 12 | 1 | 1 | 1 | 0 | 9 | 2 | 1 | 5 | 9 | 8 |
| **3** | | 5 | 2 | 7 | 2 | 4 | 3 | 4 | 11 | 2 | 5 | 7 | 10 | 10 | 5 | 12 | 3 | 5 | 3 | 4 |
| **4** | | 9 | 6 | 9 | 3 | 6 | 12 | 1 | 0 | 1 | 12 | 10 | 7 | 8 | 3 | 4 | 14 | 8 | 5 | 6 |
| **total** | | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| **Σ(f*s)** | | 157 | 116 | 162 | 107 | 135 | 166 | 136 | 127 | 118 | 171 | 173 | 166 | 159 | 140 | 156 | 167 | 148 | 135 | 135 |
| **II** | | 3.14 | 2.32 | 3.24 | 2.14 | 2.7 | 3.32 | 2.72 | 2.54 | 2.36 | 3.42 | 3.46 | 3.32 | 3.18 | 2.8 | 3.12 | 3.34 | 2.96 | 2.7 | 2.7 |
| **Rank** | | 4 | 9 | 3 | 10 | 6 | 2 | 5 | 7 | 8 | 1 | 1 | 3 | 4 | 7 | 5 | 2 | 6 | 8 | 8 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Contractor | **39** | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 3 |
| | **40** | 3 | 0 | 3 | 2 | 4 | 2 | 1 | 3 | 3 | 3 | 4 | 4 | 2 | 4 | 3 | 2 | 4 | 4 | 3 |
| | **41** | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 1 | 4 | 4 | 2 | 3 | 2 | 3 | 1 | 2 | 1 |
| | **42** | 4 | 3 | 4 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 |
| | **43** | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| | **44** | 3 | 2 | 4 | 0 | 1 | 0 | 3 | 2 | 0 | 3 | 3 | 2 | 1 | 3 | 3 | 1 | 3 | 2 | 2 |
| | **45** | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 0 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| | **46** | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 3 | 2 | 4 | 3 | 2 | 2 | 4 | 4 | 2 | 2 | 2 |
| | **47** | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 3 | 2 | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 3 | 3 |
| | **48** | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 |
| | **49** | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 |
| | **50** | 4 | 4 | 4 | 2 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 2 | 4 | 4 | 3 | 2 | 2 |
| **0** | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| **2** | | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 3 | 1 | 2 | 0 | 1 | 3 | 3 | 1 | 1 | 1 | 4 | 3 |
| **3** | | 4 | 7 | 5 | 4 | 7 | 0 | 9 | 6 | 8 | 5 | 2 | 2 | 6 | 2 | 3 | 2 | 4 | 4 | 5 |
| **4** | | 8 | 3 | 6 | 4 | 4 | 9 | 2 | 2 | 2 | 4 | 10 | 9 | 2 | 7 | 8 | 8 | 6 | 4 | 3 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | |
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| **total** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| **Σ(f*s)** | 157 | 116 | 162 | 107 | 135 | 166 | 136 | 127 | 118 | 171 | 173 | 166 | 159 | 140 | 156 | 167 | 148 | 135 | 135 |
| II | 3.14 | 2.32 | 3.24 | 2.14 | 2.7 | 3.32 | 2.72 | 2.54 | 2.36 | 3.42 | 3.46 | 3.32 | 3.18 | 2.8 | 3.12 | 3.34 | 2.96 | 2.7 | 2.7 |
| Rank | 4 | 9 | 3 | 10 | 6 | 2 | 5 | 7 | 8 | 1 | 1 | 3 | 4 | 7 | 5 | 2 | 6 | 8 | 8 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| ERA | **Centtral** | **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 |
| | | **2** | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | **3** | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 3 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 3 | 2 | 3 | 0 | 0 | 2 | 2 | 2 |
| | **North** | **4** | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 4 | 4 | 4 |
| | | **5** | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 4 | 3 | 4 | 3 | 3 | 4 | 2 | 4 | 1 | 4 | 4 | 2 | 3 | 2 | 0 | 0 | 2 | 3 |
| | | **6** | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 0 | 3 | 0 | 0 | 0 | 4 | 3 |
| | **South** | **7** | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 2 |
| | | **8** | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 0 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | **9** | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | **10** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 |
| | **East** | **11** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 |
| | | **12** | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 4 | 4 | 3 | 4 | 3 | 2 | 0 | 0 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | **13** | 2 | 2 | 4 | 2 | 3 | 4 | 4 | 2 | 2 | 2 | 3 | 0 | 3 | 4 | 3 | 3 | 3 | 4 | 1 | 1 | 1 | 3 | 3 | 1 | 0 | 3 | 2 | 0 | 3 | 0 |
| | | **14** | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 1 | 3 | 3 | 0 | 4 | 4 | 0 | 0 | 3 | 0 |
| | **West** | **15** | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 2 | 1 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 2 |
| | | **16** | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 0 |
| | | **17** | 4 | 2 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 0 | 3 | 4 | 3 | 3 | 2 | 3 |
| | **Design and Build** | **18** | 3 | 3 | 4 | 3 | 3 | 0 | 3 | 3 | 2 | 2 | 2 | 3 | 0 | 0 | 3 | 3 | 2 | 4 | 2 | 3 | 2 | 4 | 2 | 2 | 2 | 2 | 3 | 2 | 4 | 2 |
| | | **19** | 4 | 3 | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 0 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 1 | 0 | 4 | 0 | 0 | 0 | 2 |
| | | **20** | 4 | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 0 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 1 | 0 | 4 | 0 | 0 | 0 | 2 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Directors | 21 | 3 | 2 | 4 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| | 22 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 0 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| | 23 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 4 | 4 | 2 | 2 | 3 | 1 | 2 | 2 | 1 | 2 | 1 | 2 |
| | 24 | 2 | 1 | 0 | 2 | 2 | 2 | 2 | 0 | 2 | 1 | 1 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 |
| 0 | | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 1 | 4 | 5 | 5 | 8 | 8 | 4 | 5 |
| 1 | | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 6 | 0 | 2 | 6 | 1 | 2 | 4 | 3 | 2 | 1 |
| 2 | | 3 | 6 | 2 | 8 | 5 | 3 | 2 | 7 | 10 | 7 | 7 | 11 | 5 | 3 | 1 | 3 | 4 | 3 | 5 | 4 | 7 | 9 | 3 | 10 | 6 | 6 | 7 | 6 | 8 | 9 |
| 3 | | 10 | 13 | 8 | 9 | 14 | 14 | 12 | 14 | 9 | 11 | 12 | 8 | 11 | 12 | 13 | 16 | 9 | 9 | 13 | 12 | 7 | 8 | 11 | 3 | 11 | 7 | 4 | 6 | 7 | 8 |
| 4 | | 11 | 4 | 13 | 5 | 5 | 6 | 10 | 1 | 4 | 3 | 3 | 0 | 7 | 8 | 10 | 5 | 11 | 12 | 3 | 5 | 2 | 7 | 7 | 1 | 1 | 4 | 1 | 1 | 3 | 1 |
| total | | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Σ(f*s) | | 183 | 164 | 184 | 157 | 159 | 163 | 177 | 150 | 149 | 145 | 153 | 104 | 136 | 157 | 177 | 156 | 170 | 173 | 132 | 144 | 118 | 143 | 134 | 78 | 85 | 120 | 106 | 101 | 110 | 102 |
| II | | 3.66 | 3.28 | 3.68 | 3.14 | 3.18 | 3.26 | 3.54 | 3 | 2.98 | 2.9 | 3.06 | 2.08 | 2.72 | 3.14 | 3.54 | 3.12 | 3.4 | 3.46 | 2.64 | 2.88 | 2.36 | 2.86 | 2.68 | 1.56 | 1.7 | 2.4 | 2.12 | 2.02 | 2.2 | 2.04 |
| Rank | | 2 | 7 | 1 | 10 | 9 | 8 | 3 | 14 | 15 | 16 | 13 | 18 | 17 | 10 | 3 | 12 | 6 | 5 | 4 | 1 | 6 | 2 | 3 | 12 | 11 | 5 | 8 | 10 | 7 | 9 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Consultant | **13** | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 4 | 3 | 3 | 4 | 0 | 3 | 0 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 2 | 3 | 3 | 3 | 0 | 3 | 0 |
| | **14** | 4 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 2 | 2 | 0 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 |
| | **7** | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 0 | 3 | 4 | 0 | 3 | 0 | 0 | 0 | 2 | 2 |
| | **8** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **25** | 3 | 4 | 3 | 4 | 2 | 2 | 3 | 4 | 2 | 3 | 2 | 0 | 0 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 |
| | **26** | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 0 | 1 | 2 | 2 | 2 |
| | **27** | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 2 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 3 | 3 | 2 | 1 |
| | **28** | 4 | 3 | 4 | 2 | 2 | 4 | 4 | 3 | 4 | 4 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 4 | 3 | 3 | 3 | 3 |
| | **29** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 1 | 2 | 3 |
| | **30** | 4 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| | **31** | 3 | 4 | 3 | 4 | 2 | 2 | 3 | 4 | 2 | 3 | 2 | 0 | 0 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 4 |
| | **32** | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 0 | 0 |
| | **33** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 1 | 2 | 3 |
| | **34** | 4 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 2 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| | **35** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 4 | 3 | 3 | 3 | 3 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| | **36** | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 | 2 |
| | **37** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 1 | 2 | 3 |
| | **38** | 4 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **0** | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 5 | 7 | 3 | 2 | 3 | 2 | 3 |
| **1** | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 5 | 2 | 0 | 1 | 4 | 0 | 2 |
| **2** | | 0 | 3 | 0 | 6 | 6 | 3 | 0 | 0 | 5 | 2 | 3 | 10 | 8 | 2 | 2 | 6 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 4 | 9 | 4 |
| **3** | | 4 | 4 | 5 | 4 | 3 | 5 | 5 | 14 | 8 | 12 | 9 | 3 | 6 | 9 | 4 | 8 | 9 | 10 | 13 | 12 | 12 | 10 | 10 | 5 | 9 | 7 | 12 | 6 | 6 | 7 |
| **4** | | 14 | 11 | 13 | 8 | 9 | 10 | 12 | 4 | 5 | 4 | 6 | 0 | 2 | 6 | 12 | 3 | 6 | 5 | 2 | 4 | 3 | 4 | 3 | 2 | 0 | 7 | 1 | 1 | 1 | 2 |
| **total** | | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| **Σ(f*s)** | | 183 | 164 | 184 | 157 | 159 | 163 | 177 | 150 | 149 | 145 | 153 | 104 | 136 | 157 | 177 | 156 | 170 | 173 | 132 | 144 | 118 | 143 | 134 | 78 | 85 | 120 | 106 | 101 | 110 | 102 |
| **II** | | 3.66 | 3.28 | 3.68 | 3.14 | 3.18 | 3.26 | 3.54 | 3 | 2.98 | 2.9 | 3.06 | 2.08 | 2.72 | 3.14 | 3.54 | 3.12 | 3.4 | 3.46 | 2.64 | 2.88 | 2.36 | 2.86 | 2.68 | 1.56 | 1.7 | 2.4 | 2.12 | 2.02 | 2.2 | 2.04 |
| **Rank** | | 2 | 7 | 1 | 10 | 9 | 8 | 3 | 14 | 15 | 16 | 13 | 18 | 17 | 10 | 3 | 12 | 6 | 5 | 4 | 1 | 6 | 2 | 3 | 12 | 11 | 5 | 8 | 10 | 7 | 9 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Contractor | 39 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| | 40 | 4 | 1 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 0 | 2 | 2 | 3 | 3 | 1 | 4 | 4 | 3 | 4 | 1 | 1 | 2 | 2 | 0 | 4 | 2 |
| | 41 | 2 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 2 | 4 | 2 | 1 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 1 |
| | 42 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 0 | 3 | 3 | 4 | 0 | 4 | 3 |
| | 43 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 0 | 3 | 4 |
| | 44 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 2 | 1 | 1 | 2 | 1 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 1 | 2 | 4 | 1 | 0 | 2 | 3 | 2 | 4 | 2 |
| | 45 | 4 | 4 | 4 | 4 | 0 | 0 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 1 | 3 | 0 | 3 | 3 | 3 | 3 | 0 | 3 | 0 | 0 | 0 |
| | 46 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 3 |
| | 47 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 0 | 4 | 4 | 3 | 0 | 0 |
| | 48 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 2 | 2 | 3 | 3 | 0 | 2 | 2 |
| | 49 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 1 | 3 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 4 | 2 | 3 |
| | 50 | 4 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 3 | 2 | 3 | 2 | 3 |
| **0** | | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 4 | 5 | 2 | 0 | 5 | 3 | 2 |
| **1** | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 1 | 3 | 2 | 1 | 0 | 0 | 0 | 1 |
| **2** | | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 1 | 2 | 2 | 0 | 0 | 2 | 2 | 0 | 2 | 2 | 2 | 1 | 2 | 4 | 2 | 4 | 3 |
| **3** | | 1 | 1 | 2 | 3 | 3 | 2 | 4 | 9 | 7 | 6 | 6 | 7 | 7 | 4 | 1 | 2 | 5 | 3 | 7 | 9 | 7 | 8 | 3 | 3 | 4 | 6 | 6 | 4 | 1 | 4 |
| **4** | | 10 | 9 | 10 | 8 | 7 | 8 | 8 | 3 | 4 | 3 | 5 | 2 | 2 | 6 | 9 | 8 | 7 | 9 | 0 | 1 | 1 | 2 | 4 | 0 | 0 | 1 | 2 | 1 | 4 | 2 |
| **total** | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Cost Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| **Σ(f*s)** | 183 | 164 | 184 | 157 | 159 | 163 | 177 | 150 | 149 | 145 | 153 | 104 | 136 | 157 | 177 | 156 | 170 | 173 | 132 | 144 | 118 | 143 | 134 | 78 | 85 | 120 | 106 | 101 | 110 | 102 |
| II | 3.66 | 3.28 | 3.68 | 3.14 | 3.18 | 3.26 | 3.54 | 3 | 2.98 | 2.9 | 3.06 | 2.08 | 2.72 | 3.14 | 3.54 | 3.12 | 3.4 | 3.46 | 2.64 | 2.88 | 2.36 | 2.86 | 2.68 | 1.56 | 1.7 | 2.4 | 2.12 | 2.02 | 2.2 | 2.04 |
| Rank | 2 | 7 | 1 | 10 | 9 | 8 | 3 | 14 | 15 | 16 | 13 | 18 | 17 | 10 | 3 | 12 | 6 | 5 | 4 | 1 | 6 | 2 | 3 | 12 | 11 | 5 | 8 | 10 | 7 | 9 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Time Overrun | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| ERA | Centtral | 1 | 3 | 3 | 3 | 0 | 2 | 3 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| | | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 3 | 3 | 2 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 4 | 3 |
| | North | 4 | 2 | 2 | 2 | 1 | 2 | 2 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 |
| | | 5 | 3 | 2 | 4 | 1 | 3 | 1 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| | | 6 | 3 | 3 | 4 | 0 | 3 | 4 | 3 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 3 | 2 |
| | South | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | 8 | 3 | 0 | 4 | 0 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 |
| | | 9 | 2 | 2 | 1 | 0 | 2 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 10 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| | East | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 |
| | | 12 | 3 | 1 | 4 | 3 | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 2 |
| | | 13 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 3 | 4 | 3 | 2 | 2 |
| | | 14 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 2 | 2 | 2 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Time Overrun | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| | West | **15** | 3 | 2 | 3 | 2 | 1 | 4 | 2 | 1 | 1 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| | | **16** | 3 | 3 | 2 | 0 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 1 | 2 | 3 | 2 | 4 | 2 | 3 | 1 |
| | | **17** | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 4 |
| | Design and Build | **18** | 4 | 4 | 3 | 3 | 1 | 4 | 3 | 2 | 2 | 3 | 4 | 3 | 4 | 1 | 2 | 3 | 3 | 3 | 2 |
| | | **19** | 4 | 4 | 4 | 2 | 4 | 4 | 3 | 3 | 2 | 4 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 3 | 4 |
| | | **20** | 4 | 0 | 4 | 2 | 4 | 4 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 3 | 3 |
| | Directors | **21** | 4 | 3 | 4 | 1 | 3 | 4 | 1 | 0 | 1 | 4 | 3 | 2 | 2 | 0 | 2 | 4 | 1 | 1 | 2 |
| | | **22** | 4 | 4 | 3 | 0 | 3 | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 2 | 3 | 3 | 0 | 4 | 4 | 3 |
| | | **23** | 0 | 3 | 4 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 4 | 3 | 1 | 4 | 4 | 3 | 1 | 3 | 4 |
| | | **24** | 3 | 3 | 33 | 2 | 2 | 3 | 3 | 1 | 3 | 4 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 0 | 0 |
| 0 | | | 1 | 2 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 2 | 0 | 1 | 1 |
| 1 | | | 2 | 3 | 1 | 6 | 4 | 2 | 2 | 3 | 3 | 0 | 1 | 2 | 1 | 2 | 2 | 0 | 2 | 1 | 1 |
| 2 | | | 2 | 6 | 2 | 6 | 6 | 2 | 2 | 6 | 10 | 1 | 2 | 2 | 6 | 6 | 6 | 3 | 8 | 4 | 9 |
| 3 | | | 12 | 9 | 10 | 5 | 9 | 10 | 17 | 11 | 6 | 5 | 9 | 10 | 9 | 9 | 10 | 8 | 6 | 12 | 7 |
| 4 | | | 7 | 4 | 11 | 1 | 5 | 10 | 3 | 3 | 5 | 18 | 11 | 9 | 7 | 5 | 5 | 11 | 8 | 6 | 6 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Time Overrun | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | |
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Total | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Σ(f*s) | 162 | 123 | 163 | 98 | 154 | 173 | 142 | 130 | 129 | 183 | 174 | 170 | 161 | 139 | 158 | 176 | 169 | 165 | 160 |
| II | 3.24 | 2.46 | 3.26 | 1.96 | 3.08 | 3.46 | 2.84 | 2.6 | 2.58 | 3.66 | 3.48 | 3.4 | 3.22 | 2.78 | 3.16 | 3.52 | 3.38 | 3.3 | 3.2 |
| Rank | 4 | 9 | 3 | 10 | 5 | 2 | 6 | 7 | 8 | 1 | 2 | 3 | 6 | 9 | 8 | 1 | 4 | 5 | 7 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Time Overrun | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Consultant | **13** | 2 | 1 | 3 | 0 | 3 | 4 | 3 | 0 | 2 | 4 | 4 | 4 | 4 | | 4 | 4 | 3 | | 4 |
| | **14** | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 4 |
| | **7** | 2 | 3 | 2 | 4 | 3 | 3 | 2 | 3 | 2 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 |
| | **8** | 3 | 3 | 3 | 2 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **25** | 3 | 3 | 3 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| | **26** | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| | **27** | 4 | 4 | 2 | 1 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 4 | 4 |
| | **28** | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **29** | 4 | 0 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **30** | 3 | 2 | 4 | 2 | 3 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 |
| | **31** | 3 | 3 | 3 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| | **32** | 3 | 1 | 3 | 1 | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **33** | 4 | 0 | 3 | 3 | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **34** | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 |
| | **35** | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 2 | 4 | 3 | 4 | 3 | 2 | 4 | 3 | 3 | 4 | 4 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Time Overrun | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| | **36** | 2 | 0 | 3 | 1 | 4 | 4 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **37** | 4 | 0 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| | **38** | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 |
| 0 | | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | | 0 | 3 | 1 | 3 | 1 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | | 4 | 2 | 2 | 8 | 0 | 0 | 7 | 5 | 12 | 1 | 1 | 1 | 1 | 8 | 1 | 1 | 1 | 1 | 3 |
| 3 | | 7 | 5 | 9 | 3 | 8 | 6 | 9 | 10 | 3 | 6 | 6 | 7 | 8 | 5 | 12 | 5 | 5 | 6 | 5 |
| 4 | | 7 | 4 | 6 | 1 | 9 | 12 | 1 | 0 | 1 | 10 | 11 | 10 | 9 | 4 | 5 | 12 | 12 | 10 | 10 |
| Total | | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Σ(f*s) | | 162 | 123 | 163 | 98 | 154 | 173 | 142 | 130 | 129 | 183 | 174 | 170 | 161 | 139 | 158 | 176 | 169 | 165 | 160 |
| II | | 3.24 | 2.46 | 3.26 | 1.96 | 3.08 | 3.46 | 2.84 | 2.6 | 2.58 | 3.66 | 3.48 | 3.4 | 3.22 | 2.78 | 3.16 | 3.52 | 3.38 | 3.3 | 3.2 |
| Rank | | 4 | 9 | 3 | 10 | 5 | 2 | 6 | 7 | 8 | 1 | 2 | 3 | 6 | 9 | 8 | 1 | 4 | 5 | 7 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Time Overrun | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | |
| | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Contractor | | **39** | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 3 |
| | | **40** | 4 | 0 | 3 | 2 | 4 | 2 | 1 | 4 | 3 | 4 | 4 | 4 | 2 | 4 | 4 | 3 | 4 | 4 | 4 |
| | | **41** | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 |
| | | **42** | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 |
| | | **43** | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | **44** | 3 | 4 | 3 | 0 | 1 | 2 | 3 | 2 | 0 | 4 | 3 | 3 | 1 | 3 | 3 | 4 | 3 | 3 | 3 |
| | | **45** | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 0 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | **46** | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 2 | 3 | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 4 |
| | | **47** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 4 | 4 |
| | | **48** | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| | | **49** | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | **50** | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 |
| 0 | | | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | | | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | | | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Time Overrun | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | |
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| 3 | 2 | 4 | 6 | 5 | 6 | 2 | 2 | 6 | 5 | 4 | 2 | 3 | 5 | 1 | 2 | 2 | 4 | 4 | 4 |
| 4 | 10 | 7 | 6 | 3 | 5 | 8 | 9 | 3 | 5 | 8 | 10 | 9 | 5 | 8 | 10 | 10 | 8 | 8 | 8 |
| Total | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Σ(f*s) | 162 | 123 | 163 | 98 | 154 | 173 | 142 | 130 | 129 | 183 | 174 | 170 | 161 | 139 | 158 | 176 | 169 | 165 | 160 |
| II | 3.24 | 2.46 | 3.26 | 1.96 | 3.08 | 3.46 | 2.84 | 2.6 | 2.58 | 3.66 | 3.48 | 3.4 | 3.22 | 2.78 | 3.16 | 3.52 | 3.38 | 3.3 | 3.2 |
| Rank | 4 | 9 | 3 | 10 | 5 | 2 | 6 | 7 | 8 | 1 | 2 | 3 | 6 | 9 | 8 | 1 | 4 | 5 | 7 |

| Respondents | | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| ERA | Centtral | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 |
| | | 2 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | 3 | 4 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 0 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 1 | 2 | 3 | 0 | 0 | 2 | 2 | 2 |
| | North | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 |
| | | 5 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 0 | 0 | 0 | 3 | 3 | 3 |
| | | 6 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 4 | 4 | 3 | 3 | 2 | 0 | 0 | 1 | 2 |
| | South | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 2 |
| | | 8 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 0 | 2 | 3 | 3 | 3 | 3 | 0 | 0 | 0 |
| | | 9 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | 10 | 3 | 3 | 3 | 2 | 2 | 2 | 4 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 1 |
| | East | 11 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 2 | 2 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 4 | 3 |
| | | 12 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 0 | 3 | 4 | 4 | 4 | 4 | 2 | 3 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | 13 | 4 | 3 | 4 | 2 | 3 | 4 | 4 | 2 | 2 | 2 | 3 | 0 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 3 | 0 |
| | | 14 | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 2 | 4 | 4 | 4 | 4 | 3 | 3 | 1 | 3 | 3 | 1 | 0 | 4 | 0 | 0 | 0 | 0 |
| | West | 15 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 2 | 1 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 2 |
| | | 16 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 | 0 |
| | | 17 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 3 | 4 | 3 | 3 | 2 | 2 |
| | DB | 18 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 |
| | | 19 | 4 | 3 | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 0 | 4 | 3 | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 0 | 4 | 0 | 0 | 0 | 2 |
| | | 20 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 0 | 4 | 3 | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 0 | 4 | 0 | 0 | 0 | 2 |
| | Directors | 21 | 3 | 2 | 4 | 1 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 4 | 4 | 4 | 2 | 4 | 3 | 2 | 4 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| | | 22 | 2 | 2 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 0 | 3 | 3 | 4 | 1 | 3 | 3 | 3 | 4 | 0 | 1 | 3 | 3 | 2 | 3 | 0 | 2 |
| | | 23 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 1 | 1 | 2 | 1 | 2 | 3 | 1 | 2 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| **24** | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 0 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 3 | 2 | 6 | 5 | 7 | 8 | 7 | 6 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 6 | 6 | 2 | 5 | 4 | 3 | 3 | 2 |
| 2 | 2 | 6 | 1 | 6 | 2 | 1 | 1 | 8 | 7 | 8 | 4 | 8 | 6 | 4 | 1 | 0 | 1 | 7 | 1 | 4 | 8 | 11 | 9 | 10 | 6 | 5 | 6 | 4 | 7 | 13 |
| 3 | 7 | 9 | 9 | 11 | 11 | 13 | 12 | 9 | 11 | 10 | 12 | 9 | 10 | 16 | 13 | 15 | 7 | 7 | 15 | 12 | 7 | 6 | 5 | 5 | 10 | 5 | 7 | 9 | 6 | 3 |
| 4 | 15 | 9 | 14 | 6 | 11 | 10 | 11 | 5 | 4 | 4 | 6 | 1 | 8 | 3 | 10 | 9 | 16 | 9 | 8 | 6 | 2 | 5 | 1 | 1 | 0 | 4 | 0 | 0 | 1 | 0 |
| Total | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Σ(f*s) | 189 | 169 | 183 | 158 | 174 | 173 | 180 | 156 | 150 | 148 | 152 | 118 | 153 | 142 | 174 | 169 | 172 | 158 | 156 | 150 | 125 | 129 | 104 | 83 | 91 | 113 | 104 | 99 | 94 | 94 |
| II | 3.78 | 3.38 | 3.66 | 3.16 | 3.48 | 3.46 | 3.6 | 3.12 | 3 | 2.96 | 3.04 | 2.36 | 3.06 | 2.84 | 3.48 | 3.38 | 3.44 | 3.16 | 3.12 | 3 | 2.5 | 2.58 | 2.08 | 1.66 | 1.82 | 2.26 | 2.08 | 1.98 | 1.88 | 1.88 |
| Rank | 1 | 8 | 2 | 10 | 4 | 6 | 3 | 12 | 15 | 16 | 14 | 18 | 13 | 17 | 4 | 8 | 7 | 10 | 1 | 2 | 4 | 3 | 6 | 12 | 11 | 5 | 6 | 8 | 9 | 9 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Consultant | 25 | 4 | 4 | 4 | 4 | 4 | 4 | | 4 | 3 | 3 | 4 | 0 | 3 | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 0 | 3 | 3 | 0 | 2 | 0 |
| | 26 | 4 | 2 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 3 | 3 | 0 | 2 | 2 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 0 | 0 | 0 |
| | 27 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 4 | 0 | 3 | 0 | 0 | 0 | 4 | 3 |
| | 28 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | 29 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| | 30 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 0 | 1 | 1 | 3 | 3 |
| | 31 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 2 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 3 | 3 | 2 | 1 |
| | 32 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 4 | 3 | 2 | 2 | 2 |
| | 33 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 0 | 1 | 2 | 3 |
| | 34 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 4 | 2 | 3 | 3 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | 35 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 3 | 4 |
| | 36 | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 | 2 |
| | 37 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 0 | 1 | 2 | 3 |
| | 38 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 4 | 3 | 2 | 1 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| **39** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 4 | 3 | 3 | 2 | 2 |
| **40** | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 | 2 |
| **41** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 4 | 3 | 0 | 1 | 2 | 3 |
| **42** | 4 | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 8 | 5 | 4 | 5 | 4 | 2 | 3 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 4 | 2 | 1 | 0 | 1 | 4 | 0 | 1 |
| 2 | 0 | 3 | 0 | 5 | 0 | 1 | 1 | 0 | 3 | 1 | 3 | 11 | 4 | 5 | 4 | 3 | 4 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 0 | 3 | 9 | 4 |
| 3 | 4 | 6 | 5 | 4 | 8 | 5 | 4 | 11 | 8 | 13 | 10 | 2 | 6 | 5 | 4 | 9 | 7 | 12 | 12 | 13 | 11 | 12 | 8 | 5 | 5 | 10 | 11 | 5 | 6 | 8 |
| 4 | 14 | 9 | 13 | 8 | 10 | 12 | 12 | 7 | 7 | 4 | 5 | 3 | 7 | 6 | 10 | 6 | 7 | 3 | 5 | 4 | 5 | 2 | 1 | 2 | 5 | 3 | 1 | 2 | 1 | 2 |
| Total | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Σ(f*s) | 189 | 169 | 183 | 158 | 174 | 173 | 180 | 156 | 150 | 148 | 152 | 118 | 153 | 142 | 174 | 169 | 172 | 158 | 156 | 150 | 125 | 129 | 104 | 83 | 91 | 113 | 104 | 99 | 94 | 94 |
| II | 3.78 | 3.38 | 3.66 | 3.16 | 3.48 | 3.46 | 3.6 | 3.12 | 3 | 2.96 | 3.04 | 2.36 | 3.06 | 2.84 | 3.48 | 3.38 | 3.44 | 3.16 | 3.12 | 3 | 2.5 | 2.58 | 2.08 | 1.66 | 1.82 | 2.26 | 2.08 | 1.98 | 1.88 | 1.88 |
| Rank | 1 | 8 | 2 | 10 | 4 | 6 | 3 | 12 | 15 | 16 | 14 | 18 | 13 | 17 | 4 | 8 | 7 | 10 | 1 | 2 | 4 | 3 | 6 | 12 | 11 | 5 | 6 | 8 | 9 | 9 |

| Respondents | | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Contractor | **43** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **44** | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 1 | 2 | 0 | 3 | 3 | 4 | 4 | 1 | 4 | 4 | 3 | 2 | 2 | 1 | 2 | 2 | 0 | 1 | 1 |
| | **45** | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 0 | 3 | 3 | 4 | 0 | 4 | 3 |
| | **46** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 |
| | **47** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 |
| | **48** | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 2 | 1 | 1 | 2 | 1 | 1 | 4 | 4 | 4 | 4 | 3 | 3 | 1 | 2 | 0 | 0 | 0 | 2 | 3 | 2 | 0 | 2 |
| | **49** | 4 | 4 | 4 | 4 | 0 | 0 | 4 | 1 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 1 | 3 | 0 | 3 | 3 | 3 | 3 | 0 | 3 | 0 | 0 | 0 |
| | **50** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 2 |
| | **51** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 0 | 4 | 4 | 3 | 0 | 0 |
| | **52** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 0 | 1 | 1 | 3 | 3 | 3 | 2 | 2 |
| | **53** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 2 | 2 |
| | **54** | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 3 | 3 | 3 | 2 | 2 |
| 0 | | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 5 | 5 | 2 | 0 | 4 | 4 | 2 |
| 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 1 |
| 2 | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 2 | 1 | 1 | 3 | 5 |

| Respondents | Causes of Cost and Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Causes of Time Overrun | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Question | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| 3 | 1 | 2 | 2 | 4 | 1 | 1 | 2 | 5 | 9 | 8 | 6 | 8 | 8 | 6 | 2 | 3 | 3 | 2 | 9 | 10 | 7 | 9 | 5 | 4 | 5 | 7 | 8 | 7 | 3 | 2 |
| 4 | 11 | 9 | 10 | 8 | 10 | 10 | 10 | 6 | 2 | 3 | 5 | 2 | 2 | 3 | 10 | 9 | 8 | 8 | 1 | 2 | 2 | 2 | 1 | 0 | 0 | 1 | 3 | 0 | 1 | 2 |
| Total | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Σ(f*s) | 189 | 169 | 183 | 158 | 174 | 173 | 180 | 156 | 150 | 148 | 152 | 118 | 153 | 142 | 174 | 169 | 172 | 158 | 156 | 150 | 125 | 129 | 104 | 83 | 91 | 113 | 104 | 99 | 94 | 94 |
| II | 3.78 | 3.38 | 3.66 | 3.16 | 3.48 | 3.46 | 3.6 | 3.12 | 3 | 2.96 | 3.04 | 2.36 | 3.06 | 2.84 | 3.48 | 3.38 | 3.44 | 3.16 | 3.12 | 3 | 2.5 | 2.58 | 2.08 | 1.66 | 1.82 | 2.26 | 2.08 | 1.98 | 1.88 | 1.88 |
| Rank | 1 | 8 | 2 | 10 | 4 | 6 | 3 | 12 | 15 | 16 | 14 | 18 | 13 | 17 | 4 | 8 | 7 | 10 | 1 | 2 | 4 | 3 | 6 | 12 | 11 | 5 | 6 | 8 | 9 | 9 |

# Appendix-C: Kendall Concordance Test

## For Cost overrun

| No. | Causes of cost Overrun | Code | Rank | (R-Rmean)2 |
|---|---|---|---|---|
| 1 | Delays in decision making | A1 | 17 | 59.44 |
| 2 | Change management ways | A2 | 40 | 233.78 |
| 3 | Change in the scope of the project | A3 | 8 | 279.22 |
| 4 | High competition in bids | A4 | 44 | 372.10 |
| 5 | Delay in progress payment by owner | A5 | 31 | 39.56 |
| 6 | The practice of assigning contract to the lowest bidder | A6 | 11 | 187.96 |
| 7 | Poor coordination and communication between construction parties | A7 | 32 | 53.14 |
| 8 | Incompetent in contract administration | A8 | 37 | 151.04 |
| 9 | Financial difficulties of owner | A9 | 40 | 233.78 |
| 10 | Right of way problem | A10 | 10 | 216.38 |
| 11 | Mistakes and Errors in design | B1 | 3 | 471.32 |
| 12 | Frequent design change | B2 | 9 | 246.80 |
| 13 | Inappropriate design | B3 | 17 | 59.44 |
| 14 | Incomplete design at the time of tender | B4 | 29 | 18.40 |
| 15 | Incompetent designers/incapable inspectors/ Inadequate experience | B5 | 15 | 94.28 |
| 16 | Unrealistic contract duration and requirements/ Inaccurate time and cost estimate | B6 | 9 | 246.80 |
| 17 | Late inspection/ poor supervision | B7 | 23 | 2.92 |
| 18 | Delay, Preparation and approval of drawings | B8 | 32 | 53.14 |
| 19 | Delay in inspection and approval of completed works | B9 | 36 | 127.46 |
| 20 | Inadequate planning and scheduling | C1 | 1 | 562.16 |
| 21 | Insufficient skilled and experienced labors | C2 | 14 | 114.70 |
| 22 | Poor project management system | C3 | 1 | 562.16 |
| 23 | Labour productivity/poor workmanship | C4 | 21 | 13.76 |
| 24 | Insufficient Numbers of equipment and labour | C5 | 14 | 114.70 |

| No. | Causes of cost Overrun | Code | Rank | (R-Rmean)2 |
|---|---|---|---|---|
| 25 | Lack of equipment efficiency | C6 | 13 | 137.12 |
| 26 | Poor site management and supervision | C7 | 5 | 388.48 |
| 27 | Construction material/Equipment unavailability and failure | C8 | 24 | 0.50 |
| 28 | Rework from poor material quality | C9 | 24 | 0.50 |
| 29 | Obsolete and improper construction method | C10 | 28 | 10.82 |
| 30 | Rework due to error in construction | C11 | 22 | 7.34 |
| 31 | Problems with subcontractors | C12 | 46 | 453.26 |
| 32 | Inadequate contractor experience/ Lack of experience | C13 | 30 | 27.98 |
| 33 | Unrealistic project cost frame | C14 | 17 | 59.44 |
| 34 | Poor resource management | C15 | 4 | 428.90 |
| 35 | Late delivery of materials and equipment | C16 | 20 | 22.18 |
| 36 | Cash flow and financial difficulties faced by contractors | C17 | 7 | 313.64 |
| 37 | Poor financial management system | C18 | 6 | 350.06 |
| 38 | Adverse Weather condition | D1 | 32 | 53.14 |
| 39 | Unforeseen ground condition | D2 | 26 | 1.66 |
| 40 | Natural disaster | D3 | 38 | 176.62 |
| 41 | Fluctuation in material price/ Escalation of material prices | D4 | 27 | 5.24 |
| 42 | Inflation | D5 | 32 | 53.14 |
| 43 | Accidents during construction | D6 | 49 | 590.00 |
| 44 | Laws and Regulatory Framework | D7 | 46 | 453.26 |
| 45 | Fraudulent practices and kickbacks | D8 | 38 | 176.62 |
| 46 | Acts of GOD | D9 | 43 | 334.52 |
| 47 | High interest rate charge by bank | D10 | 46 | 453.26 |
| 48 | Exchange rate fluctuation | D11 | 42 | 298.94 |
| 49 | Changing of bankers' policy for loans | D12 | 43 | 334.52 |
| | | | Sum (S)= | 9645.78 |
| | | | S*12 | 115749.37 |
| | | Mean= | 24.71 | 12xmx(m2-1)=117600 |
| | | | W= | 0.984263357 |

## For Time overrun

| No. | Causes of Time Overrun | Code | Rank | (R-Rmean)2 |
|---|---|---|---|---|
| 1 | Delays in decision making | A1 | 17 | 61.15 |
| 2 | Change management ways | A2 | 37 | 148.35 |
| 3 | Change in the scope of the project | A3 | 15 | 96.43 |
| 4 | High competition in bids | A4 | 45 | 407.23 |
| 5 | Delay in progress payment by owner | A5 | 27 | 4.75 |
| 6 | The practice of assigning contract to the lowest bidder | A6 | 11 | 190.99 |
| 7 | Poor coordination and communication between construction parties | A7 | 30 | 26.83 |
| 8 | Incompetent in contract administration | A8 | 36 | 124.99 |
| 9 | Financial difficulties of owner | A9 | 36 | 124.99 |
| 10 | Right of way problem | A10 | 3 | 476.11 |
| 11 | Mistakes and Errors in design | B1 | 9 | 250.27 |
| 12 | Frequent design change | B2 | 13 | 139.71 |
| 13 | Inappropriate design | B3 | 22 | 7.95 |
| 14 | Incomplete design at the time of tender | B4 | 33 | 66.91 |
| 15 | Incompetent designers/incapable inspectors/ Inadequate experience | B5 | 22 | 7.95 |
| 16 | Unrealistic contract duration and requirements/ Inaccurate time and cost estimate | B6 | 10 | 219.63 |
| 17 | Late inspection/ poor supervision | B7 | 15 | 96.43 |
| 18 | Delay, Preparation and approval of drawings | B8 | 17 | 61.15 |
| 19 | Delay in inspection and approval of completed works | B9 | 20 | 23.23 |
| 20 | Inadequate planning and scheduling | C1 | 1 | 567.39 |
| 21 | Insufficient skilled and experienced labors | C2 | 14 | 117.07 |
| 22 | Poor project management system | C3 | 2 | 520.75 |
| 23 | Labour productivity/poor workmanship | C4 | 20 | 23.23 |
| 24 | Insufficient Numbers of equipment and labour | C5 | 6 | 354.19 |
| 25 | lack of equipment efficiency | C6 | 5 | 392.83 |
| 26 | Poor site management and supervision | C7 | 4 | 433.47 |

| No. | Causes of Time Overrun | Code | Rank | (R-Rmean)2 |
|---|---|---|---|---|
| 27 | Construction material/Equipment unavailability and failure | C8 | 25 | 0.03 |
| 28 | Rework from poor material quality | C9 | 30 | 26.83 |
| 29 | Obsolete and improper construction method | C10 | 32 | 51.55 |
| 30 | Rework due to error in construction | C11 | 25 | 0.03 |
| 31 | Problems with subcontractors | C12 | 40 | 230.43 |
| 32 | Inadequate contractor experience/ Lack of experience | C13 | 27 | 4.75 |
| 33 | Unrealistic project cost frame | C14 | 33 | 66.91 |
| 34 | Poor resource management | C15 | 7 | 317.55 |
| 35 | Late delivery of materials and equipment | C16 | 12 | 164.35 |
| 36 | Cash flow and financial difficulties faced by contractors | C17 | 7 | 317.55 |
| 37 | Poor financial management system | C18 | 24 | 0.67 |
| 38 | Adverse Weather condition | D1 | 19 | 33.87 |
| 39 | Unforeseen ground condition | D2 | 28 | 10.11 |
| 40 | Natural disaster | D3 | 39 | 201.07 |
| 41 | Fluctuation in material price/ Escalation of material prices | D4 | 35 | 103.63 |
| 42 | Inflation | D5 | 43 | 330.51 |
| 43 | Accidents during construction | D6 | 48 | 537.31 |
| 44 | Laws and Regulatory Framework | D7 | 46 | 448.59 |
| 45 | Fraudulent practices and kickbacks | D8 | 41 | 261.79 |
| 46 | Acts of GOD | D9 | 42 | 295.15 |
| 47 | High interest rate charge by bank | D10 | 48 | 537.31 |
| 48 | Exchange rate fluctuation | D11 | 47 | 491.95 |
| 49 | Changing of bankers' policy for loans | D12 | 44 | 367.87 |
| | | | Sum (S)= | 9743.91 |
| | | | S*12 | 116926.89 |
| | | | Mean= 24.82 | 12xmx(m2-1)=117600 |
| | | | W= | 0.994276286 |

## For Impacts of poor time and cost performance

| No. | Impact of local contractors, poor Time and cost performance | Code | Rank | (R-R mean)1 |
|---|---|---|---|---|
| 1 | Loss of confidence and loss of reputation by the employer | I1 | 13 | 26.32 |
| 2 | Influence to meet, plan and program objectives of the stakeholders, especially the government. | I2 | 11 | 9.80 |
| 3 | Made the employer for additional cost and loss its investment return money lately | I3 | 15 | 50.84 |
| 4 | Loss of benefit to road users they get from the project | I4 | 8 | 0.02 |
| 5 | Additional cost on the contractor to keep its resources on the project site for a prolonged period of time (Prolongation cost), | I5 | 7 | 0.76 |
| 6 | Liquidated damage cost | I6 | 14 | 37.58 |
| 7 | Lead to poor cash flow to the contractor and lowering contractor's capacity development | I7 | 6 | 3.50 |
| 8 | Adversarial relationship between participants of the project, | I8 | 10 | 4.54 |
| 9 | Dissatisfaction by project owners and consequently by road users/the public, | I9 | 11 | 9.80 |
| 10 | Increase political pressure/ instability, | I10 | 8 | 0.02 |
| 11 | Impact on the overall development of the nation | I11 | 5 | 8.24 |
| 12 | Negative attitude towards the construction industry by the higher public authority and by the society as a whole, | I12 | 2 | 34.46 |
| 13 | The contribution of the construction industry to the growth of the national economy of the country will be less, | I13 | 4 | 14.98 |
| 14 | Weakens the growth of the construction industry by eroding mutual trust and respect, | I14 | 3 | 23.72 |
| 15 | Discourage investment on road construction projects by government | I15 | 1 | 47.20 |
| | | | Sum (S)= | 271.73 |
| | | | S*12 | 3260.80 |
| | | | Mean= 7.87 | 12xmx(m2-1)=3360 |
| | | | W= | 0.97 |