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INVESTIGATION ON CAUSE AND EFFECT OF COST OVERRUN USING SEM: (A CASE OF GOVERNMENT OWNED INDUSTRY PARK CONSTRUCTION PROJECTS)

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MSc Thesis On:

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A Thesis Submitted to the School of Civil and Water Resources Engineering of the Bahir Dar University in Partial Fulfilment of the Requirements for the Degree of Master of Science in Construction Technology and Management

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APPROVAL of thesis for defence result

I hereby confirm that the changes required by the examiners have been carried out and incorporated in the final thesis.

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As member of the board of examiners, we examines this thesis entitled by "Investigation on Cause and Effect of Cost Overrun Using SEM: (A Case of Government Owned Industry Park Construction Projects)" by Melkie Fenta. We hereby certify that the thesis is accepted for fulfilling the requirement for the award of the degree of Master of Science in "Construction Technology and Management."

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Declaration

This is to certify that the thesis entitled "Investigation on Cause and Effect of Cost Overrun Using SEM: (A Case of Government Owned Industry Park Construction Projects)", submitted in partial fulfillment of the requirements for the degree of Master of Science in in Construction Technology and Management under Civil and Water Resources Engineering, Bahir Dar Institute of Technology, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Melkie Fenta Mequanint	____________	**August 2022**
Name of the candidate	Signature	Date

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Abbreviations

AGFI	(Adjusted) Goodness of Fit
AIGC	Agro-Industrial Growth Corridors
AMOS	Analysis of Moment Structure
ANRS	Amhara National Regional State
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CMB	Common Method Bias
CR	Composite Reliability
CSF	Critical Success Factors
EFA	Explanatory Factor Analysis
ETB	Ethiopian Birr
FA	Factor Analysis
GDP	Growth Domestic Product
GOF	Goodness of Fit
GTP	Growth & Transformation Plan
IAIP	Integrated Agro-Industrial Park
IPDC	Industrial Park Development Corporation
KMO	Kaiser-Meyer-Olkin
NFI	Normed Fit Index
NNFI	(Non) Normed Fit Index
PCP	Programmes for Country Partnership
RII	Relative Importance Index
RMR	Root Mean Square
RMSEA	Root Mean Square Error of Approximation
ROW	Right of Way
RTC	Rural Transformation Centres
SEM	Structural Equation Modeling
SMC	Squared Multiple Correlations

SNNPR	South Nation Nationality & Peoples Region
SPSS	Statistical Package for Social Sciences
SRMR	(Standardized)Root Mean Square
TLI	Tucker Lewis Index
UNIDO	United Nations Industrial Development Organization's

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Abstract

Construction cost overrun is a major problem faced by the construction project in the world and it needs serious attention to improve. Many projects experience cost and thereby exceed initial contract amount. In Ethiopia, the number of projects is increasing from time to time. However, it becomes difficult to finish projects within the allocated cost and time. Taking under consideration the scarce financial resources of the country, cost is one among the main problems in Ethiopia.

Cost overrun is a result of one or more grouping of several causes, which are very essential to identify for effective cost performance. Existing practices focusing on the identification of causes does not give the insight of underlying relationships between the causes. Hence, this study focused on studying the fundamental relationship between factors of cost overrun using Analysis of Moment Structure-SEM method. This is an advanced multivariate analysis procedure for estimating and analyzing causal relationships in path models.

The main object of this study was to investigate the cause and effect of cost overrun of construction projects in case of government owned industry park construction projects. This research also prioritized the mitigation measure of cost overrun effect.

Questionnaire survey has been conducted on a total of 158 respondents from client, contractors and consultant to model the cause factors of project cost overrun using Structural Equation Modeling (SEM) approach via Analysis of Moment Structure (AMOS v23) software package. To rank the Methods of Minimizing of cost overrun using Relative Importance Index (RII). In addition, a detailed archival document review was conducted to get the actual essence of cost overrun of the project. Both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used for data reduction and identification of factor structures and validate study results, respectively.

Findings of the research shows that, Contractor Inefficiency are the most significant construct or group of factors causing cost overrun. Following Contractor Inefficiency, Improper Project Design are the second significant construct or group of factors causing affects cost overrun.

Client Incompetence, An Ineffective Contract Management and Construction Material Related Problems are the third, fourth and fifth significant construct or group of factors causing affects cost overrun.

The Cost overrun method of mitigation in the Amhara Industry Park Development Corporation projects mainly minimized by Proper cost control/cost performance management. Hire and motivate experienced and qualified workforce to improve productivity and quality of workshops and Appropriate scope of definition were the second and third main method of mitigation of the Project Overruns.

Keywords: Construction projects, Cost overrun, cause and effect, SEM.

CHAPTER-ONE

INTRODUCTION

1.1.Background of the Study

Construction industry now-a-days is being faced by continuing problems like delay in completion, low productivity, low quality and cost overrun etc., of these, cost overrun is the most significant issue faced in globally. Commonly, most of the projects faced cost overrun when executed (Oynaka, 2020) and these overruns produce immediate effects on construction stakeholders and on the country's economy.

Since the 1960s, more and more countries have embarked on the path of promoting industrialization and economic restructuring through industrial parks. For developing countries, industrial parks can maximize the mixing of resources of restricted factors of production within a selected space. By attracting the labor industry and capital investment in the manufacturing and service industry, industrial parks cannot improve employment opportunities, salaries and skills of local workers. In addition, we will participate in international competition and we will make a link to the global value chain by always using the comparative effect to promote the updating of industrial structures, and to always improve the country's position of the international labor sector. Currently, the industrial economy of the park is a global trend (Zhang et al., 2018).

An Integrated Agro-Industrial Park (IAIP) is one of the industrial park which is a geographic cluster of independent firms grouped together to gain economies of scale and positive externalities by allocation infrastructure and taking advantage of opportunities for bulk purchasing and selling, training courses and extension services.

Each IAIP is work for by a linkage of Rural Transformation Centres (RTC) which provide linkages to manufacturers. RTC is launch to serve as raw material aggregation points in the catchment areas (100 km radius) of each IAIP. Each rural transformation centres contain warehouses, input supply, sorting, grading, extension services, pre-processing activities and microfinance.

Ethiopian Minister of Industry disburse a large sum of money for the construction of IAIP which incorporate companies engaged in exporting value-added agricultural products to the world market in addition to domestic companies, farmers and youth which are the epicentre of agricultural commercialization.

In construction industry, it is necessary to have control on cost performance of projects to ensure the construction cost is within the budget. A project gets more technical and systematic when the project gets longer and more complex. This is because the project turn into necessary to integrate and coordinate human inputs and some of physical components within the four fundamental constrictions which are scope, cost, time and quality (Literate & Indonesia, 2020).

Construction industry is considered as a backbone for the economy in all countries where it is a key capital of different investments, which provides job opportunities for a huge number for experiences. In many countries, this industry accounts for 6 to 9% of the Gross Domestic Product (GDP) which is rising up to 10%. In addition, it is the main source of economic growth and provides about 10% of the country's GDP (Faten Albtoush et al., 2021).

Many factors are responsible for the increase in costs, such as underestimating costs to make projects more viable, increase scope through the later stages of project planning, during construction stage, changed conditions, etc. The amount of cost in large transport projects is project delays. In addition, the length of the project development phase from planning to construction is important factor for Cost-increasing (Turan and Lopez, 2006) (Oynaka, 2020).

The construction industry is an important industry that plays an important role in socio-economic development. The development of a country economically, it contributes to a significant improvement in the overall GDP of a country. It also improves the quality of life by providing the necessary infrastructure like Roads, hospitals, schools and other basic and improved facilities. Therefore, it is important to complete construction projects on time, within budget and successfully Quality. However, being a multifaceted, fragmented and schedule driven industry it always facing continuing problems such as low quality and output, cost overrun, time overrun, construction waste and others. From those problems, cost overrun is a many problem (Cantarelli, 2009, Olawale and Sun, 2010) because it affects the total development of any country (Oynaka, 2020).

Construction projects go through cost performance have the potential to become defaulted projects, with a resultant significant impact on all the projects' parties. For example: employers will be unable to use the facility, as the projects have not finished so far, and consultation and designing fees might increase. For contractors the impact could include loss of status and being "stuck" in only one project for long time (Aljohani, 2017).

Mostly, cost is a major attention in executing building projects because it includes a risk of investment failure. And also, cost efficiency measures the degree to which the general situations in the expected budget support the completion of a project. Nevertheless, construction projects look various challenges that hold back their completion within the specified budget. Cost overrun is a vital problem in the construction sector that may cause lower output, project delays and disputes between parties. Nowadays, this problem has become a frequent occurrence in most countries of the world. (Faten Albtoush et al., 2021) Thus, this study focuses on investigating the most important causes and effect of cost overrun in Amhara National Regional State (ANRS) Industry park construction projects.

1.2.Statement of the problem

Cost is one of the pillars in a project's success. The deviation of this pillar from the stipulated budget depends on the type of project and experience of similar projects before. Since the industry park project are an emerging industry in developing countries like Ethiopia, the investigation of cost overruns needs high attention.

Construction industry nowadays is facing several problem of poor cost management resulting in huge amount of cost overrun. The problem of poor cost management in project cost is serious issue in both developed and developing countries. The success measure for a project is defined by finishing it within specified cost, time and quality. However, the construction industry is full of projects that were completed with significant cost deviation (Amhed, Zahara & Juma, 2010) (Tsige, 2015).

Keeping construction projects within estimated costs and schedules needs sound strategies, good practices, and careful judgment. To the dislike of owners, contractors and consultants, however, many projects practice extensive suspensions and thereby exceed original time and cost estimations. This problem is more clear in the traditional or 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 (Hameed Memon et al., 2014).

Due to the dynamic nature of the construction industry, construction projects continue to face uncertainty, which makes cost management difficult, leading to poor cost performance. For this reason, poor cost performance has been considered as one of the most critical issues during the execution of public construction projects (Sinesilassie et al., 2018).

Throughout the project lifecycle, performance metrics are the drivers for innovation and corrective actions. They can help policy-makers and decision-makers and various related stakeholders understand how processes or practices lead to success or failure, improvements or inefficiencies, and how to use this knowledge to improve the results of methods, processes and activities.

Industry-wide measurements are needed to determine whether the overall situation is improving or decreasing over time. Various indicators can be used to track industry trends over several years to determine the root cause of improvement or decline. Project-level metrics are necessary to help understand how a single project compares to other similar projects in terms of cost, schedule, cost changes, work hours, and other factors. Such current measures are of the greatest value to multi-project owners and large contractors looking to reduce project costs and lead times, improve worker safety, or make some other changes to construction-related processes and practices (Oynaka, 2020).

The findings of the study conducted by Memon et al. (2012) revealed that 92% of construction projects of Malaysia were facing time overrun and only 8% of project could achieve completion within contract duration and 89% of respondents agreed that their projects were facing the problem of cost overrun with average overrun at 5-10% of contract price. The same is true for Nigeria and Kenya. Construction projects in Nigeria are also facing the same problem concerning cost and time. According to Akinsiku (2014) 42.3% of construction projects' time and cost performance is between 5-10% of the time scheduled and budgeted cost.

Report by Federal Democratic Republic of Ethiopian, Ministry of Urban Development, Housing and Construction (2014) on project performance status evaluation stated that among 14 public building projects under construction 8 projects, i.e. 57%, have failed to meet the planned percentage, (MOUDHD, 2014) (Anshebo, 2017).

According to Industrial park development in Ethiopia Case study report, currently, 17 areas with agro-industrial potential (Agro-Industrial Growth Corridors-AIGCs) were identified across the country and 4 pilot agro-processing industrial parks in Tigray, Amhara, Oromia and Southern

Nations, Nationalities and Peoples' are under construction and the remaining identified agro industrial potential will be start their constructions in the next phase(Zhang et al., 2018).

On this thesis, the researcher investigates the extent, causes and impact of cost overruns in Government Owned Industry Park Construction Projects in relation to contractual and organizational aspects and provides measures which can be used as an input to decrease the presence of cost increment in future projects.

1.3.Research Questions

a) To what extent has performance of industry park construction projects been achieved in terms of cost overrun?
b) What are the critical factors that affect the cost overrun of industry park construction projects in Amhara Industry Park Development Corporation?
c) What are the impact or effect of government owned enterprises' cost overrun in construction industry
d) What are the mitigation measure for cost overrun of government owned enterprises performance in construction industry

1.4.Objectives of the Study

1.4.1 General Objectives

The general objective of this study is to assess the cost performance of government owned enterprise on Amhara industry park construction projects.

1.4.2 Specific objectives

a) To assess the presence and extent of cost overrun in Amhara industry park construction projects.
b) To identify the causes of cost overrun and modeling cause factors using SEM Approach
c) To assess the major impacts of cost overrun in the construction projects.
d) To prioritize the mitigation measures of government owned enterprises' cost overrun in the construction industry

1.5.Significance of the study

The study significance on assessing the past and current status of cost performance practice in the construction projects of ANRS Industry Park Development Corporation. It is therefore, important to professionals and decision makers to look for the best reference, methods and process of doing and managing projects and to use and coordinate human, material and other resources efficiently and effectively. In addition, it will initiate to review the existing practices, methods of work and management system to improve the performance of industry park projects in ANRS Industry Park Development Corporation. Based on the findings, it encourages each stakeholder to play their role for the successful achievement of projects and effective utilization of resources.

1.6.Scope of the study

The scope of this study is the assessment of the cost performance of ANRS industry park projects. The study is covered the cost performance of the government owned enterprise in industry park projects overseen by ANRS Industry Park Development Corporation since the last five years (2017 -2021).The study is also bound by geographical, project stage, performance measurement parameters and Project years.

1.7. Limitations of the study

The study is limited only cover industry park construction projects under the ANRS industry park development corporation and the assessment of cause and effect of the cost overrun focus on government owned enterprise. Private clients, contractor and other construction sectors were not covered in this research.

1.8.Research Outline

This research comprises of five main chapters and Annexes which are described as follows:

Chapter one: Introduction: this chapter shows background of the study, statement of the problem, objectives of research, research questions, and gives an overview of cost performance in the construction projects.

Chapter two: Literature review: this chapter shows a detail review from concepts and definitions to identify the main factors affecting cost performance of construction projects which have been identified by previous researchers, the impacts of government owned enterprises' cost performance and managing project cost.

Chapter three: Research methodology: this chapter shows the methodology used in this research in order to achieve the required objectives and to answer the research questions.

Chapter four: Result analysis and discussions: this chapter shows result, description and discussion of research results.

Chapter five: Conclusions and recommendations.

CHAPTER-TWO

LITERATURE REVIEW

2.1. Introduction

A comprehensive literary review was conducted to develop a better understanding of the purpose of the research. Hence, the purpose of this chapter is to discuss about the definition of performance practice and its indicators from industry park construction perspective. It also identifies the factors which affect performance causes of cost overrun in construction projects by looking into previous studies carried out on the subject and the impact of cost overrun in the construction projects. In addition, it examines the proposed mitigation measure cost 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 Definition of Industrial Park

The industrial park concept is not an overlong. In fact, it has been around for decades and has grown over the past twenty-five years (Bonde-Henriksen1982). A study made in America by Industrial Development and Manufacturing Record, however, indicates that they have not evolved in a steady progression. Their emergence was motivated by concepts of regional policies and they were found in crisis areas of Great Britain in 1930s (Vidová12010). By1960, there were already 46 industrial parks.

Industrial park is defined as a track of land set aside for industrial purpose under the private management and control of developers or investors. Typically, it includes many designated sites.

Bonde-Henrikson (1982) Explains the Industrial Park as a Careful Plan Low-rise buildings are connected horizontally by wide lawns, wide rocks. Generally, the property has all the characteristics of an ideal industrial site, including installed utilities, highly accessible highways and rail connections, and finished grading.

According to the Ethiopian Industrial Park Proclamation, the term "industrial park" is defined as a place with a specific boundary for a comprehensive, integrated, multifaceted or selective development or selected purposes of industries, based on a planned fulfillment of infrastructure and various services such as road, electric power and water, one-stop shops and have special incentive schemes, with abroad view to achieving planned and systematic, development of industries, mitigation of impacts of pollution on environment and human being and development of urban centers, and includes specialized economic zones, technology parks, export processing zones, agro-processing zones, free trade zones, etc. designed by the Investment Board ("St. Mary's University," 2020).

2.3.Industrial Park Development in Ethiopia

It is un-doubtable that nations should reduce their dependency on the agricultural sector and supposed to be strong in the industrial sectors for sustainable economic prosperity and poverty reduction. The term industrial park is currently the most widely used term in Ethiopian economic policies and it is important to look at the diversification of resources into one place to understand a positive influence on actual use of resource, infrastructures and increase employment rate and productivity. The development of industrial parks should be one of the main objectives of the economy by allocating the industrial production and services sector in this way and focusing on improving the development of the park. In Ethiopia, in order to safeguard a proper management of the industrial parks, the Ethiopian federal government came up with the Industrial parks proclamation no. 886/2015 which states that industrial parks can be developed by any profitable public, public-private or private enterprise. The proclamation recognizes the establishment of the Industrial Park Development Corporation (IPDC), which is leading the development of large, medium and light industrial parks, and authorizes the development of integrated agro-industrial parks for the Ministries of Industry and Agriculture.

According to the proclamation, this investment is open to local and foreign investors. Industrial park developers have the right to develop their own industrial parks independently or in partnership with IPDC. With respect to large, medium and light industrial parks, Industrial Park Development Corporation (IPDC) is authorized to facilitate gaining of land and providing infrastructure (IPDC, 2015).At present the Corporation is aggressively engaged on building and developing industrial parks in Addis Ababa and other major towns. There are many industrial parks that already start operation, and more are under-construction and in the planning stage ("St. Mary's University," 2020).

2.4.Regional developed park----Integrated Agro- Industrial Park (IAIP)

Another type of industrial parks set in the country are integrated agro-industrial parks which is create a revolution in the agricultural sector. IAIP is a geographic cluster of companies that come together to share and use a variety of infrastructure to purchase, sell, train, extension services and other integrations. The IAIPs business model promotes the effectiveness of the commercial food supply chain. It is the end-to-end process that connects products to the market. Agro-industrial parks will be located 100 km from the Inputs and Commodities Market.

The development of IAIP is the leader project of the initiatives of United Nations Industrial Development Organization's (UNIDO) Programmes for Country Partnership (PCP), a model partnership for achieving Inclusive Sustainable Industrial Development has selected Ethiopia and Senegal for the model implementation of PCP following the Lima Declaration. The agro-processing industrial parks can further develop Ethiopia's agricultural sector, which supports the livelihoods for the majority of Ethiopians. It can also produce sustainable market linkage by establishing Rural Transformation Centers (RTC) that can improve production and productivity (Zhang et al., 2018).

Table 2. 1 Regional State Developed Parks (Source IPDC)

No	Name of Industry Zone	Location	Main industry	Progress	Size
1	Bure Integrated Agro-Industrial Park	Amhara	Agro-processing	Under construction	260.35ha
2	Bulbula Integrated Agro-Industrial Park	Oromia	Agro-processing	Under construction	263.09ha
3	Yirgalem Integrated Agro-Industrial Park	SNNPR	Agro-processing	Under construction	214.86ha
4	Baeker Integrated Agro-Industrial Park	Tigray	Agro-processing	Under construction	258.62ha

2.5. Purposes of Promoting Industrial Parks in Ethiopia

- At-traction of foreign capital and technology: foreign capital should ease the financing bottle necks e.g. for infrastructure of the modernization process, whereas technology transfer is vital to upgrading old production facilities, to improve production sizes and to promote the evolution from labor intensive to technology intensive production.
- Increase of foreign trade of export: The share of export-oriented production in development zones should equal 70% of the total production in order to settle the trade deficit caused by capital imports. Production for import replacement in the zones is only permitted for modern high-quality products ("St. Mary's University," 2020).
- Linkage Effects (cumulative effects of industrialization): There are two types of linkage effects: 1) backward linkage, whereby investments are made in anterior provinces to procure input for park production, i.e. natural resources or products of domestic suppliers flow to the park and 2) forward linkage whereby the output of park production flows to commercial customers outside for further processing. The success of linkage effects is critical for whether a zone functions as an isolated territory or a promoter of regional economic development.
- Learning effects (production related education effects): Learning by doing increase the production and management knowhow of the employees, which supports the upgrading of processes, the improvement of product quality and the creating of more efficient organizational structures.

2.6.Definition of Project Performance

Performance is defined as the level of performance of a particular task (TRADE, 1995). It is related to the stated objectives, which form the estimate of the project. In terms of project management, it is about meeting the needs of all stakeholders and project expectations. It always involves taking into account three major project components: time, cost and quality

Various literature and researchers have discovered that performance should not be considered only as the achievement of project schedule, time and quality. It is a broader concept that can be assessed taking different parameter relating to the objective of different parties for a particular project. Customer satisfaction, meeting specifications, health and safety, environmental responsiveness are some of the concerns when evaluating successful achievement of project objectives (Anshebo, 2017).

According to Flanagan and Norman (2013), the ultimate importance of project performance is attained through avoiding the project's failure to keep within cost budget, failure to keep within time specified for approvals, design, possession and failure to meet the required technical standards for quality, functionality, fitness for purpose, safety and environment protection. Kululanga and Kuotcha (2010) states that project performance confirms that enterprises maximize on profitability, minimize the consequences of risky and undefined events in terms of achieving the project's objectives and seizes the chances of the risky actions from arising.

Operational involvement of all the stakeholders in construction projects such as project owners, contractors, engineers as well as consultants is also serious in ensuring that their projects are completed within schedule and where possible with minor or no cost escalations. The profitability of any project will mainly be dependent on whether quality standards are met using the most economical approach (Viera Valencia & Garcia Giraldo, 2019).

2.7.Problem of Performance in Construction Industry

The failure of any construction project is primarily related to the problems and failures of Performance. Moreover, there are many reasons and factors for such a problem. Shaban SA (2008) identifies emerging performance problems in the construction industry developing economies can be divided into three stages: shortages or lack of industry infrastructure (mainly supply of resources), problems with customers and consultants, and problems caused by incompetence of contractors (Tagesse, 2017).

2.8.The Project success

A project success defined as achieving goals and objectives as set in the project plan. A successful project means that the project has accomplished its technical performance, sustained its schedule and keep on within budgetary costs (Frimpong, 2003). According to Thabiso, (2013) project success depends on five outcomes of project management, has to be, constructed within the expected duration of the project, within budget, with the right quality and in the correct environment and needs to be achieved safely. A project is a collection of activities to accomplish a definite objective. Project management involves planning, monitoring and control (Dadi, 2017).

The construction industry is sector of the economy, which is responsible for the planning, design, construction, maintenance and eventual demolition of buildings and works (Rohaniyati, 2009). Construction encompasses all civil engineering works and all types of new building projects (including housing), as well as the maintenance and repair of existing facility.

A construction in simple word is a process of constructing something by human for one purpose or another. It may be a road, bridge, dam, a private residence, an airport, commercial building, etc. (Addis, 2014) further define construction is the process the requirement and utilization of capital, specialized personnel, materials and equipment on specific site in accordance with drawings, specifications and contract documents prepared to help the purpose of an employer. According to concise oxford dictionary-tenth edition definition, "construction is the action or process of constructing the industry of erecting buildings" and building is a structure with a roof and walls. Construction business has complex in its nature because it covers a large number of parties such as employer, contractors, consultants, bank/insurances, regulators and others (Dadi, 2017).

The principle that 'project success is repeatable and it is possible to find certain success characteristics' has been the beginning of many research works in this area (Ashley et al. 1987). Several researchers identified, explained and discussed the factors that are critical to the success of a project. By 1982, Rockart used the word 'critical success factors (CSFs)' for the few key areas of activity in which positive results are absolutely necessary for a particular manager to reach his or her goals (1982). Further, Boynton and Zmud (1986) defined CSFs as those few things that must go well to ensure success for a manager or an organization, and therefore, they represent those decision-making or enterprise areas that must be given special and constant attention to bring about high performance (Sinesilassie et al., 2018).

Construction project is a task that undertaken to make a unique facility, manufactured goods or service within the definite scope, quality, time, and cost (Chitkara, 2004). In practice, still some construction projects run into cost overrun, delay on completion time or poor workmanship upon completion. Cost overrun, poor quality workmanship and delay of construction projects require a detailed investigation to improve the productions of the construction industry (Fetene Nega, 2008).

2.9.Construction industry in Ethiopia

Ethiopia's economy continues to grow Real Growth Domestic Product (GDP) grew by 10.3% in 2013/14, compared to the Growth & Transformation Plan (GTP) target of 11.2% in 2013/14. This significant growth was mainly attributed to the service sector (51.7%), agricultural sector (21.9%) and industrial sector (26.4%). The construction industry, on the other hand, accounted for more than half of the industrial sector's growth (53.1%) and 7.6% of GDP growth. This means that the construction sector is currently the leading industry in the country due to the expansion of construction of roads, railways, dams and residential houses (Ethiopia, 2014).

The construction industry trend in the past ten years shows a yearly growth rate of 12.43 % cited on (Zinabu & Getachew, 2015) (Dadi, 2017).

2.10. Cost Performance

Navon (2005) defined that performance measurement is a comparison between the planned and the actual performances of the specific project. For example, when a deviation is noticed, the construction management analyzes the reasons for it. The reasons for deviation can be schematically divided into two groups: (a) impracticable target setting (i.e., planning) or (b) causes creating from the actual construction process. In many cases the causes for deviation comes from both sources. Navon (2005) stated that performance measurement is needed not only to control current projects but also to bring up to date the historic database. Such updates allow better planning of future projects in terms of costs, schedules, labor allocation, etc. (Yismalet & Patel, 2020).

Cost performance is calculated through the comparison of final cost of a completed project and the initial or budgeted cost; it has been announced as a major benchmark of project success over the years (Aigbavboa & Thwala, 2020).

The cost increase is defined that the actual budget exceeds the planned budget. This is an unpredictable cost due to the low actual cost estimate during the budget / plan, which is more than the budgeted amount. The cost problem is a global phenomenon in the construction industry, and its effects are usually hard on owners, especially government owners, project managers and contractors (Anandhi and Makilan, 2017).

Project cost management should consider the following regular costs of using, maintaining, and supporting the impact of project decisions, product, service, or results. In addition, project cost management is explained, including planning, estimating, budgeting, financing, funding, and cost control so that the project is completed within the approved budget (Dadi, 2017).

2.11. Cost performance in the world Construction

The history of the construction industry worldwide abounds in projects that were completed with a significant amount of cost overrun, despite the use of modern technologies and software packages (Memon, 2013: 16). In the United States of America, only 16% of the 8,000 surveyed projects in 1994 could satisfy the following requirements: timely completion within the budget, and maintaining a high standard of quality (Ameh et al., 2010: 51). In Canada, 50 road construction projects were investigated, and the results revealed a cost overrun of up to 82% in 2006 (Odeck, 2014: 71) (Saidu & Shakantu, 2017).

Azhar et al. (2008) Top 10 Causes of Inflation in Pakistan Fluctuating prices, unstable prices for manufactured goods, high cost of machinery, low bidding processes, poor project management (poor cost control, delay in design and procurement stages, incorrect cost estimation methods, overwork, improper planning And unsupported government policies. Dissanayaka and Kumaraswamy (1999) found that purchase-related factors were the main cause of cost overrun in Hong Kong construction projects**.** Kaming et al. (2010) identified factors, which cause cost overrun in Indonesia, which include material cost and inaccurate material estimating. Endut May (2008) identified the five highest factors which cause cost overrun in Malaysia; changes in building codes was a most critical factor (Almaktari et al., 2017).

2.12. Cost performance in Ethiopian Construction

Cost performance for construction projects in Ethiopia is one of the most significant problems in the field of construction management. Research and studies in this field are few compared to the problem of and cost performance. Having this in to consideration, this research will be done assessing on cost performance in ANRS industry park construction projects. Despite the importance and the significant of the construction sector in Ethiopia, it is note that the parties of project (owner, consultant, and contractor) did not give sufficient evaluation for cost performance at the end of the project.

Cost overrun is a very common phenomenon and bulk projects in construction industry facing this problem. Cost overrun occurs when the final cost or expenditure of the project exceeds the original estimation cost (Issn, 2010). Angelo and Reina (2002) pointed out that cost overrun is one of the leading problems in construction industry. The problem cost overrun may found in both developing and developed countries. This problem is quite serious and further study on this issue is needed to reduce the problems. There are some factors contribute to cost overrun in construction industry which are originate from the researchers' study.

2.13. Causes of Cost Overrun

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

Olawale & Sun (2010) investigated the cost and time control of construction projects and found out that design changes, risks/uncertainties, inaccurate evaluation of project time/duration, complexities and non – performance of subcontractors are the main causes of cost and time overrun.

Durdyev et al (2017) examined cost overrun factors in Cambodia and establish out that project and cost management, project finance as well as project risk factors were the main factors of cost overrun. Johnson & Babu (2018) looked at cost overruns in UAE construction industry and noted that the main cost overrun factors were design variation, poor cost estimation, delays in client's decision making process, financial limitations of clients and inappropriate procurement method. Franca & Haddad (2018) analyzed the causes of construction projects cost overrun in Brazil and found out that the change of scope, lack of design detail during budgeting and high indirect cost in a period of low productivity were the main cost overrun issues. Seddeeq et al (2019) explored time and cost overrun in the Saudi Arabian oil and gas construction industry and concluded that altering of design and scope by client during construction, poor planning and scheduling of project, design errors, inadequate knowledge of scope of work at the bidding stage and underestimating of cost and schedules/ overvaluing benefits were the main drivers of cost overrun. Prasad et al (2019) investigated cost overrun factors in India and determined that delay in payment for additional work, delay in settlement claims by owner, contractor' s financial difficulties and late payment from contractors to subcontractors were the main cost overrun factors (Thabani, 2019).

(Rosenfeld, 2013) studied cost overruns in the construction of high-rise buildings in Indonesia, and mentioned factors such as whether conditions, materials cost escalation, inaccurate estimates of work quantities, project complication, and unexperienced contractors as main causes for cost overruns. In Nigeria, in infrastructure projects the main root causes of cost overruns are: poor contract management, price fluctuation, material shortage, frequent design change, weather, financing and late issuing of payments (Niazi & Painting, 2017).

Based on (Sohu et al., 2019), thirty common causes of cost overrun were recognized: inadequate planning, delay in payment process by client, owner interference, poor contract management, delay in decision making, shortage of material, instability in price of materials, financial difficulties by contractor, poor site management, natural disasters, change in material specifications and type, poor financial control at site, mistakes and errors in design, lack of experience of the technical consultant, additional works, mistakes and inconsistencies in contract document, accidents, poor design, severe overtime, fraudulent practices and kickboards, the relationship between management and labor, delay in approval, problems with neighbours, complex design, unskilled subcontractor, insufficient monitoring, incorrect site investigation, schedule delay, and high labor cost.

(Fetene Nega, 2008), explored the causes of high costs during construction and the impact on public construction projects in Ethiopia. Using a survey of 70 completed public construction projects in Ethiopia. The authors have assessed the impact of inflation on the supply of construction projects. As a result, 67 out of 70 public buildings were suffered cost overrun. The rate of cost over run ranges from a minimum of 0% to a maximum of 126% for individual projects. The main reasons for the increase in prices are inflation or increase in construction materials, lack of planning and coordination, changes in orders due to customer demand, and excessive increases during construction.

Table 2. 2 common factor of cost overrun identified from previous studies

Group/Constructs	Item	Description of Item	Source
An Ineffective Contract Management (ICOM)	**ICOM1**	Poor project planning & administration system	(Hemanta Doloi, 2012)
	ICOM2	Delay of payments	(Thabani, 2019)
	ICOM3	Slow and poor decision making	(Niazi & Painting, 2017), (Tebeje Zewdu, 2015)
	ICOM4	Lack of appropriate project supervision & reporting system	(Thabani, 2019)
	ICOM5	Lack of coordinating & managing project stakeholders	(Hemanta Doloi, 2012)
	ICOM6	Failure of taking law enforcement measure	(Rahman, Memon, & Karim, 2013)
	ICOM7	Resource management problems	(Rahman, Memon, & Karim, 2013)
Client Incompetence (CLICOM)	**CLICOM1**	Weak project management leadership skills & institutional capacity	(Enshassi et al., 2010)
	CLICOM2	Extra work order	(Durdyev et al., 2010)
	CLICOM3	Lack of arranging & delivering project site free of complain	(Asiedu & Adaku, 2020)
	CLICOM4	Financial problems	(Enshassi et al., 2010)
	CLICOM5	Holding key project decision	(Asiedu & Adaku, 2020)
	CLICOM6	Not scheduled construction inputs delivery	(Issn, 2010)
	CLICOM7	Lack of knowledge related to construction work	(Rahman, Memon, & Karim, 2013)
	CLICOM8	Late project fund preparation & allocation process	(Asiedu & Adaku, 2020)
Improper Project Design (IMPD)	**IMPD1**	Inadequate design & specification	(Sohu et al., 2019)
	IMPD2	Lack of sufficient skill and experience of the consultant teams	(Rahman, Memon, & Karim, 2013)

	IMPD3	Inadequacy of the procurement process	(Durdyev et al., 2010)
	IMPD4	Lack of full feasibility study before the design	(Sohu et al., 2019)
	IMPD5	Frequent design change	(Issn, 2010)
	IMPD6	Inadequate project time and cost estimation	(Issn, 2010)
	IMPD7	Slow design modification approval process	(Durdyev et al., 2010)
Construction Material Related Problems (MAT)	**MAT1**	Unscheduled delivery of construction materials	(Sohu et al., 2019)
	MAT2	Escalation of construction materials price	(Rahman, Memon, & Karim, 2013)
	MAT3	Inefficient construction materials quality test	(Durdyev et al., 2010)
	MAT4	Poor resource usage & controlling on the project site	(Sohu et al., 2019)
	MAT5	Use of low-quality construction materials	(Issn, 2010)
	MAT6	Depending on the import construction inputs	(Issn, 2010)
Project Stakeholders Coordination Influence (PSCIN)	**PSCIN1**	Lack of unified project planning system among project party's	(Niazi & Painting, 2017), (Tebeje Zewdu, 2015)
	PSCIN2	An existence of fraudulent practices among project parties	(Ikechukwu et al., 2017), (Tebeje Zewdu, 2015)
	PSCIN3	Lack of commitments to perform as an agreement	(Niazi & Painting, 2017)
	PSCIN4	Lack of effective communication and coordination among project parties	(Issn, 2010)
Contractor Inefficiency (CONIE)	**CONIE1**	Poor capacity of contractors (financial, technical, skill and experience aspects)	(Enshassi et al., 2010)
	CONIE2	Poor project site management & supervision	(Almaktari et al., 2017)
	CONIE3	Project overload	(Rahman, Memon, & Karim, 2013)

	CONIE4	Project team commitment problems	(Hemanta Doloi, 2012)
	CONIE5	Activities sequence problems	(Almaktari et al., 2017),(Rahman, Memon, & Karim, 2013)
	CONIE6	Lack of use of up-to-date construction types of equipment	(Ikechukwu et al., 2017)
	CONIE7	Incompetent sub-contractor	(Enshassi et al., 2010)
	CONIE8	Absence of satisfactory skilled construction professionals on the project site	(Almaktari et al., 2017),(Rahman, Memon, & Karim, 2013)
	CONIE9	Use of unqualified workforce	(França & Haddad, 2018)
External Factors (EXT)	**EXT1**	Riot around the Project Site	(Hemanta Doloi, 2012)
	EXT2	Laws and Regulatory Framework	(Tebeje Zewdu, 2015)
	EXT3	Accidents during construction	(Tebeje Zewdu, 2015)
	EXT4	Political Interference	(França & Haddad, 2018)
	EXT5	Currency Exchange Fluctuations	(Tebeje Zewdu, 2015)
	EXT6	Access to Project Sites	(Hemanta Doloi, 2012)
	EXT7	Natural disasters/Acts of GOD	(Hemanta Doloi, 2012)
	EXT8	Surrounding Social and Cultural Impacts	(Niazi & Painting, 2017) ,(Tebeje Zewdu, 2015)

2.14. Impacts of Cost overrun

Cost overruns have noticeable special effects for the key stakeholders in particular, and on the construction industry in general.

To the client, cost overruns indicates added costs over and above those originally agreed upon at the commencement, resulting in less profits on investment. To the end user, the added costs are delivered on as higher rental/lease costs or prices (Ikechukwu et al., 2017).

To the professionals, cost overrun indicates failure to bring value for money and could well discolor their reputations and result in loss of confidence idled in them by clients.(Ikechukwu et al., 2017).

To the contractor, it implies loss of profit for non-completion, and insult that could expose 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 building activities, bad reputation and failure to secure project finance or securing it at higher costs due to extra risks (Mbachu,et al 2004). All these costs weaken the viability and sustainability of the construction industry (Ikechukwu et al., 2017).

Cost overruns in construction projects touch both participants and business condition (Amoa Abban and Allotey 2014). These effects are not restricted to the project level, but they can spread to the industry level. The impacts of cost overrun in industrial level consist of; time overrun, disagreement, arbitration, total abandonment and litigation (Kikwasi 2012; Sambasivan and Soon 2007).According to Haseeb et al. (2011), the impacts of cost overrun can lead to slowing down the growth of the construction sector. The implication of these impacts is to slow down other development sectors. Therefore, grouping the cost performance is the first stage on mitigating the challenges (Tebeje Zewdu 2015) (Almaktari et al., 2017).

(Fetene Nega, 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 stakeholders of the project,

- Loss of reputation,
- High cost of supervision and contract management for consultants
- The contractor will suffer from a budget deficient of the client,
- Poor quality workmanship,
- Dissatisfaction by project owners and subsequently by end users,
- Bad attitude towards the construction industry by the higher public authority and by the society as a whole,
- The role of the construction industry to the growth of the national economy of the country will be less,
- Cost overruns on construction projects stop the planned increase in property and facility production from taking place, and this phenomenon in turn affects, in a bad way, the rate of national growth
- Weakens the growth of the construction industry by eroding mutual belief and respect
- Discharges 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 decline in the future,
- Creates doubtful outlook on assessment of other new construction projects,
- Some project owners (clients) become unwilling to effect additional payments to contractors and they sight the cost overrun as a fabricated matter. This will push to delay the project and become a cause of dispute among participants of the project,
- Creates frustration on stakeholders.

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

Table 2. 3 Major impact of cost overrun identified

S.No	Major impact of cost overrun	Code	Source
1	Adversarial relations among stakeholder	MI1	(Ikechukwu et al., 2017),(Fetene Nega, 2008)
2	Delay	MI2	(Taye, 2016),(Fetene Nega, 2008)
3	Bad reputation in ability to secure project finance	MI3	(Ikechukwu et al., 2017)
4	Supplementary agreement	MI4	(Fetene Nega, 2008)
5	Dissatisfaction by project owners and consequently by industry park users/the public,	MI5	(Taye, 2016)
6	Increase political pressure/ instability	MI6	(Taye, 2016) cause-effect-mitigation-best
7	Project abandonment	MI7	(Fetene Nega, 2008)
8	Made the employer for additional cost and loss its investment return money lately	MI8	(Ikechukwu et al., 2017)cause-effect-mitigation
9	Lead to poor cash flow to the contractor and lowering contractor's capacity development	MI9	(Ikechukwu et al., 2017)cause-effect-mitigation
10	Impact on the overall development of the nation	MI10	(Ikechukwu et al., 2017)cause-effect-mitigation
11	Negative attitude towards the construction industry by the higher public authority and by the society as a whole,	MI11	(Fetene Nega, 2008)
12	High cost of supervision and contract administration for consultants	MI12	(Fetene Nega, 2008)

2.15. Method of mitigation for Cost overrun

Some causes of cost overruns are unavoidable because they cannot be reasonably stopped. However, overruns due to design plan or project management problems are avoidable because they could have reasonably been predicted and prevented (Azhar et al.2008) (Almaktari et al., 2017).

Managing construction cost is one of the important tasks in attaining successful project completion. Unluckily it is very rarely attaining effective cost management and often experiencing important amount of cost overrun (Azis et al., 2013).

(Jongo et al., 2019) identified mitigation measures in dealing with delay and cost overrun in public building project, in which out of 25 mitigation measures, effective project planning and scheduling was ranked first; followed by monitoring design changes, and effective coordination and communication between parties. Furthermore, the respondents claimed on more attention to be paid on the progressively payment to the parties by the client; having accurate cost estimates; as well as appointment of competent site and project manager. Other included, complete contract administration; ensuring quick resolution in design change requests, issues and authorization report; efficient and effective planning time schedule for material procurement delivery process; developing effective strategic planning for solving identified risks; and confirming on the timely availability of finance.

(Taye, 2016) has found out fifteen main mitigation measure to improve cost performance

- Effective strategic planning
- Proper project planning and scheduling
- Effective site management
- Frequent progress meeting
- Proper emphasis on past experience
- Use of well experienced of subcontractors and suppliers
- Use of appropriate construction method
- Use up to date technology
- Clear information and communication channels
- Frequent coordination between the parties
- Perform a detailed study and planning before construction of project tasks and resources needs
- Developing human resources in the construction industry through training
- Comprehensive contract administration
- Systematic control mechanism

Table 2. 4 common mitigation methods for cost overrun identified

S.No	Mitigation method for cost overrun	Code	Source
1	Allow sufficient time for feasibility studies, design, planning and tender submission	MM1	(Asiedu et al., 2017)
2	Appropriate contractual frame work	MM2	(Asiedu et al., 2017)
3	Appropriate scope of definition	MM3	(Jongo et al., 2019)
4	Good coordination and communication between designer and contractor	MM4	(Ikechukwu et al., 2017)
5	Hire and motivate experienced and qualified workforce to improve productivity and quality of workshops	MM5	(Azis et al., 2013),(Jongo et al., 2019)
6	Increase supply of material	MM6	(Taye, 2016)
7	Elimination of waste at both professional and trade practice level	MM7	(Taye, 2016)
8	Bulk purchase of material	MM8	(Taye, 2016)
9	Proper cost control/cost performance management	MM9	(Jongo et al., 2019)
10	Risk management during project execution	MM10	(Jongo et al., 2019)
11	Studying of project history for possible application on another similar project	MM11	(Azis et al., 2013)
12	Establish training programs	MM12	(Jongo et al., 2019)

2.16. Summary of literature review and Research Gap

The literature review is done through previous studies, internet and journals. By referring to the previous literature, the information on cause of cost performance, Impact and mitigation measure of poor performance in the construction industry is observed.

The impact of cost performance is not limited 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 industry park community users they get from the project, additional cost, increase political pressure and adversarial relationship between the stakeholders.

Studies presented in various articles shows that the problem of cost increase is common to many countries and that the causes are repeated. The poor performance of public works in relation to cost increases and delivery times, compared to expected values, has been repeated in Brazil and other emerging countries (Santos et al., 2015) (França & Haddad, 2018). As the researcher has been working in the construction industry projects more than ten years, the researcher usually observe that they are routine, but neglected cost performance. According to Industrial park development in Ethiopia Case study report, currently, 17 areas with agro-industrial potential (Agro-Industrial Growth Corridors-AIGCs) were identified across the country and 4 pilot agro-processing industrial parks in Tigray, Amhara, Oromia and Southern Nations, Nationalities and Peoples' are under construction and the remaining identified agro industrial potential will be start their constrictions in the next phase(Zhang et al., 2018).

In addition, previous domestic scholars merely focused on identifying cost performance in the industry as a whole, instead. The researcher thought there were gaps to focusing on very specific recurrent situations and the study tried to answer the questions regarding factors of cost overrun, impact of cost overrun and mitigation methods related to those specific but recurrent situations. By taking this in to consideration, this thesis mainly focus on assessment of government owned enterprises cost overrun in Amhara industry park development corporation projects.

Table 2. 5 Summary of literature review and research gaps

Researchers	Summary of findings	Study gaps
A M Faten Albtoush (2021)	The researcher found that the most important causes were within four major components, such as financial difficulties, materials cost, design issues and additional works.	The Study only focused on cause of cost overrun in developing countries (in Jordanian projects) and did not assess the major constraint/challenges/ and mechanism for cost overrun mitigation. Further, the study was specific to Jordan.
E . G. Sinesilassie, S. Z. S. Tabish & K. N. Jha (2018)	The researcher found out that scope clarity and project manager's competence can significantly contribute to the cost performance of Ethiopian public construction project.	The study focused only on cause of cost overrun in the Construction industry with no review of cost overrun impact and mitigation measure. The Study focused all stakeholders' private and government it is General not specified. The method of analysis is RII method.
Aber Mohamed Almaktari, Ren Hong, Juma Nzige (2017)	The researcher found that political instability was the root cause of factor affecting cost overrun in the construction industry of Yemen	The study focused only on cause of cost overrun in the Construction industry with no review of cost overrun impact and mitigation measure. The study was based in Yemen and thus the context is different. There is therefore a need to do for a specific construction sector.
Fetene Nega (2008)	The researcher found out that most common causes of cost overrun are inflation or increase in the cost of construction materials, change in foreign exchange rate (for imported materials), change orders and/or lack of control on excessive change orders, failure to identify problems and institute the necessary and timely actions	The study focused only on cause and impact of cost overrun in Public Building Construction Projects with no review of cost overrun mitigation measure. The method of analysis is RII method.
Negalign Nigatu Oynaka (2020)	The researcher found that socio political factors, economic factors, Managerial factors, construction techniques and design, time lines of payment and financial factors are positively or cost overrun in construction project in Arba Minch town	The study focused only on cause of cost overrun in Public Building Construction Projects with no review of cost overrun impact and mitigation measure. The method of analysis is RII method.

CHAPTER-THREE

RESEARCH 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, Research design, data and information sources, research instruments, sample size and method of analysis are presented.

3.2. Study Area Description

The study was conducted in south West Amhara region in Burie integrated agro Industry Park whose total area of the IAIP is 154.99 hectares. And seven rural transformation centres (Motta, Merawi, Dangila, Ingibara, Chagni, Finoteselam and Amanuel) which serve as raw material aggregation points in the catchment areas (100 km radius) of Burie IAIP. The study areas are found within three neighbouring zones namely West Gojjam, East Gojjam and Awi administrative zones.

3.3. Research Design

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

The research tries to explore, examine and identify the cost performance of government owned enterprise and it implements more of descriptive research design is used because the purpose of the study is more of describing the existing situation and identifying the cost performance of government owned enterprise.

For this study, the researcher was apply both a qualitative and quantitative research approach. Quantitative data is obtained using questionnaire survey whereas qualitative data is collected through interviews, field observation and document analysis.

On the basis of the data and information sources the research instruments were decided and available document sources relevant to the research were reviewed. The review includes journals, articles, and archival documents such as contract agreements, monthly progress reports of contractors and monthly report of the client representative. In addition to this different literatures and software tutorials are studied to adopt the Structural equation modeling (SEM) for this research.

The research was carried out having a three-phased approach in order to achieve the aims and objectives of the research. It was attempted to collect data from the employer (ANRS Industry Park Development Corporation), the Consultants and the Contractors engaged in the project to assess the cost Performance aspects of Amhara Industry Park Construction Projects.

After a literature in-depth review and desk study, a questionnaire was designed and distributed to contractors, consultants and the employer to get their professional responses for the research questions.

3.4. Population

The population for this study was the number of industry park construction projects constructed by Government owned enterprise whose employer is ANRS industry park Development Corporation. The project that is completed for the last five years (from 2017 to 2021) and projects whose current progress reached more than 70% of the accomplishment is considered as a population of the research. The second population is the number of professionals who have been directly participated on the population projects. The population consists of contractors, consultant and client. The list of government owned enterprise (contractors and consultants) currently involved in Amhara industry park construction projects was obtained from the Amhara Industry Park Development Corporation.

The total number of industry park projects that had been constructed during this period were 25. The respondents included in the survey comprised of a total of 158 professionals: 8 from owner, 100 from contractors and 50 from consulting firms. 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.

3.5. Sample size determination

The target groups in this study were Amhara Integrated Agro-Industry Park and RTCs construction projects and their participants that are owners, contractors and consultants.

Structural Equation Modeling (SEM) is employed to test the hypothesis in this study. The main criteria for SEM is the sample size, the sample size for SEM should be at least with a range of 100 – 200 (Mulugeta, 2015).

From a total of 25 projects were which is obtained as sample projects and a number of professionals who directly participated on selected sample projects representing each organizations were taken as sample of second population. The table shows number of professional working for each participating organizations on selected sample projects. Three respondent groups participated in the questionnaire survey. These are contractors, consultant and client.

Table3.1. the total number of professionals participated on the selected sample projects

S.No	@ Project Level			
	Stakeholders Name	No Of projects	Minimum number of professional deployed by stakeholders	Total number of professional deployed by stakeholders
1	Client	25	-	-
2	Consultants	25	2	50
3	Contractors	25	4	100
Total				150
S.No	@ Head Office Level			
	Stakeholders Name	No Of projects	Minimum number of professional deployed by stakeholders	Total number of professional deployed by stakeholders
1	Client	25	8	8
2	Consultants	25	0.5	10
3	Contractors	25	0.5	12
Total				30
Total (Project Level+ Head Office Level)				**180**

3.6. Sample Technique

The purpose of sampling is used for data collection. The study were adopted purposive sampling technique to select the contractors, consultants, clients and other civil engineer professionals. This technique is preferred because purposive sampling allows the researcher to select respondents who have good knowledge about the subject in question and case study. The questionnaires were distributed for contractors and consultants at their offices and sites and for the owner the questionnaires were distributed at the office.

3.7. Data Collection

3.7.1. Primary data

The source of the primary data was collected through distributing a closed ended questionnaire through in person. The primary objective of the survey was assessing the presence or absence of cost overrun. The Second objective was to identify the main cause factors of cost overrun if the Amhara Industry Park projects faced cost increment during their implementation.

3.7.2. Secondary Data

The secondary data was gathered through reviewing related literatures for questionnaire designing and archival documents such as contract agreements, monthly progress reports of contractors and monthly report of the client representative were studied to actual project data and these were included with the survey result in the Analysis and Discussion chapter

3.8. Method of Analysis

The results of the questionnaires were analysed 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 analysing the data were: Relative Importance Index (RII) and SEM based Cause factors modeling. This was followed by in-depth discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

3.8.1. Relative Importance Index (RII)

Relative important index method is adopted to establish the relative importance of Method of Mitigation for cost overrun in Amhara Industry Park Construction 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 research, a 5-point Likert scale (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree) was used to assess the degree of mitigation method of cost overrun. It is used to calculate the importance index for each factors that is used to determine the relative ranking.

$$RII = \sum \frac{W}{A * N} \qquad \text{Equation 1}$$

Where: -

RII= relative importance index

W= weighting given to each impact by the respondents and ranges from 1 to 5 where '1' is Strongly Disagree and '5' is Strongly Agree,

A = highest weight (i.e. 5 in this case), and

N = total number of respondents

3.8.2. Structural Equation Modeling (SEM)

Why SEM?

SEM is an addition of the general linear model (GLM) that allows a researcher to test a set of regression equations concurrently. SEM has a number of attractive qualities (Cain, 2021)**.**

- Assumptions underlying the statistical analyses are clear and testable, giving the investigator full control and possibly advancing understanding of the analyses.
- Graphical interface software increase creativity and facilitates rapid model servicing (a feature limited to selected SEM software packages).
- SEM programs provide complete tests of model fit and individual parameter estimate tests simultaneously.
- Regression coefficients, means, and variances may be compared concurrently, even across multiple between-subjects groups.
- Measurement and confirmatory factor analysis models can be used to eliminate errors, making estimated relationships among hidden variables less contaminated by measurement error.
- Ability to fit non-standard models, including flexible management of longitudinal data, files with auto correlated error structures (time series analysis), and folders with non-normally distributed variables and incomplete data.

Structural equation modeling method is similar to linear regression analysis, it has several advantages. Some of the features that pass the structural equation modelling are summarized below. These superior features distinguish structural equation modeling from other classical linear modeling approaches (Çelik & Yılmaz, 2013)(Civelek, 2018).

1. It tells the relationship among hidden structures that are not directly measured.
2. Possible errors in the measurements of the observed variables are taken into consideration. The common regression approach assumes no measurement error.
3. It is a very useful method to analyze highly complex multiple variable models and to reveal direct and indirect relationships between variables.

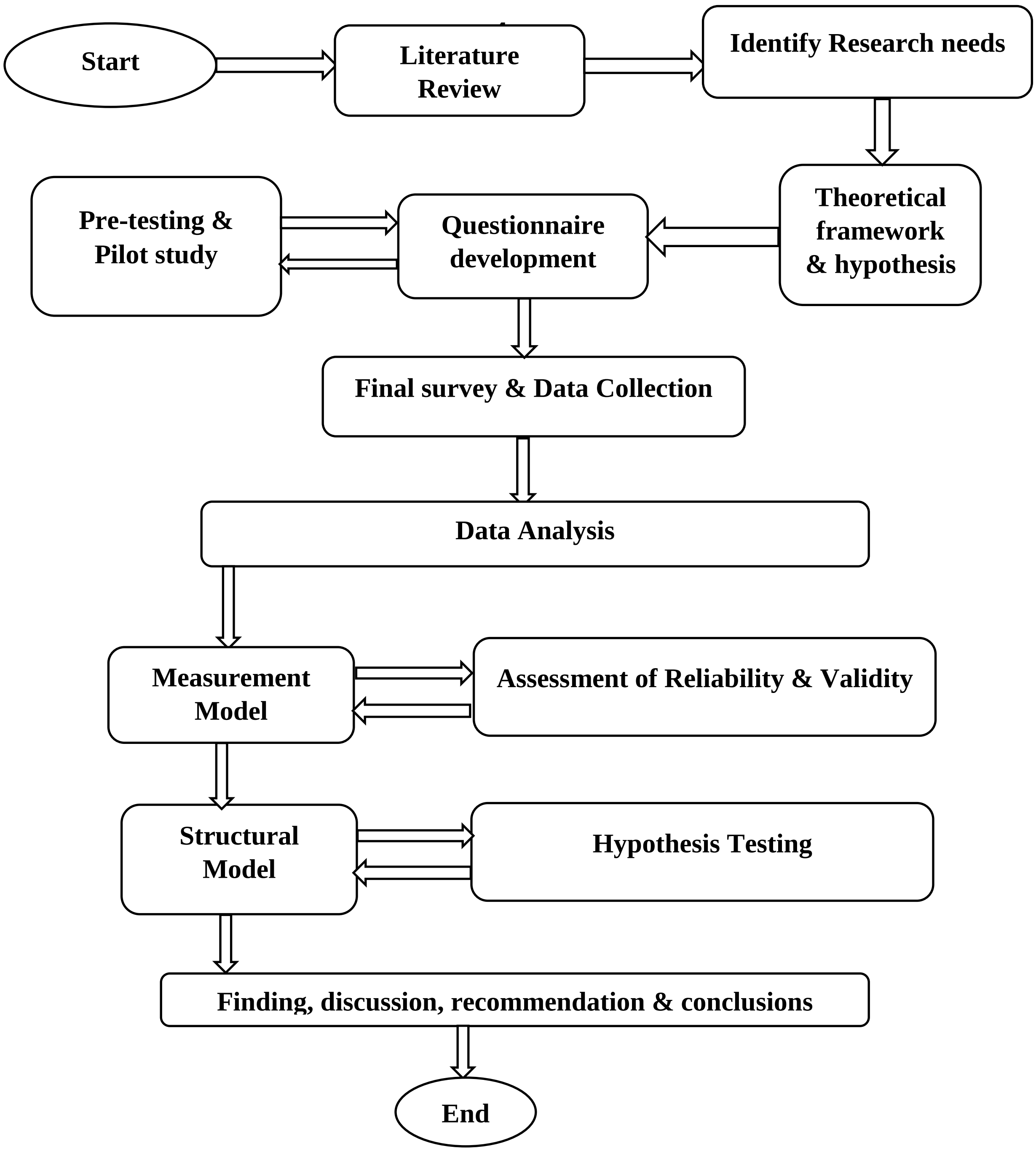

Figure 3. 1: Research Design

3.9. SEM Procedural Methods

Depending on the main objective of the study, the researcher undertakes the data analysis process in order to transform the raw data to relevant, valid, and meaningful summary. Following this, raw data was collected and cleaned properly for further analysis. After the data is cleaned Explanatory

Factor Analysis (EFA) is done to obtain the rotated component matrix which is used as an input for Confirmatory Factor Analysis (CFA). CFA is used to test the validity of the data and used as an input for SEM (Structural Equation Modeling). Under SEM two models were analyzed measurement model and structural model. All the descriptive and inferential statistics were analyze using SPSS v23 and AMOS v23 software's.

3.9.1. Evaluation of Outer Model

Assessment of the outer model (measurement model) is to see the reliability and validity of the constructs of the model (Hameed Memon et al., 2013). It determines how fit the indicators (specific questions) load on the hypothetically defined constructs. This can be carryout in two steps as:

a) Indicator reliability and convergent validity.
b) Discriminant validity of the research instruments ((Rahman, Memon, Azis, et al., 2013).

A. Convergent validity of constructs

Convergent validity is the degree of the internal consistency. It is estimated to confirm that the items assumed to measure each latent variable measures them and not measuring another latent variable (Fornell & Larcker, 1981; Hulland, 1999). (Hameed Memon et al., 2013).

Convergent validity of the construct can be determined by calculating single item reliability, Cronbach's alpha, Composite reliability (CR) and Average Variance Extracted (AVE) as mentioned by (Hameed Memon et al., 2013).

Individual Item Reliability is the extent to which measurements of the latent/hidden/ variables measured with multiple-item scale reflects mostly the true score of the latent variables relative to the error. It is measured by calculating standardized loadings of each variable where items with loadings of less than 0.4 should be deleted (Hameed Memon et al., 2013). While (Chin, 1998) recommended that item with loading lesser than 0.5 should be dropped.

Cronbach's Alpha is the second measure of the reliability of internal consistency. It deals how well a fixed of items or variables measures a single one-dimensional latent construct. (Rahman et al., 2022) recommended that value of cronbach alpha should be higher than 0.7.

Composite Reliability (CR) measure is used to check how fine a construct is measured by its allocated indicators. However, the understanding of composite reliability score and Cronbach's Alpha is the same. (Terzioglu et al., 2022) suggested 0.7 as a benchmark for 'modest' composite reliability.

Average Variance Extracted (AVE) is used to measure the internal consistency of the construct by measuring the amount of variance that a latent/hidden variable captures from its measurement variables comparative to the amount of variance due to measurement errors.(Ayele, 2019).

A basic theory is that the average covariance among indicators has to be positive. Barclay, Thompson, and Higgins (1995) and Hair et al., (2011) identified that AVE must be higher than 0.5. This means that at least 50% of measurement variance is taken by the latent variables.

B. Discriminant validity of constructs

Discriminant validity indicates the degree to which a given construct is altered from other constructs (Hulland, 1999)(Rahman, Memon, Azis, et al., 2013). It is tested through investigation of average variance extracted by using the conditions that a construct should share more variance with its measures than it shares with other constructs in the model (Fornell & Larcker, 1981). This is observed by comparing the AVE of construct shared on it and other constructs. For valid discriminant of construct, AVE shared on it must be greater than variance shared with another constructs (Kassem et al., 2020).

Analysis of measurement model

During the analysis of the measurement model the following validity and reliability indices were taken into consideration based on the work of HENSELER et al., (2009); HAIR et al., (2010); NYÍRŐ, (2011); GASKIN, (2012); NEMANN-BÓDI, (2013) (Ráthonyi, 2016).

- ❖ Examination of direct standardised weights related to reflective indicators (expected value above 0.7) and explained variance (expected value above 0.5).
- ❖ Examination of composite reliability of latent concept (expected value above 0.7).
- ❖ Examination of average variance extracted of latent variable (expected value above 0.5).
- ❖ Examination of discriminate validity with the analysis of the difference between

AVE and CR.

Construct Validity

Construct validity used to test how the researcher translated or converted a concept, knowledge, or behavior that is developing a hypothesis into effective and operative reality, the operationalization. Before assessing, the structural model and testing the research hypotheses, it is necessary to assess construct validity further through CFA after the fundamental factor structure for each of the theorized research constructs are determined through EFA (Civelek, 2018). The two components of construct validity are: convergent and discriminant validity.

Convergent Validity

The extent of the relationship between an observed variable and a latent construct is directly measured by construct validity. Always convergent validity is attained when the relationship between observed variable and latent construct significantly is different from zero when represented by factor loadings. Furthermore, regression weights, standardized regression weights and squared multiple correlations (SMC) can be calculated to assess convergent validity. Standardized regression weights should be above 0.5, with values of above 0.7 optimal (Zhao et al., 2019). SMC are squared standardized factor loadings and represent the extent to which a measured variable‘s variance is explained by a latent factor (Hair et al, 2006). SMC can also be used to measure item reliability. An SMC between 0.3 and 0.5 indicates that the item is a weak but adequate measure of the construct (Holmes-Smith, 2007). An SMC of 0.5 calculates to a standardized loading of 0.7, which indicates that the item reflects the construct very well (Beyene et al., 2020).

Discriminant Validity

Discriminant validity is the degree of the level at which a structure in a measurement model differs from other structures. It is an indicator of a low correlation between the questions that form a construct and other questions that form other construct (Civelek, 2018). It is tested through examination of average variance extracted by using the conditions that a construct should share more variance with its measures than it shares with other constructs in the model (Fornell & Larcker, 1981). This is observed by comparing the AVE of construct shared on it and other constructs. For valid discriminant of construct, AVE shared on it should be higher than variance shared with other constructs (Ayele, 2019).

3.9.2. **Evaluation of Inner Model**

Inner model (structural model) assessment is carried out to evaluate the relationship between exogenous and endogenous latent variables in respect of variance accounted (Hulland, 1999). It also defines the explanatory power of the model by assessing squared multiple correlations (R^2) and path co-efficient (β) values, where R^2 shows the percentage of a construct's variance in the model, whereas the path coefficients indicate the strengths of relationships between constructs (Chin, 1998).

According to (Kassem et al., 2020) R^2 of endogenous can be assessed as substantial =0.26, enough =0.13 and weak=0.02. For path coefficient assessment, β value of all structural paths is compared, highest β value indicates that effect of the construct is most significant and lowest value shows the lowest outcome of construct on endogenous latent variable.

3.9.3. **Performance of Model**

Performance of the developed model was evaluated with in two-step process as

a. Outer model assessment to examine the reliability and validity of the construct, and
b. Inner model assessment to evaluate the relationship between exogenous and endogenous latent variables (independent latent variables and dependent variable) in respect of variance accounted for (Hameed Memon et al., 2013).

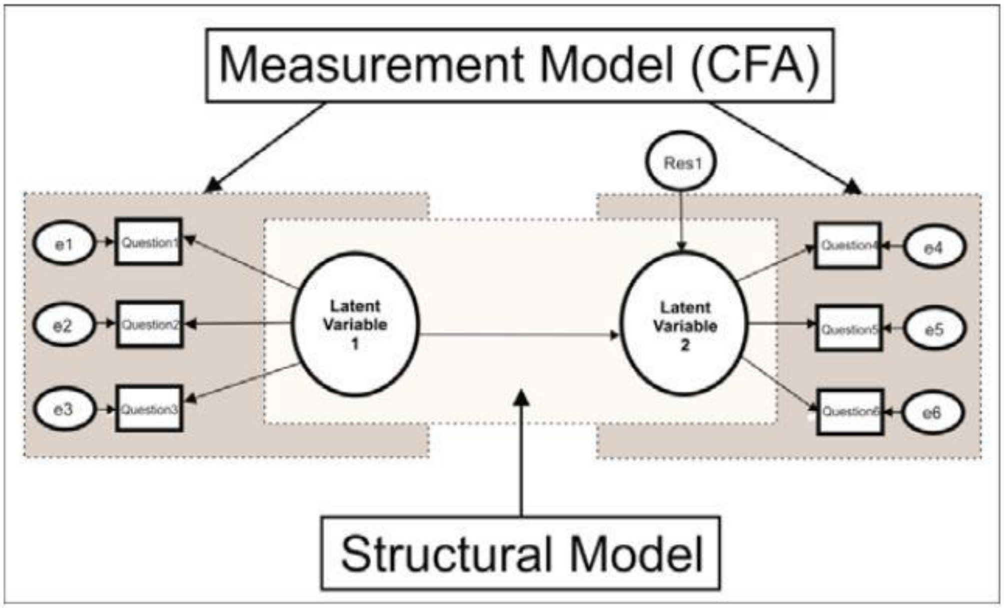

Figure 3. 2 Demarcation between Measurement Model and Structural Model

Source: Byrne, B. M. (2010). Structural Equation Modeling with AMOS. New York: Routledge Taylor & Francis Group. (Civelek, 2018).

3.10. Case study

Besides, conducting questionnaire survey on the selected sample projects, this research also use case study on selected projects for prevailing factors affecting their cost performance.

For the case study data such as final payment certificate from the client or the consultant for completed project, progress report of the ongoing projects are collected. Based on the current progress and condition of their cost performance, identified factors for poor cost performance, impact of poor cost performance and their mitigation measure for cost overrun were analyzed as per the set questionnaires.

Case studies can be single or multiple-case designs, where a multiple plan must follow a repetition rather than sampling judgement. Yin (1994) pointed out that generality of results, from either single or multiple designs, is made to model and not to populations. Multiple cases strengthen the results by replicating the pattern-matching, thus increasing confidence in the robustness of the theory (Nikmatuzaroh, 2019).

Yin (1994) identified six major sources of evidence for case study research. The use of each of these might need different skills from the researcher. Not all sources are necessary in every case study, but the importance of multiple sources of data to the reliability of the study is well established (Stake, 1995; Yin, 1994). The six sources acknowledge by Yin (1994) are:

- documentation,
- archival records
- interviews,
- direct observation,
- participant observation, and
- Physical artifacts.

3.11. Ethical Consideration

The researcher guarantee the ethical undertaking of the research by obeying to the following ethical standards of doing research. Informed consent, Voluntary participation, Confidentiality and secrecy of the respondents. Prior to data collection, letter issued from concerned administrative bodies of Bahir Dar University to different Government owned enterprise from where valuable information has been obtained for the research. The public bodies or the client, consultants and Contractors under the study was also informed about the study and a formal letter was obtained. During data gathering, each respondent was informed about the purpose, scope and expected outcome of the research, and appropriate written consents was taken from the respondents. Anyone who was not ready to participate was excluded from the study.

3.12. Data coding

While analyzing the questioner the author has coded factors (research variables). The coding is according the sequential arrangement on the questioner. First, the group of variables (exogenous latent variables) has been coded taking the first letter of the group name e.g. An Ineffective Contract Management coded as (ICOM) and the variables under this group coded according to their sequence like Poor project planning & administration system (ICOM1), Delay of payments (ICOM 2) and so on. For the analysis of major Impacts of the cost overrun of the Amhara Industry Park Construction projects, coding for major impact taken as MI and MI1, MI2, M3 were coded for major impacts listed in the questionnaire in their sequential manner. This coding style also used for proposed Mitigation Measure methods like MM1, MM2 in their sequential manner.

CHAPTER-FOUR

RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter presents the contents of the questionnaire findings and the archival facts of different documents of the project. The questionnaire used to identify the presence of cost overrun, to model the main causal factors with through SPSS statistical package and AMOS 23.0 cost overrun, to rank the mitigation measures being used to avoid the occurrence of cost overrun for future Industry Park projects in Amhara region.

The questionnaire survey was conducted being inclusive of key professionals from major stakeholders of the project, these are the client, the consultants, and the contractors.

4.2. Pilot Study Results

It was essential to pilot test the questionnaire prior to its use within this study in order to examine the validity and reliability of the instrument and to improve the questions, format and scales. A pilot study was conducted with 16 respondents who have experience in construction projects in government owned enterprises, Amhara Region, examined and answered the questionnaire survey. They have more than 10 years working experience, both in the construction industry and in their current organization.

The main purpose of the pilot study was to confirm the readability and clarity of the questionnaire items and to check if the data collected answers the examined questions and provide face validity (Zhao et al., 2019).

Based on the feedback and suggestions from the participants, minor changes were suggested on the questions wording and the questionnaire layout by the respondents, and thus face validity was established. Respondents also suggested two deletion constructs and some items. The researcher then analyzed the data to discover any drawbacks or potential threats within the questionnaire items and thus decisions can be made regarding the items to be deleted, kept or even added.

4.3. Testing for Non-Response Bias

The two forms of non-response are item non-response and unit item non-response. Sometimes respondents doesn‘t answer certain question such non-response is called item non-response. Unit non-response occurs when some individuals totally refuse to answer the questions or cannot be contacted. When one of the two non-responses occurred, bias will occur (Tarhini, 2018). The possible bias that occurred due to non-response increases with the size of non-responding group. Any research conducted using questionnaire necessary to be tested for non-response bias. Most of research texts list these rules: e.g., "A response rate below 60% is a disaster, and even a 70% response rate is not much more than minimally acceptable" (Willimack, Lyberg, Martin, Japec, and Whitridge, 2004)(Beyene et al., 2020). For this study, 180 respondents receive the questionnaires and 168 usable responses were collected with 93% response rate. Since the response rate is higher, there is no worry for response bias.

4.4.Analysis of Questionnaire Response

To perform a comprehensive study on assessment of the presence, causal factors, impacts and mitigation methods of cost overrun of Amhara Industry Park Construction projects a total of 180 respondents were selected after Pilot study was conducted and the questionnaire get advancement. Among out of those 180 respondents 168 questioners were collected giving a response rate of 93.0 % and from 168 questioners, which were, collected 10 questioners were found to be invalid due to lack of full information given by the respondents. Therefore, valid response rate of 88% was obtained. On the basis of these 158 questioners analysis was conducted to determine the presence of the project overrun and model the causal factors that attribute for cost overrun.

Table 4. 1 Questionnaire response rate

Respondents Category	*Questioner Distributed*	*Questioner Received*	*Percentage Collected*	*Valid Response*	*Valid Response Rate*
Client	8	8	100.00%	8	100.00%
Consultants	60	55	91.67%	50	83.33%
Contractors	112	105	93.75%	100	89.29%
Total	180	168	93.33%	158	87.78%

4.5.Respondents Academic Background and Work Experience

Total of 158 participants working for client, consultant and contractor with percentage 5.1%, 31.6%, and 63.3% respectively responded in this study. Among the total proportion 13.3% Project Manager, 8.9% of participants were resident engineers, 8.9% of participants were material engineers,31.0% were office engineers, 22.2% were site engineers, 17.7% were contract engineers while the remaining 0.6% were others. Regarding educational level, the majority of participants, 51.9%, have educational qualification of master Degree. 48.1% of participants were having educational level of first degree. 29.1% have work experience greater than 10 years, 67.1

% of participants have work experience between 5-10 years while the remaining 3.8% have work experience less than 5 years. Regarding organization, 63.3% of participants were contractors' employees, 31.6% were consultants' employees and 5.1% were client employees.

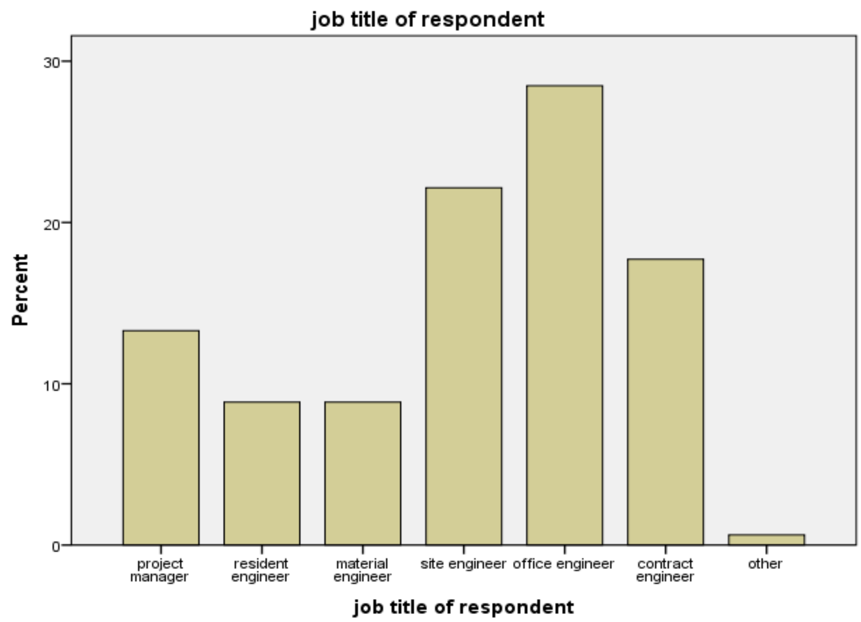

Figure 4 1: Title of respondent Group.

Figure 4 2: Experience of Respondent Group

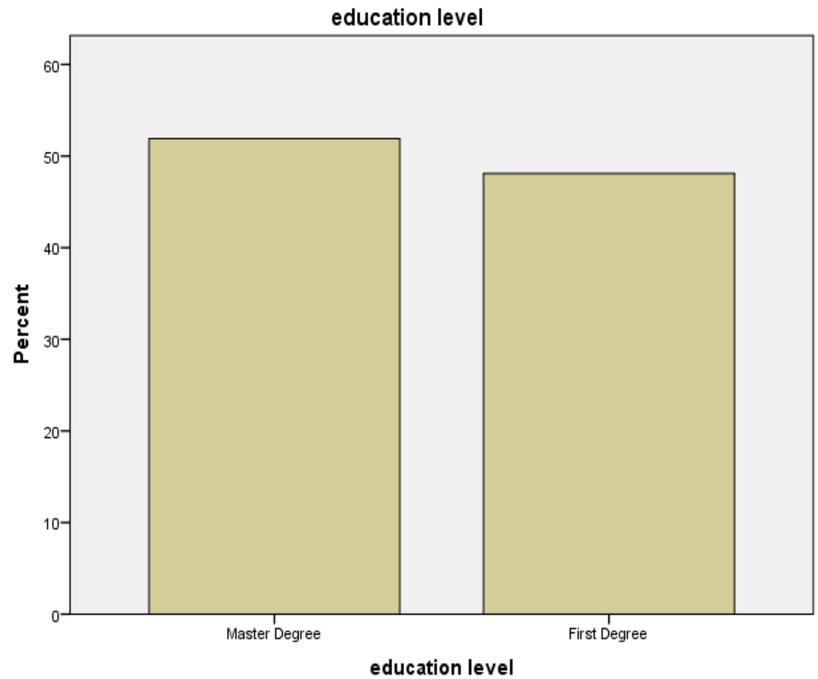

Figure 4 3: Educational Level of Respondent

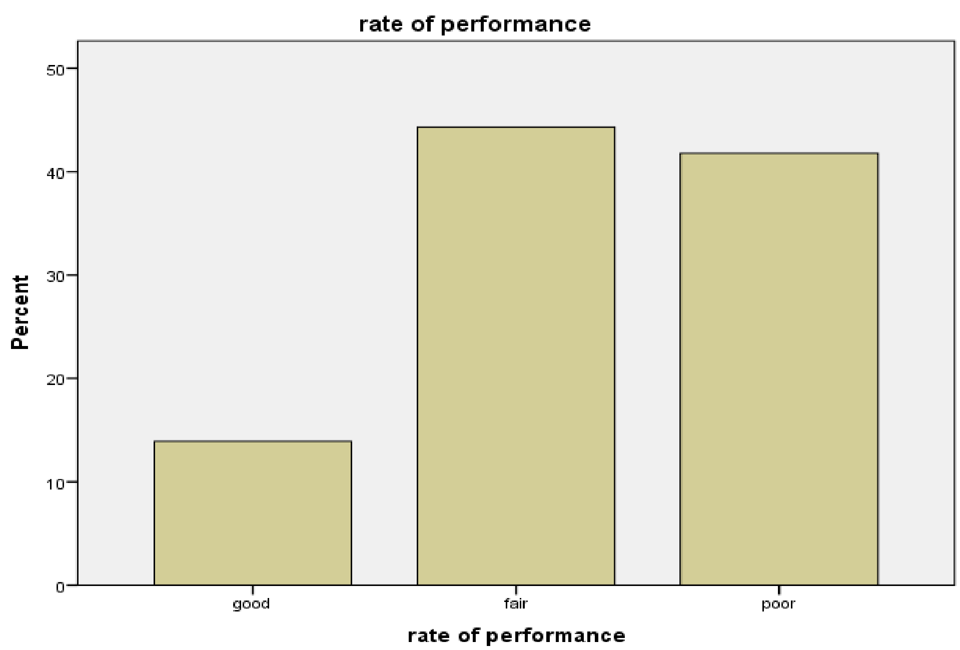

Figure 4 4: Rate of government enterprise project Performance

4.1.Data Analysis: Assessing the Quality of Data

4.1.1. Assessing Common Method Bias

Common Method Bias (CMB) is the systematic variance shared among the variables (Podsakoff and Mackenzie, 2012). CMB has a negative effect on validity of measure and is a main source of measurement error. If there is CMB in any measure then correlation is inflated (Meade, Watson, and Kroustalis, 2007) and yields hypothetically ambiguous conclusion (Carlson, Kacmar, and Williams, 2000)(Beyene et al., 2020). According to Podsakoff, Mackenzie, and Podsakoff (2003), the first factor of un-rotated factor analysis should be less than 50% to be free from CMB. In this study the first factor accounted for 14.81%, therefore, the results suggested that there were no common variable.

Table 4. 2 Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.036	14.814	14.814	9.036	14.814	14.814	6.713	11.005	11.005
2	5.645	9.254	24.068	5.645	9.254	24.068	4.850	7.951	18.956
3	5.149	8.440	32.509	5.149	8.440	32.509	4.690	7.689	26.645
4	4.701	7.707	40.216	4.701	7.707	40.216	4.536	7.436	34.081
5	4.534	7.433	47.649	4.534	7.433	47.649	4.406	7.222	41.303
6	3.265	5.353	53.001	3.265	5.353	53.001	4.286	7.026	48.329
7	2.664	4.367	57.369	2.664	4.367	57.369	3.898	6.390	54.719
8	2.515	4.122	61.491	2.515	4.122	61.491	3.333	5.463	60.183
9	1.810	2.967	64.458	1.810	2.967	64.458	2.019	3.310	63.493
10	1.377	2.258	66.716	1.377	2.258	66.716	1.480	2.427	65.919
11	1.201	1.968	68.684	1.201	1.968	68.684	1.292	2.118	68.037
12	1.121	1.838	70.522	1.121	1.838	70.522	1.267	2.078	70.115
13	1.060	1.738	72.260	1.060	1.738	72.260	1.190	1.950	72.065
14	1.039	1.704	73.964	1.039	1.704	73.964	1.158	1.899	73.964
15	.913	1.498	75.461						
16	.855	1.402	76.863						
17	.843	1.382	78.246						
18	.780	1.278	79.524						
19	.747	1.225	80.749						
20	.729	1.195	81.944						

21	.653	1.070	83.014						
22	.640	1.049	84.063						
23	.598	.981	85.044						
24	.576	.945	85.989						
25	.541	.887	86.876						
26	.510	.836	87.712						
27	.499	.818	88.530						
28	.480	.786	89.316						
29	.465	.762	90.079						
30	.448	.734	90.813						
31	.404	.663	91.476						
32	.386	.632	92.108						
33	.377	.618	92.726						
34	.344	.564	93.289						
35	.325	.533	93.822						
36	.298	.489	94.311						
37	.281	.461	94.772						
38	.272	.446	95.217						
39	.258	.423	95.640						
40	.237	.389	96.029						
41	.212	.348	96.377						
42	.202	.331	96.708						
43	.189	.310	97.018						
44	.172	.282	97.300						
45	.163	.267	97.568						
46	.157	.257	97.824						
47	.148	.242	98.066						
48	.142	.233	98.300						
49	.132	.217	98.516						
50	.118	.193	98.710						
51	.108	.177	98.887						
52	.103	.168	99.055						
53	.102	.167	99.222						
54	.086	.141	99.363						
55	.075	.123	99.486						
56	.074	.121	99.606						
57	.069	.113	99.719						
58	.053	.086	99.805						
59	.048	.079	99.884						
60	.039	.063	99.947						

61	.032	.053	100.000						

Extraction Method: Principal Component Analysis.

4.1.2. Assessing Normality Assumption

Testing the existence of normality is essential in multivariate analysis. In other words, if the data is not normally distributed then it may affect the validity and reliability of the results (Tarhini, 2018).

In the current study, the researcher used Jarque-Bera (skewness-Kurtosis) test to check whether the data is normally distributed or not. The skewness value indicate the symmetry of the distribution (Tarhini, 2018). A negative skew shows that the distribution is shifted to the right; whereas positive skew shows a shift to the left. Kurtosis provides data about the height of the distribution (Tarhini, 2018). The positive kurtosis value shows a peaked distribution; whereas a negative value shows a flatter distribution. According to Tabachnick and Fidell (2007), the normal range for skewness-kurtosis value is ± 2.58. Following this recommendation, all the items in the dataset for the sample were found to be normally distributed (i.e, < ± 2.58). Tables B1 in Appendix B show the means, standard deviation, skewness and kurtosis values for each variable. This confirms that there was no major issue of normality of the data. (See in appendix B).

4.6. Data Analysis: Factor Analysis

Factor analysis is used to eliminate redundancy from set of correlated variables. Factor analysis minimizes number of correlated variables by representing correlated variables with derived variables (Beyene et al., 2020). It is also suitable for testing significance of results of the research. Currently, FA becomes the most important means to measure the significance of research data and to deduce data to a significant one. There are two factor analysis techniques these are, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

4.6.1. Exploratory Factor Analysis (EFA)

EFA is a variable reduction technique that identifies a number of latent constructs, and underlines factor structure of a set of variables (Suhr, 1999)(Chinda, 2020). (Building et al., 2016) mentioned that EFA is a precursor to SEM. There are three main steps in performing EFA:

1) valuation of the suitability of the data;
2) Factor extraction; and

3) Factor rotation (Chinda, 2020).

On the basis of the assumptions of EFA, the researcher used principal component method for the factor extraction with the results of the univariate analysis and used Variamax rotation to carry out factor interpretation.

Factor analysis (FA) of any data is evaluated by statistical measures generated by SPSS; these are Kaiser-Meyer-Olkin (KMO); and Bartlett's test of Sphericity (Pallant, 2003). Kaiser – Meyer – Olkin (KMO) is measure of sampling adequacy. It measures the distribution value, whether or not it is adequate to conduct FA. The cutoff points for Kaiser-Meyer-Olkin (KMO) measures are a measure of >0.9 is excellent, >0.8 is very good, >0.7 is acceptable, >0.6 is medium, >0.5 is weak and <0.5 is unacceptable. Moreover, Bartlett's test of Sphericity tests a null hypothesis; this supposed that the population correlation matrix was an identity matrix. This test depended on the assumption of normality, which was proved above. FA would be meaningless with an identity matrix. A significance value <0.05 indicates that the data do not produce an identity matrix and are thus appropriately multivariate normal and acceptable for FA (Building et al., 2016).

Table 4.3 reported that Chi-Square was 5,586.361 with (df = 990, p<0.001) which means that variables were related to one another. Therefore, the study was able to continue to complete the remaining steps of the factor analysis.

Table 4. 3 KMO and Bartlett's Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.708
Bartlett's Test of Sphericity	Approx. Chi-Square	5586.361
	df	990
	Sig.	.000

4.6.2. Communality

The measure of the percentage of variables variation that is explained by the factors is called communality. It is the amount of variance an original variable share with all other variables involved in the analysis. If a variable has much in common with other, variables take as a group then there is high communality (Islam and Mamun, 2005). Further, the communality measures the existence of variance in a given variable explained by all the factors jointly and may be interpreted as the reliability of the indicator. Through the common source with others, the communality estimates a part of the variance in a variable. Low communality (below 0.5) may lead to its variable being omitted (Ráthonyi, 2016). Principal component analysis starts with certain variables and common factors. Initially, it undertakes that all variances are common. Hence, the communalities equal 1 before extraction. This means that there are common factors, which, after extraction, represent the common variance in the data structure. The communalities after extraction represented the amount of variance in each variable, which could be explained by the retained factors. All the variables of in the data were above 0.5 indicating high communality (see in the appendix B, table B2).

4.6.3. Total Variance Explained

Total variance explained used to measure the variance in all variables which are accounted for by a single factor. Total variance is displayed by Eigen values. The percentage of explanatory importance of a given factor with respect to the variables is expressed by the ratio of Eigen values. A factor with low Eigen value is considered as a redundant when compared to the more important factors and contribute small in explanation of the variance in the variables (Kaiser, 1958). Mostly different extraction approaches are used but the most used extraction approach is "root greater than one" extraction approach criterion and originally suggested by (Kaiser, 1958). This criterion holds those components whose Eigen values are greater than 1.

In this study, initially 61 variables extracted with 61 Eigen values and fourteen factors explained 73.96% of the variance but later on, these factors were reduced in to eight because some variables, which were unrelated to any of the factors and/or have low loadings, were dropped. These eight factors explained 71.15% variance using Varimax rotation to conduct this analysis.

Table 4. 4 Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.231	16.069	16.069	7.231	16.069	16.069	5.464	12.142	12.142
2	4.812	10.692	26.762	4.812	10.692	26.762	4.251	9.447	21.588
3	4.582	10.182	36.944	4.582	10.182	36.944	4.246	9.435	31.023

4	4.152	9.227	46.171	4.152	9.227	46.171	4.214	9.363	40.387
5	3.692	8.205	54.376	3.692	8.205	54.376	4.105	9.122	49.508
6	3.026	6.724	61.100	3.026	6.724	61.100	3.433	7.629	57.138
7	2.509	5.576	66.676	2.509	5.576	66.676	3.200	7.111	64.248
8	2.014	4.476	71.152	2.014	4.476	71.152	3.107	6.903	71.152
9	.924	2.053	73.205						
10	.855	1.901	75.106						
11	.810	1.801	76.906						
12	.740	1.645	78.551						
13	.708	1.574	80.125						
14	.671	1.490	81.615						
15	.658	1.462	83.078						
16	.605	1.345	84.422						
17	.576	1.281	85.703						
18	.514	1.141	86.845						
19	.486	1.079	87.924						
20	.446	.992	88.916						
21	.432	.960	89.876						
22	.388	.862	90.737						
23	.361	.801	91.539						
24	.351	.780	92.319						
25	.315	.700	93.019						
26	.298	.663	93.682						
27	.271	.602	94.284						
28	.265	.588	94.872						
29	.248	.550	95.423						
30	.224	.497	95.920						
31	.211	.469	96.389						
32	.199	.442	96.831						
33	.176	.390	97.221						
34	.167	.372	97.593						
35	.154	.341	97.934						
36	.146	.324	98.258						
37	.142	.316	98.574						
38	.127	.283	98.857						
39	.115	.255	99.112						
40	.093	.207	99.319						
41	.083	.185	99.505						
42	.075	.166	99.671						
43	.061	.137	99.807						

44	.047	.105	99.912						
45	.040	.088	100.000						

Extraction Method: Principal Component Analysis.

4.6.4. Factor Rotation

Factor rotation is used to check and increase the interpretability of factors. Rotation used to maximize the loadings of each variable on one of the extracted factors at the same time it minimizes the loading on all other factors. Despite the fact that keeping their differential values constant, rotation works through changing the absolute values of the variables despite the fact that keeping their differential values constant (Field, 2009).

The three techniques used for orthogonal rotation are Varimax, quartimax and equamax. The varimax method is the most popular among these techniques and is often used to make factor analysis. The procedure seeks to rotate factors so that the variation of the squared factor loadings for a given factor is made large (Beyene et al., 2020). The higher the loading, the better the symbol that particular item has on the factor. (Chinda, 2020) recommended that factor loadings greater than 0.30 are the minimum requirement; loadings of 0.40 are considered more important; and loadings of 0.50 or greater are considered significant. The exact choice of rotation depends mainly on whether or not the researcher should choose one of the orthogonal rotations.

Based on this guideline, varimax rotation is used and items that have factor loadings of lower than 0.50 discarded to get items more representatives for their respective factor. In order to increase the significance of items to their respective factor the researcher used 0.50 as cutoff.

Besides, this technique initially divided the factors into fourteen factors but later they were reduced in to eight when some variables were dropped because they were unrelated to any of the factors or have low loadings (loadings below 0.5). The analysis was done in an iterative way, until factor extraction rules were met. The rotated factor loadings of eight constructs which obtained from the SPSS outputs are presented in table 4.6.These out puts of EFA are used as inputs for CFA. In summary, the EFA results in eight factors namely ICOM, CLICOM, IMPD, MAT, PSCIN, CONIE, EXT and MI, consisting of 6, 6, 4, 5, 4, 6, 7 and 8 questions respectively.

Table 4. 5 Rotated Factor Loadings

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
ICOM1					.839			
ICOM2					.734			
ICOM4					.686			
ICOM5					.846			
ICOM6					.811			
ICOM7					.885			
CLICOM1		.833						
CLICOM2		.807						
CLICOM3		.860						
CLICOM4		.829						
CLICOM5		.828						
CLICOM6		.766						
IMPD1								.804
IMPD2								.805
IMPD6								.777
IMPD7								.857
MAT1						.841		
MAT2						.711		
MAT3						.795		
MAT4						.835		
MAT6						.788		
PSCIN1							.850	
PSCIN2							.905	
PSCIN3							.889	
PSCIN4							.758	
CONIE1			.842					
CONIE2			.816					
CONIE3			.857					
CONIE4			.840					
CONIE6			.759					
CONIE7			.820					
EXT2				.774				
EXT3				.865				
EXT4				.868				
EXT6				.766				

EXT7				.824				
EXT8				.833				
MI1	.773							
MI2	.754							
MI4	.880							
MI5	.788							
MI6	.850							
MI9	.789							
MI11	.817							
MI12	.843							

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

4.7. Confirmatory Factor Analysis (CFA)

CFA is performed to test the reliability and validity of the measurement variables and to provide a basis for the subsequent structural analysis (Zhao et al., 2019). CFA also have different uses it is used to; establishes the validity of a single factor model, compare the capability of two different models to validation for the same set of information, test the significance of a specific factor loading, check the relationship between two or more factor loadings, check whether a set of factors are correlated or uncorrelated and used to assess the convergent and discriminant validity of a set of measures (Brown, 2015). CFA has strong relations to Structural Equation Modeling. Structural Equation Modeling (SEM) is a statistical method increasingly used in scientific studies in the field of social sciences in recent years (Barrett, 2007). Structural equation modeling is a statistical process used to test the relationships between observed and latent variables. Observed variables are the measured/visible variables in the data collection process and latent variables are the variables measured by connecting to the observed variables because they cannot be directly measured.

Structural Equation Modeling SEM helps researchers to specify Confirmatory Factor Analysis (CFA), regression analysis and complex models. It can be viewed as a combination of factor analysis and regression or path analysis (Civelek, 2018). There are two sub models under structural equation modeling: measurement model and structural model. The main objective of measurement model is to estimate the relationship between the observed variables (indicators) and the latent variables. The main objective of the structural equation model is to estimate the relationship within latent variables (Kaplan and Miller, 2000).

4.7.1. Measurement Model

The measurement model measures how well latent variables are represented by the observed variables. It is mainly confirmatory factor analysis (CFA) and indicates the construct validity of scales. Therefore, if the measurement model fit indices are low, it will not make sense to test the structural model (Civelek, 2018). CFA is mostly used for reliability test of the observed variables. In addition to CFA, researchers also used the measurement model to examine the amount of co-variation and level of interrelationship among the latent constructs. The first step that comes before testing the structural model is deriving the best indicator that fits the latent variables by estimating factor loadings, unique variances, and modification indexes. The modification indexes are used to decide whether a variable is dropped or a path is added (Kaplan and Miller, 2000). One of the main importance‘s of measurement model is to evaluate construct validity. Construct validity in a measurement model is done in terms of convergent validity and discriminant validity. Convergent validity and discriminant validity are used to determine the degree to which the measures have acceptable internal consistency by conducting the necessary tests and acceptance levels for goodness of fit (Pohlmann, 2004).

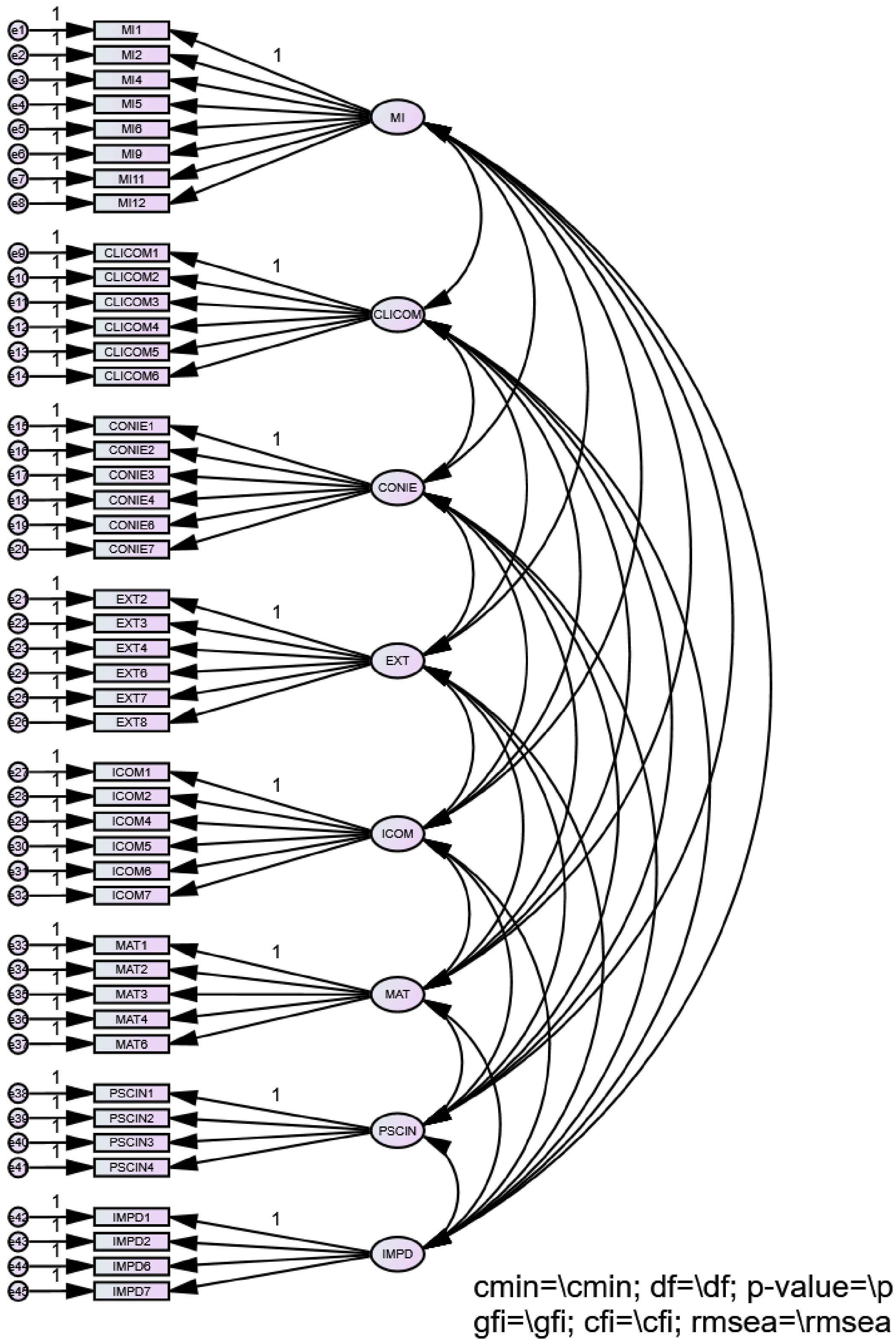

Figure 4 5: Hypothesized CFA model derived from preliminary analysis

Goodness of Fit

The goodness of Fit (GOF) for a statistical hypothesis tests is to look through how well the data fits into set of observation (or how well sample data fit a distribution from population with a normal distribution). Goodness of fit creates the discrepancy between the observed values and those that would be expected of the model in a normal distribution.

There are various GOF indicators; generally, GOF indicators can be grouped into three categories: absolute measures, incremental measures and parsimonious fit measures. To ensure consistency in the empirical assessment, as suggested in the literature (Kline, 2005) multiple GOF indices are used. (Zhao et al., 2019) suggests that at a minimum the following indices should be reported: The model chi-square, RMSEA, CFI, and SRMR. This study uses the GOF indices reported by Cornell University, Cornell Statistical Consulting Unit and the following fit indices are used as a threshold values chis-square, normed chi-square, RMSEA, RMR and CFI.

Table 4. 6 Category of GOF Indices

Measure	**GOF indices**	**Description**	**Cut off for good fit**
Chi-Square (X2)	Chi-Square (X2)	Assess overall fit and the discrepancy between the sample and fitted covariance matrices. Sensitive to sample size.	p-value< 0.05
	Degrees of freedom	Covariance in the observed matrix less the number of estimated coefficients	
	Probability statistic (p-value)	Probability that the observed and estimated covariance matrices are actually equal	
(A)GFI	(Adjusted) Goodness of Fit	GFI is the proportion of variance accounted for by the estimated population covariance. Analogous to R2. AGFI favors parsimony.	GFI ≥ 0.90 AGFI ≥0.90

(N)NFI TLI	(Non) Normed Fit Index and Tucker Lewis Index	An NFI of .95 indicates the model of interest improves the fit by 95% relative to the null model. NNFI is preferable for smaller samples. Sometimes the NNFI is called the Tucker Lewis index (TLI)	NFI ≥ 0.90 NNFI ≥ 0.95
CFI	Comparative Fit Index	A revised form of NFI. Not very sensitive to sample size. Compares the fit of a target model to the fit of an independent, or null, model.	CFI ≥0.90
RMSEA	Root Mean Square Error of Approximation	A parsimony-adjusted index. Values closer to 0 represent a good fit.	RMSEA < 0.08
S)RMR Residual	(Standardized) Root Mean Square	The square-root of the difference between the residuals of the sample covariance matrix and the hypothesized model. If items vary in range (i.e. some items are 1-5, others 1-7) then RMR is hard to interpret, better to use SRMR	SRMR <0.08
AVE (CFA only)	Average Value Explained	The average of the R2s for items within a factor	AVE >0.5

The modification indices in AMOS provide data or information on the improvement in model fit. The following measures were applied by the researcher in order to achieve a better fit of the model(Tarhini, 2018).

- The standardized residual covariance should be within |2.58| (Tarhini, 2018)
- Factor loading (Standardized regression weight) should be greater than 0.5 and preferably above 0.7.
- Modification indices (MI) that reveal a very high covariance and also demonstrate high regression weights should be deleted (Tarhini, 2018).

Based on different previous researches and researchers goal, the researcher develops the full confirmatory factor analysis measurement model as shown in figure 4.6 below. The analysis of SEM begins with the model shown below. Using AMOS software the Goodness of Fit indices are obtained and summarized in Table 4.7. The result reveals that the proposed measurement model is **unacceptable.**

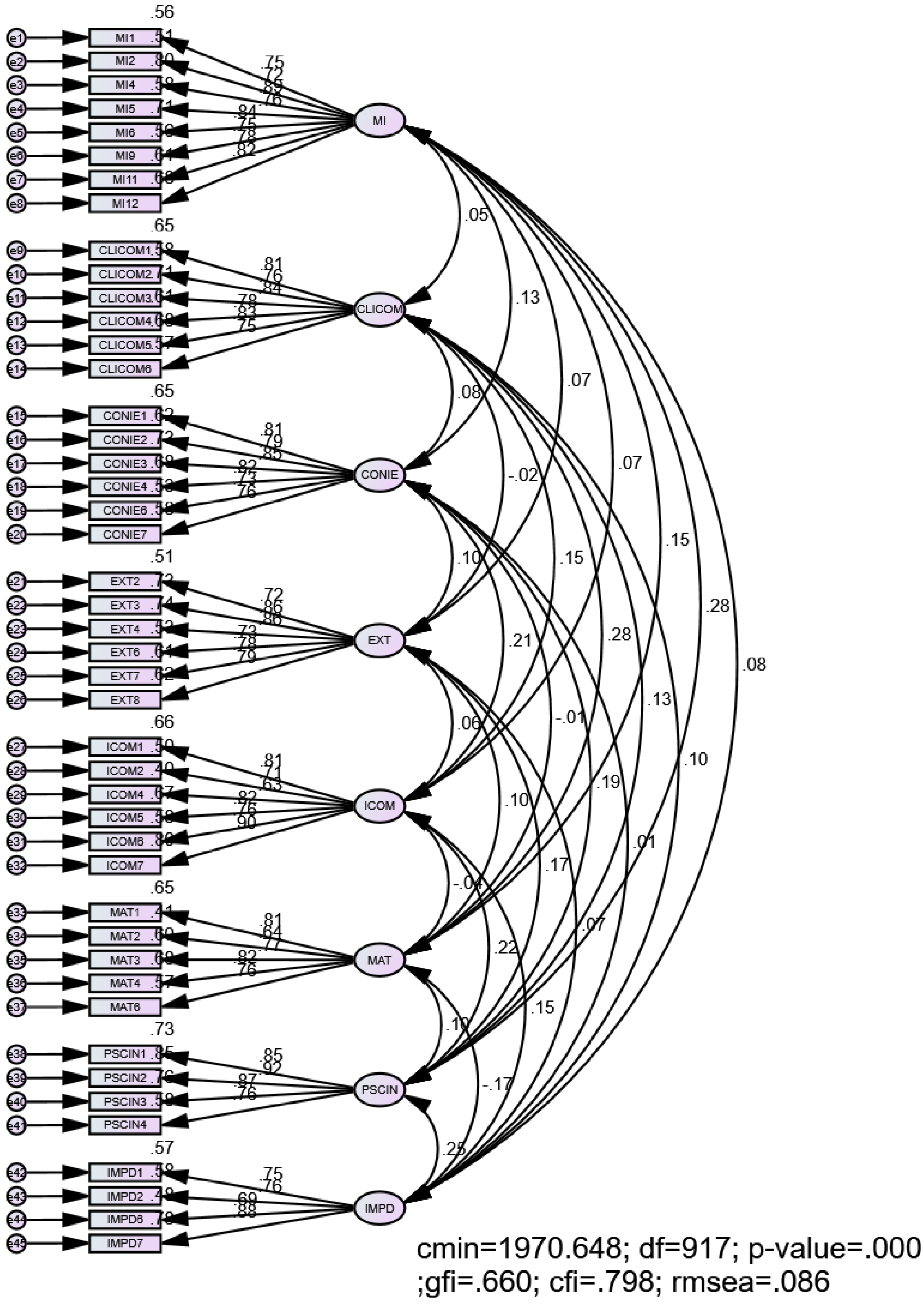

Figure 4. 6 The complete CFA measurement Model (Source Researchers AMOS output)

Table 4. 7 Results of CFA measurement model for convergent validity

Initial Iteration							
Chi-Square		Absolut Fit Indices		Incremental Fit Indices		Parsimony Fit Indices	
X2	1970.648	RMSEA	0.086	CFI	0.798	PCFI	0.739
Df	917	RMR	0.043	IFI	0.801	PNFI	0.632
X2/Df	2.149	CMIN/ DF	2.149	TLI	0.782	GFI	0.660
Factor Loadings ***=p<0.001, **=p<0.01, *=p<0.05 Rows with blank space indicates indicator is set as default							
Regression Weights: (Group number 1 - Default model)							

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	SMC	Comment
MI1	<---	MI	.746				0.557	Convergent Validity Holds
MI2	<---	MI	.717	.111	9.143	***	0.514	>>
MI4	<---	MI	.892	.110	11.685	***	0.796	>>
MI5	<---	MI	.764	.114	9.818	***	0.584	>>
MI6	<---	MI	.844	.113	10.973	***	0.712	>>
MI9	<---	MI	.749	.118	9.598	***	0.561	>>
MI11	<---	MI	.783	.125	10.087	***	0.613	>>
MI12	<---	MI	.822	.116	10.648	***	0.675	>>
CLICOM1	<---	CLICOM	.808				0.653	>>
CLICOM2	<---	CLICOM	.762	.087	10.527	***	0.581	>>
CLICOM3	<---	CLICOM	.843	.082	12.037	***	0.71	>>
CLICOM4	<---	CLICOM	.779	.089	10.825	***	0.606	>>
CLICOM5	<---	CLICOM	.827	.085	11.733	***	0.684	>>
CLICOM6	<---	CLICOM	.754	.088	10.374	***	0.568	>>
CONIE1	<---	CONIE	.806				0.65	>>
CONIE2	<---	CONIE	.790	.089	11.009	***	0.624	>>
CONIE3	<---	CONIE	.854	.086	12.213	***	0.729	>>

			Estimate	S.E.	C.R.	P	SMC	Comment
CONIE4	<---	CONIE	.822	.086	11.612	***	0.676	>>
CONIE6	<---	CONIE	.729	.100	9.911	***	0.531	>>
CONIE7	<---	CONIE	.764	.098	10.542	***	0.584	>>
EXT2	<---	EXT	.717				0.514	>>
EXT3	<---	EXT	.855	.108	10.298	***	0.732	>>
EXT4	<---	EXT	.861	.116	10.358	***	0.741	>>
EXT6	<---	EXT	.729	.128	8.784	***	0.531	>>
EXT7	<---	EXT	.783	.102	9.440	***	0.613	>>
EXT8	<---	EXT	.790	.115	9.528	***	0.624	>>
ICOM1	<---	ICOM	.813				0.66	>>
ICOM2	<---	ICOM	.708	.090	9.654	***	0.502	>>
ICOM4	<---	ICOM	.632	.091	8.373	***	0.4	>>
ICOM5	<---	ICOM	.821	.085	11.761	***	0.675	>>
ICOM6	<---	ICOM	.759	.087	10.555	***	0.575	>>
ICOM7	<---	ICOM	.896	.077	13.211	***	0.802	>>
MAT1	<---	MAT	.809				0.654	>>
MAT2	<---	MAT	.637	.087	8.149	***	0.405	>>
MAT3	<---	MAT	.772	.088	10.273	***	0.596	>>
MAT4	<---	MAT	.822	.082	11.066	***	0.676	>>
MAT6	<---	MAT	.756	.086	10.017	***	0.572	>>
PSCIN1	<---	PSCIN	.852				0.725	>>
PSCIN2	<---	PSCIN	.923	.071	15.407	***	0.852	>>
PSCIN3	<---	PSCIN	.874	.068	14.177	***	0.764	>>
PSCIN4	<---	PSCIN	.762	.082	11.350	***	0.58	>>
IMPD1	<---	IMPD	.752				0.566	>>

			Estimate	S.E.	C.R.	P	SMC	Comment
IMPD2	<---	IMPD	.759	.113	9.269	***	0.576	>>
IMPD6	<---	IMPD	.694	.105	8.436	***	0.482	>>
IMPD7	<---	IMPD	.884	.119	10.409	***	0.782	>>

Source: researcher AMOS output

From the results in table 4.9, the value of CMIN/DF is 2.149 which is within the threshold value (between 1 and 5), the value for RMSEA is about 0.086 which is not with in the threshold value (<0.08), the value for RMR is 0.043 which is in the acceptable range (<0.08), the values of CFI, IFI, and TLI are all not within the threshold ranges (>=0.9) and the values are 0.798, 0.801 and 0.782 respectively. Additionally the values of PCFI and PNFI are also fall within the acceptable range both have values greater than 0.5. All standardized regression weights (estimates) are significant at p value of below 0.001(as described in ***). The critical ratios of the factor loadings are all significantly different from zero (above 1.96). Standardized regression weights (Estimates) are expected to be above 0.5, and all items satisfy it. Since there is a problem of model fit, the CFA measurement model needs to be re-modeled.

To re-model the CFA measurement model the items which do not satisfy the model fit are deleted from the initial model and the AMOS regression was rerun again. To check the discriminant validity for each item the researcher uses the correlations of each latent variable. As can be seen in the Table 4.9, the correlations of all the latent variables are below the threshold of 0.8, indicating the existence of discriminant validity within the latent variables.

Table 4. 8 Results of CFA measurement model for discriminant validity

Correlations: (Group number 1 - Default model)

Initial Iteration				
Constructs			Estimate	Comments
MI	<-->	CLICOM	.050	Discriminant Validity Holds
MI	<-->	CLICOM	.050	Discriminant Validity Holds
MI	<-->	CONIE	.126	Discriminant Validity Holds
MI	<-->	EXT	.069	Discriminant Validity Holds
MI	<-->	ICOM	.067	Discriminant Validity Holds

Initial Iteration				
Constructs			Estimate	Comments
MI	<-->	MAT	.148	Discriminant Validity Holds
MI	<-->	PSCIN	.279	Discriminant Validity Holds
MI	<-->	IMPD	.083	Discriminant Validity Holds
CLICOM	<-->	CONIE	.078	Discriminant Validity Holds
CLICOM	<-->	EXT	-.020	Discriminant Validity Holds
CLICOM	<-->	ICOM	.151	Discriminant Validity Holds
CLICOM	<-->	MAT	.280	Discriminant Validity Holds
CLICOM	<-->	PSCIN	.132	Discriminant Validity Holds
CLICOM	<-->	IMPD	.101	Discriminant Validity Holds
CONIE	<-->	EXT	.097	Discriminant Validity Holds
CONIE	<-->	ICOM	.215	Discriminant Validity Holds
CONIE	<-->	MAT	-.013	Discriminant Validity Holds
CONIE	<-->	PSCIN	.193	Discriminant Validity Holds
CONIE	<-->	IMPD	.013	Discriminant Validity Holds
EXT	<-->	ICOM	.061	Discriminant Validity Holds
EXT	<-->	MAT	.103	Discriminant Validity Holds
EXT	<-->	PSCIN	.175	Discriminant Validity Holds
EXT	<-->	IMPD	.068	Discriminant Validity Holds
ICOM	<-->	MAT	-.037	Discriminant Validity Holds
ICOM	<-->	PSCIN	.216	Discriminant Validity Holds
ICOM	<-->	IMPD	.155	Discriminant Validity Holds
MAT	<-->	PSCIN	.100	Discriminant Validity Holds
MAT	<-->	IMPD	-.166	Discriminant Validity Holds
PSCIN	<-->	IMPD	.251	Discriminant Validity Holds

Source: researcher Amos output

The above validity tables only show the validity within the latent variables. The validity for unobserved variables is tested using Average Value Explained (AVE). Table 4.10 shows the validity for unobserved variables. The table was generated as a template to analyze AVE and other parameters. The result shows that as discriminant validity as well as convergent validity exists for all unobserved variables. The result of the template is presented in Table 4.10 below.

Table 4. 9 Validity check for unobserved variables initial

	CR	AVE	MSV	MaxR(H)	MI	CLICOM	CONIE	EXT	ICOM	MAT	PSCIN	IMPD
MI	0.930	0.627	0.078	0.938	**0.792**							
CLICOM	0.912	0.634	0.079	0.915	0.050	**0.796**						
CONIE	0.911	0.632	0.046	0.915	0.126	0.078	**0.795**					
EXT	0.909	0.626	0.030	0.917	0.069	-0.020	0.097	**0.791**				
ICOM	0.900	0.602	0.046	0.917	0.067	0.151*	0.215*	0.061	**0.776**			
MAT	0.873	0.581	0.079	0.882	0.148*	0.280**	-0.013	0.103	-0.037	**0.762**		
PSCIN	0.915	0.730	0.078	0.929	0.279**	0.132	0.193*	0.175*	0.216*	0.100	**0.855**	
MPD	0.857	0.601	0.063	0.878	0.083	0.101	0.013	0.068	0.155*	-0.166*	0.251**	**0.775**

Master Validity Tool", AMOS Plugin. Gaskination's StatWiki.

Unlike in the structural model, in the measurement model modification indices considered from covariance between error terms of observed indicators only within the same latent variable and having a M.I. of above 4. From the Amos result reveals the existence of covariance having a high M.I within the same latent variable. Consequently, the measurement model was unacceptable. After the variables whose Standardized regression weights (Estimates) are below 0.7, (ICOM4, MAT2 and IMPD6) are deleted and after covariance between errors terms of observed indicators only within the same latent variables, AMOS has been rerun. The results of the modification indices are shown below.

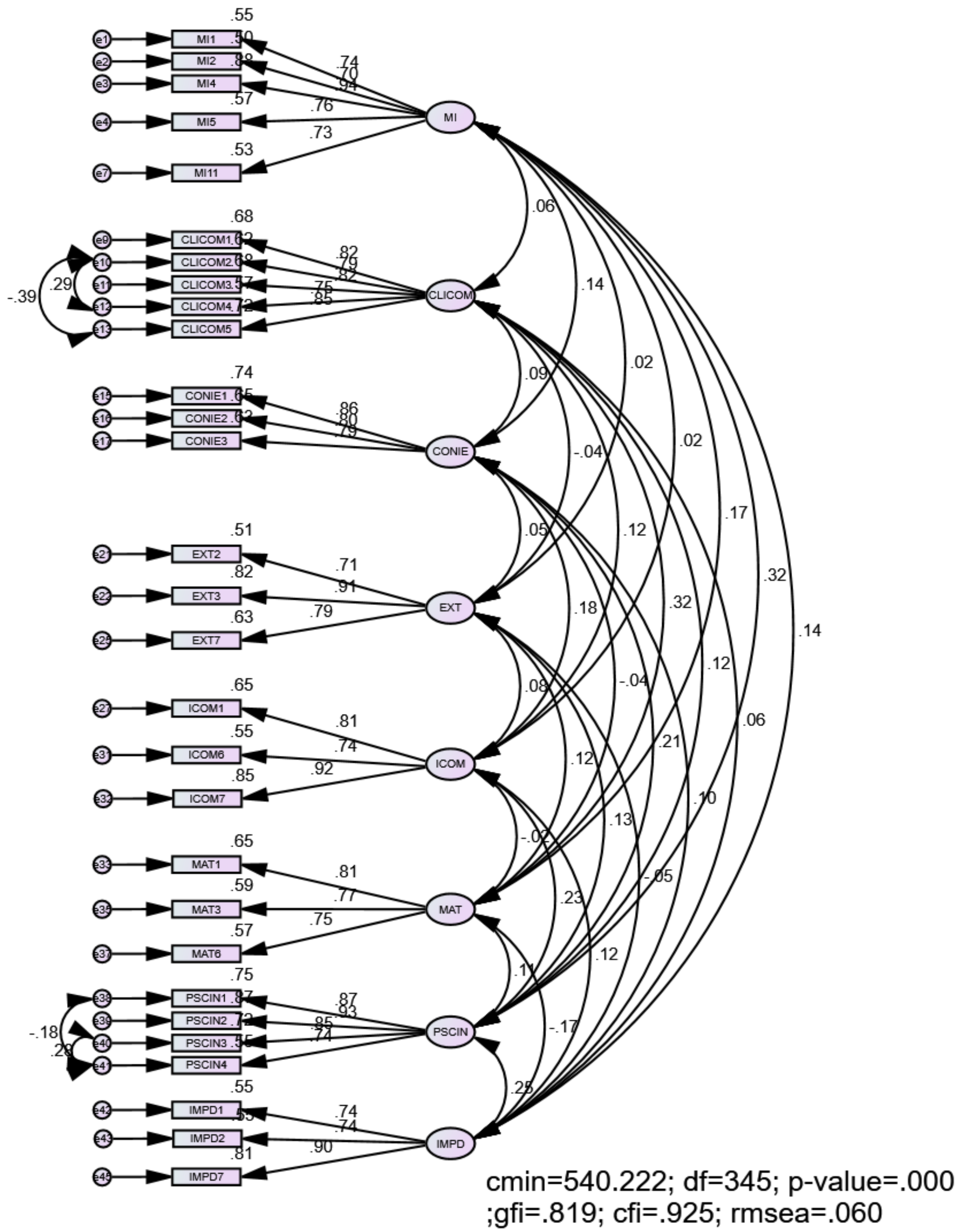

Figure 4 7: Final CFA Measurement Model (source: researcher Amos output)

Note(s): the text in the oval circle refers to the constructs, and the text in the rectangle denotes the manifested variables/indicators. The values on the single arrow and double headed arrow represents the regression weight and correlation coefficients respectively.

Table 4. 10 Results of Final CFA Measurement Model for convergent validity

After Variable delete and modification index							
Chi-Square		Absolut Fit Indices		Incremental Fit Indices		Parsimony Fit Indices	
X2	540.222	RMSEA	0.060	CFI	0.950	PCFI	0.786
Df	345	RMR	0.032	IFI	0.926	PNFI	0.696
X2/Df	1.566	CMIN/ DF	1.566	TLI	0. 911	GFI	0.819
Factor Loadings ***=p<0.001, **=p<0.01, *=p<0.05 Rows with blank space indicates indicator is set as default							
Regression Weights: (Group number 1 - Default model)							

			Estimate	S.E.	C.R.	P	Label
MI1	<---	MI	.742				
MI2	<---	MI	.704	.114	8.818	***	
MI4	<---	MI	.938	.117	11.639	***	
MI5	<---	MI	.758	.117	9.556	***	
MI11	<---	MI	.725	.129	9.106	***	
CLICOM1	<---	CLICOM	.822				
CLICOM2	<---	CLICOM	.785	.089	10.481	***	
CLICOM3	<---	CLICOM	.823	.079	12.006	***	
CLICOM4	<---	CLICOM	.754	.088	10.362	***	
CLICOM5	<---	CLICOM	.849	.083	12.036	***	
CONIE1	<---	CONIE	.860				
CONIE2	<---	CONIE	.803	.088	10.577	***	
CONIE3	<---	CONIE	.794	.087	10.485	***	
EXT2	<---	EXT	.714				
EXT3	<---	EXT	.908	.128	9.244	***	
EXT7	<---	EXT	.793	.107	9.147	***	
ICOM1	<---	ICOM	.808				
ICOM6	<---	ICOM	.742	.090	9.956	***	
ICOM7	<---	ICOM	.922	.093	11.245	***	
MAT1	<---	MAT	.806				
MAT3	<---	MAT	.768	.103	8.796	***	
MAT6	<---	MAT	.755	.099	8.710	***	
PSCIN1	<---	PSCIN	.867				
PSCIN2	<---	PSCIN	.935	.069	15.675	***	
PSCIN3	<---	PSCIN	.848	.066	13.817	***	
PSCIN4	<---	PSCIN	.743	.087	10.190	***	
IMPD1	<---	IMPD	.743				

			Estimate	S.E.	C.R.	P	Label
IMPD2	<---	IMPD	.743	.116	8.907	***	
IMPD7	<---	IMPD	.902	.136	9.390	***	

Table 4.10 reveals that all the model fit indices are within the acceptable range and all observed variables have a convergent validity. As can also see from Table 4.11, all the latent variables correlation is below 0.8 indicating the existence of discriminant validity. Consequently, the overall model fit was acceptable. Therefore, the proposed measurement model is **acceptable.**

Table 4. 11 Results of final CFA measurement model for discriminant validity

Correlations: (Group number 1 - Default model):

After Variables Deleted and after Modification Indices			
Constructs			Estimate
MI	<-->	CLICOM	.055
MI	<-->	CONIE	.144
MI	<-->	EXT	.017
MI	<-->	ICOM	.023
MI	<-->	MAT	.168
MI	<-->	PSCIN	.322
MI	<-->	IMPD	.138
CLICOM	<-->	CONIE	.092
CLICOM	<-->	EXT	-.044
CLICOM	<-->	ICOM	.117
CLICOM	<-->	MAT	.316
CLICOM	<-->	PSCIN	.117
CLICOM	<-->	IMPD	.064
CONIE	<-->	EXT	.047
CONIE	<-->	ICOM	.178
CONIE	<-->	MAT	-.043
CONIE	<-->	PSCIN	.208
CONIE	<-->	IMPD	.100
EXT	<-->	ICOM	.077
EXT	<-->	MAT	.123
EXT	<-->	PSCIN	.134
EXT	<-->	IMPD	-.047
ICOM	<-->	MAT	-.018
ICOM	<-->	PSCIN	.231
ICOM	<-->	IMPD	.120
MAT	<-->	PSCIN	.112
MAT	<-->	IMPD	-.171

After Variables Deleted and after Modification Indices			
Constructs			Estimate
PSCIN	<-->	IMPD	.246

The validity of unobserved variables was done with the template after variable deleted and modification indices covered. The result proves that as discriminant validity as well as convergent validity exists for all unobserved variables. The result of the template is presented in table 4.12 below.

Table 4. 12 Final Validity check for unobserved variables

	CR	AVE	MSV	MaxR(H)	MI	CLICOM	CONIE	EXT	ICOM	MAT	PSCIN	IMPD
MI	0.883	0.605	0.104	0.923	**0.778**							
CLICOM	0.903	0.652	0.100	0.906	0.055	**0.807**						
CONIE	0.860	0.672	0.043	0.864	0.144	0.092	**0.820**					
EXT	0.849	0.655	0.018	0.881	0.017	-0.044	0.047	**0.809**				
ICOM	0.866	0.684	0.053	0.897	0.023	0.117	0.178***	0.077	**0.827**			
MAT	0.820	0.603	0.100	0.822	0.168**	0.316**	-0.043	0.123	-0.018	**0.777**		
PSCIN	0.912	0.724	0.104	0.932	0.322***	0.117	0.208*	0.134	0.231*	0.112	**0.851**	
IMPD	0.841	0.640	0.060	0.873	0.138	0.064	0.100	-0.047	0.120	-0.17	0.246**	**0.800**

Final Reliability

Reliability is the extent of how the said measurement model in measuring the intended latent construct. After research constructs have been checked for reliability validated, the model is checked for reliability to go for structural model. Most commonly used solution to assess reliability is checking the Cronbach‘s alpha coefficients of internal consistency. The Cronbach‘s alpha should exceed 0.7, the threshold value.

Table 4. 13. Instrument Reliability

Constructs	Number of items	Cronbach's Alpha
MI	5	0.881
CLICOM	5	0.903
CONIE	3	0.859
EXT	3	0.842
ICOM	3	0.860

MAT	3	0.819
PSCIN	4	0.912
IMPD	3	0.838

4.7.2. Structural Model

Measurement model is mainly used for observed variables whereas the structural model develops the relationships between the latent variables. The relationship between latent variables and observed variables that are not indicators of the latent variables is mentioned by structural equation model. Before developing structural equation model several issues should be considered. From different issues to be considered the major one is that the measurement model (factor analysis) should be fitted first followed by the structural model.

Structural model can be assessed by testing the explained variance on endogenous latent variable (R^2) and path co-efficient also termed as beta (β) values of each path. According to Cohen (1988) R^2 of endogenous can be assessed as substantial = 0.26, moderate = 0.13 and weak = 0.02. In assessing the path coefficient, beta value of all structural paths is compared, higher the path co-efficient the significant effect on endogenous latent variable (Ayele, 2019).

Based on the structural model the goal of the analysis is to forecast the output layer data by means of the input layer data. In other words, the structural model is used to show one or more dependence relationships liking the hypothesized model's construct.

After checking the convergent and discriminant validity as well as reliability of the proposed measurement model finally, the admissible measurement model is converted into structural model to assess the relationship between latent and observed variables that are not indicators of latent variables. Figure 4.8 presents the structural model which shows the relationship between constructs or latent variables or unobserved variables that are easy to understand.

1.1 Research hypotheses and conceptual model

Based on the detail of existing theories and the factors considered in the preceding section the 15 relationships among the factors affecting construction cost performance are further explored with the structural model, to examine the directions of relationships we propose as the followings (see Figure 4.8).

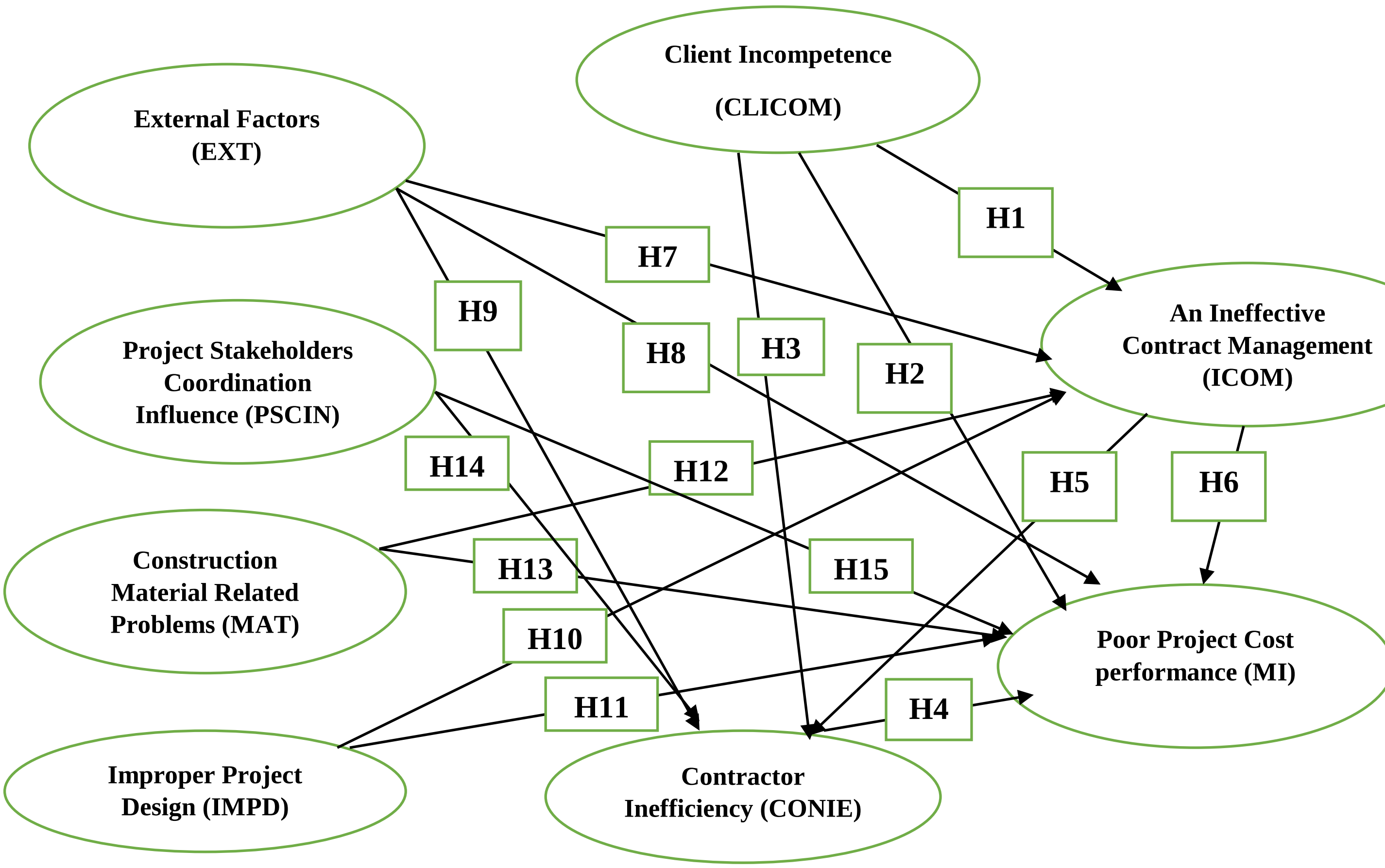

Figure 4 8. Conceptual model of factors leading to the poor cost Project performance in Amhara Industry Park Development Corporation**.**

H1: Client's incompetence ⟶ An Ineffective Contract Management: Occurrence of the client's incompetence triggers project contract administration problems, which in turn leads to weak construction projects cost performance.

H2. Client's incompetence ⟶ Poor Cost Performance (MI): The client's incompetence has a positive influence on the overall poor construction projects' cost performance.

H3. Client's incompetence ⟶ Contractor Inefficiency: Occurrence of the client's incompetence causes inefficient contractor work.

H4. Contractor Inefficiency ⟶ Poor Cost Performance (MI): Inefficient contractor has a positive influence on the overall poor construction project cost performance.

H5. An Ineffective Contract Management → Contractor Inefficiency: Ineffective project contract administration triggers contractor inefficiency.

H6. An Ineffective Contract Management → Poor Cost Performance (MI): Ineffective project contract administration system has a positive impact on the overall poor construction project cost performance.

H7. External Factors → An Ineffective Contract Management: Project external environmental influence activates project contract management problems.

H8. External Factors → Poor Cost Performance (MI): Project external environmental influence has a positive effect on the overall poor construction project cost performance.

H9. External Factors → Contractor Inefficiency: Occurrence of project external environmental influence triggers contractor inefficiency performance.

H10. Improper Project Design → An Ineffective Contract Management: Improper project design triggers the problems related to the project contract management process.

H11. Improper Project Design → Poor Cost Performance (MI): Improper project design positively impacts an overall poor construction project cost performance.

H12. Construction Material Related Problems → An Ineffective Contract Management: Construction materials supply related problems triggers contract management related problems.
H13. Construction Material Related Problems → Poor Cost Performance (MI): Occurrence of construction materials supply related problems has a positive influence on the overall poor construction project cost performance.

H14. Project Stakeholders Coordination Influence → Contractor Inefficiency: Project stakeholder's coordination related constraints trigger contractor inefficiency performance.
H15. Project Stakeholders Coordination Influence → Poor Cost Performance (MI): Project stakeholders' coordination related problems have a positive effect on the overall poor construction project cost performance.

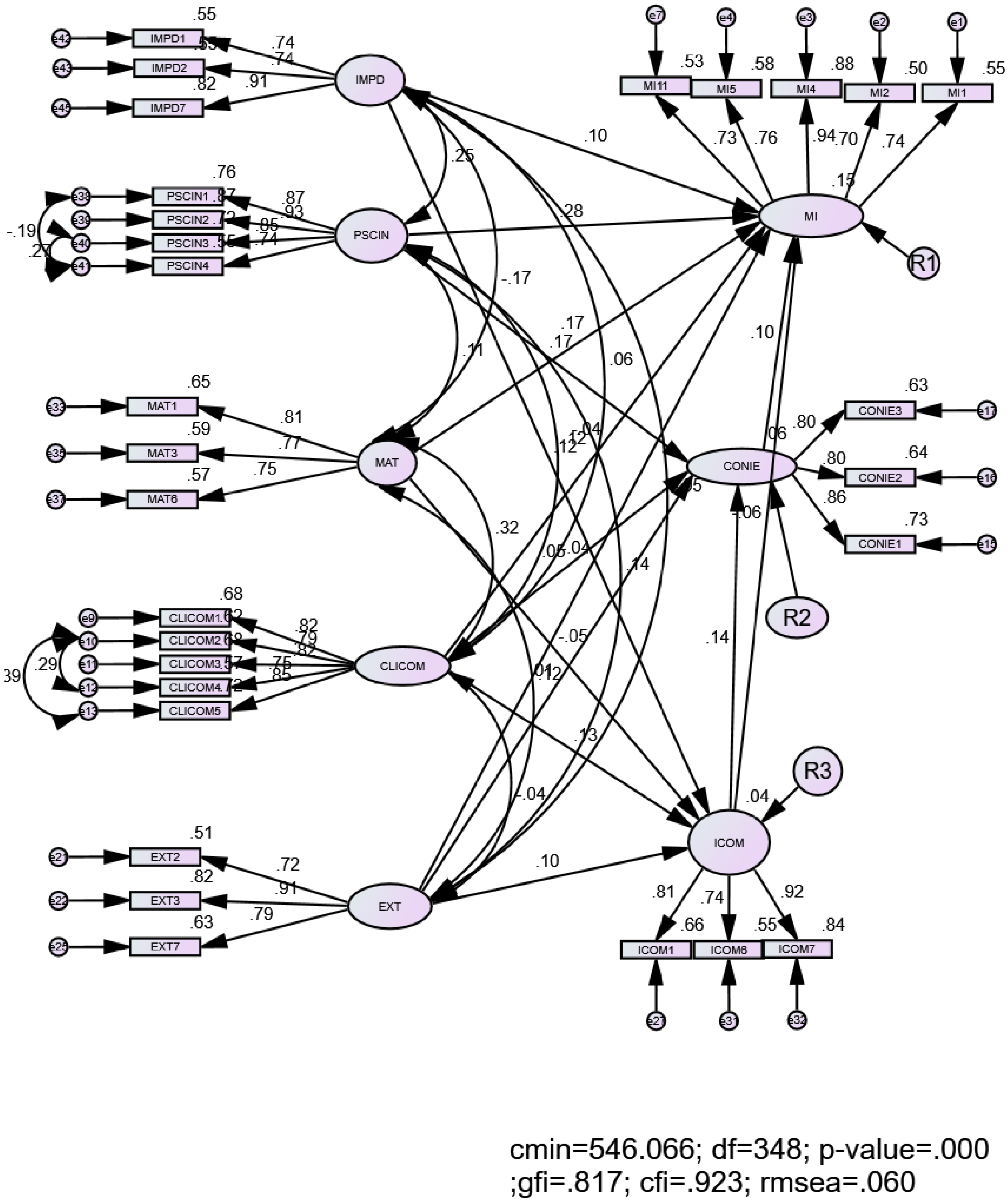

Figure 4. 9 Structural Model (Source: researcher Amos output)

Criteria 1: Assess model fit

The model fit statistics of the structural model are shown in Table 4.16

Table 4. 16 Model Fit Results for Structural Model

GOF Indices							
Chi-Square		Absolut Fit Indices		Incremental Fit Indices		Parsimony Fit Indices	
X2	546.066	RMSEA	0.060	CFI	.923	PCFI	0.786
Df	348	RMR	0.035	IFI	.925	PNFI	0. 696
X2/Df	1.569	CMIN/ DF	1.569	TLI	.911	GFI	0.817

From the results in Table 4.16, the value of CMIN/DF is 1.569 which is within the threshold value (between 1 and 5), the value for RMSEA and RMR is about 0.060 and 0.035 respectively, both are in the acceptable range (<0.08), the values of CFI, IFI, and TLI are all within the threshold ranges (>=0.9) and the values are 0.923, 0.925 and 0.911 respectively. Additionally the values of PCFI and PNFI are also fall within the acceptable range both have values greater than 0.5. Hence, the full structural model as indicated in Figure 4.9 is supported and accepted in terms of the selected fit indices in SEM literature.

Criteria 2: Assess the level of R^2

The R^2 values show the amount of variance in the construct that is explained by the model. R-square shows the amount of variance explained by the exogenous variable in its endogenous counterpart. It represents the quality of the model variables (Hair, Black, and Anderson, 2010). Higher R2 presents better model variance explanations and thus have a higher predictive power. A value of 0.67 is considered substantial, greater than 0.33 is considered average, while less than 0.19 is considered weak (Field, 2009) (Byarugaba, 2016). In this study, the inner path models were 68%, 71%, and 69% for the quality endogenous latent constructs. This indicates that the three independent constructs substantially explain of the variance in the quality. Meaning that the model explains; 68%, 71% and 69% of the variance (R^2) in poor cost performance (MI), Contractor Inefficiency (CONIE) and An Ineffective Contract Management (ICOM) respectively.

The squared multiple correlation was 0.68 for poor cost performance (MI), this shows that 68% variance in poor cost performance (MI) is accounted by Improper Project Design (IMPD), Project Stakeholders Coordination Influence (PSCIN), Construction Material Related Problems (MAT), Client Incompetence (CLICOM) and External Factors (EXT).

Criteria 3: The size, direction, and significance of the estimated structural parameters

The fifth set of criteria for assessing the validity of the structural model is investigating the size, direction, and significance of the structural parameter estimates. Table 4.16 presents the structural path estimates and ten of the fifteen paths are significant**.**

Table 4.16: Summary of hypothesis test result of the best-fit structural model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label	Decision
ICOM	<---	MAT	.243	.027	6.632	***		S
ICOM	<---	CLICOM	.097	.045	2.549	.011(*)		S
ICOM	<---	EXT	.105	.048	2.678	.007(**)		S
ICOM	<---	IMPD	.495	.045	12.119	***		S
CONIE	<---	PSCIN	-.157	.062	-4.32	***		S/IV
CONIE	<---	CLICOM	.304	.061	7.539	***		S
CONIE	<---	EXT	-.149	.07	-2.914	.004(**)		S/IV
CONIE	<---	ICOM	.331	.054	7.959	***		S
MI	<---	IMPD	.013	.049	.297	.766		NS
MI	<---	PSCIN	-.040	.044	-1.295	.195		NS
MI	<---	MAT	.254	.026	10.119	***		S
MI	<---	CLICOM	.409	.046	12.945	***		S
MI	<---	EXT	.105	.048	3.616	***		S
MI	<---	CONIE	.521	.003	17.273	***		S
MI	<---	ICOM	-.093	.046	-2.526	.012(*)		S/IV

Note(s): S=Supported; NS= Not Supported; S/IV=Supported but inversely, C.R = Critical Ratio, S.E= Standard error, P= probability level. The probability value/level is statistically significant at $p<0.05$ for *, $p< 0.010$ for ** and $p<0.001$ for ***

Fifteen theoretical hypotheses are planned, depending on the relations between five exogenous and three endogenous constructs. The survey results in Table 4.16 show that ten of them were supported without objection. All goodness of fit measures related with the selected indexes for both the measurement and structural model was sufficient, which confirmed the theoretical model is well fitted with the observed data. The results of the hypotheses testing were presented in detailed as follows:

1) There is a substantial and statistically significant standardized path coefficient (0.521) between contractor inefficiency and construction project cost performance that supports Hypothesis 4.
2) The predictive relationship between client incompetence and construction project cost performance is positive and robust, with the standardized path coefficients 0.409, then Hypothesis 2 accepted.
3) Construction Material Related Problems have a positive impact on low project cost performance with standardized coefficient 0.254; thus, Hypothesis 13 recognized.
4) Possible path projected from the external factors on to poor construction projects cost performance latent is statistically significant (beta = 0.105), then Hypothesis 8 accepted.
5) There is a stable and positive significant relationship between improper project design and An Ineffective Contract Management with the standardized coefficient 0.495, which thoroughly confirms hypothesis 10.
6) The effect of relationships between client incompetence and An Ineffective Contract Management constructs are positive and statistically significant. So Hypothesis 1 is accepted.
7) The relationship of both the analytical effect of Construction Material Related Problems and External Factors on the project An Ineffective Contract Management are substantial with the standardized beta coefficients of 0.243 and 0.105, respectively. Thus Hypothesis 12 and Hypothesis 7 are accepted reasonably.
8) Client Incompetence has statistically significant influence with standardized coefficient 0.304 on Contractor Inefficiency, which helps us to accept assumption 3.
9) The analytical effect of An Ineffective Contract Management is positive and statistically significant (beta= 0.331) on Contractor Inefficiency performance. Hypothesis 5 accepted.
10) And the rest five hypotheses, namely 6, 9, 11, 14 and 15, are not supported statistically and then rejected.

Discussion of the results

The extended results are discussed as per the purpose of this research and existing theories. Based on various critical factors identified through extensive literature reviews and validated by senior construction professionals, the research data comes from important respondents. Verify the information, then use SPSS statistical techniques for analysis, and use the recommended software (AMOS) for further estimates. It is estimated that eighteen (18) influential failure factors were investigated and noted that these issues undermined the performance of Amhara Industry Park construction projects. The standardized regression weights related to the influencing factors recognized by the study are detailed in Figure 4.9.

These root causes are expressed as Weak project management leadership skills & institutional capacity, Lack of arranging & delivering project site free of complain and financial problems of the client organization, and Extra work order at the construction stage related to the failure of the project client. Poor capacity of contractors (financial, technical, skill and experience aspects), Poor project site management & supervision and Project overload are considered to be the main difficulties related to contractor inefficiency in the Amhara Industry Park construction projects. The inadequate design & specification, lack of sufficient skill and experience of the consultant teams and slow design modification approval process may lead to incomplete design and specifications, which is a serious problem.

In addition, there are a lack of unified project planning system among project parties, an existence of fraudulent practices among project parties, lack of commitments to perform as an agreement and lack of effective communication and coordination among project parties.

4.8.Cost Overrun Mitigation method

4.8.1. Reliability Test by Cronbach's alpha (α) coefficient

The data gathered through questionnaires were checked by Cronbach's alpha (**α**)) coefficient for reliability or consistency. Cronbach's alpha (**α**)) coefficient ranges from 0 to 1.0. The minimum level for reliability using Cronbach's alpha (**α**)) coefficient is 0.7 and any value below this indicates the variables are inconsistent and unreliable.

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\sum s^2{}_y}{s^2{}_x}\right]$$ …………………. Equation (3)

Where (**α**) = Cronbach's alpha

K=the number of test item

$\sum \mathbf{s^2y}$ = Sum of Item Variance

$\mathbf{s^2x}$ = Variance in Total Score

Test for Method of Mitigation for Cost Overrun data

Items/Components =12

Sum of the items variance =9.64

Variance of Total score =40.56

Cronbach's alpha =0.832

The reliability test done using Cronbach's alpha coefficient indicate that this data collected from questionnaires was well consistent.

4.9. Prioritizing Method of Mitigation of Cost overrun

In this section, the cost overrun mitigation measure practices in Amhara Industry Park Construction projects were prioritized by using the Relative Importance index (RII) to rank the method for mitigation measures. Table 13 shows the RII and ranks of the method for mitigation measures.

Table 13 RII method for mitigation measures Assessment

No	Methods of minimizing	Code	RII	Rank
1	Allow sufficient time for feasibility studies, design, planning and tender submission	MM1	0.619	7
2	Appropriate contractual frame work	MM2	0.592	9
3	Appropriate scope of definition	MM3	0.685	3
4	Good coordination and communication between designer and contractor	MM4	0.671	4
5	Hire and motivate experienced and qualified workforce to improve productivity and quality of workshops	MM5	0.696	2
6	Increase supply of material	MM6	0.649	6
7	Elimination of waste at both professional and trade practice level	MM7	0.576	10
8	Bulk purchase of material	MM8	0.608	8
9	Proper cost control/cost performance management	MM9	0.703	1
10	Risk management during project execution	MM10	0.551	12
11	Studying of project history for possible application on another similar project	MM11	0.562	11
12	Establish training programs	MM12	0.665	5

The Cost overrun method of mitigation in the Amhara Industry Park Development Corporation projects mainly minimized by Proper cost control/cost performance management. Hire and motivate experienced and qualified workforce to improve productivity and quality of workshops and Appropriate scope of definition were the second and third main method of mitigation of the Project Overruns.

4.10. Case Studies

This chapter presents five case studies collected from actual project implemented in the Amhara Industry Park Development Corporation. The data was collected via interviews with the project's contractors, consultants and owners. Site visits and reviewing project documents are the main of data collection for all case studies. Summarized data of the collected information was presented by concentrating on the factors influencing cost overruns, the impact of cost overrun and the proposed mitigation method for cost overrun of these projects. After presentation of all opinions of contractors, consultants and owner, conclusion and recommendation has been concluded at the end of this chapter.

4.10.1. Case study No 1: Burie Integrated Agro Industry Asphalt Road Project

Project background

This case illustrates one of projects which experienced cost overruns in Amhara Industry Park Development Corporation. The project faced a lot of obstacles and problems that face every party of the project with variant degree of responsibility for each party. The project consists of Construction of, road, storm water drain, water supply system and sewerage system for IAIP at Bure. The project implementation activities started on 22, August, 2017 and finished on 31, December, 2021.

However, this project has been substantially completed with a total project cost of Ethiopian Birr 683,016,906.19, which shows negative ETB 21,429,394.44. This project has decreased in cost by 3.04% for the reason that there is an omission of works.

4.10.2. Case study No 2: Injibara Transformation Center Road Project

Project background

The project is located in Awi Zone, Amhara Region. The contract of the project had been signed on 1st June 2019. The purpose of the project is to construct new road, Storm Water Drain & Culvert, Sewer Collection System and site works. The project commenced June 2, 2019 and the original completion date was March 17, 2020 with a contract period of 290 calendar days. The Original contract amount was ETB 41,472,494.52.

4.10.3. Case study No 3: Construction of access Road Works in Chagni RTC Project

Project background

The project is located in Awi Zone, Amhara Region. The contract of the project had been signed on 10th May 2020. The purpose of the project is to construct access road for the rural transformation center. The project commenced May 25, 2020 and the original completion date was January 21, 2021 with a contract period of 230 calendar days. The Original contract amount was ETB 9,048,754.73.

4.10.4. Case study No 3: Construction of All Building Works in Chagni RTC Project

Project background

The project is located in Awi Zone, Amhara Region. The contract of the project had been signed on 10th June 2020. The purpose of the project is to construct access road for the rural transformation center. The project commenced June 25, 2020 and the original completion date was June 25, 2021 with a contract period of 365 calendar days. The Original contract amount was ETB 195,254,615.07.

4.10.5. Case study No 5: Dangila Transformation Center Road Project

Project background

The project is located in Awi Zone, Amhara Region. The contract of the project had been signed on 1st June 2019. The purpose of the project is to construct new road, Storm Water Drain & Culvert, Sewer Collection System and site works. The project commenced April 2, 2019 and the original completion date was March 17, 2020 with a contract period of 290 calendar days. The Original contract amount was ETB 37,000,096.99.

In this case, the three project's parties (contractor, consultant and owner) were interviewed, they evaluate the case through their point of views.

Assessment

❖ **Contractor opinion**

The contractor consider that the project cost overruns cause and effect were according to the following reasons:

- Issue of variation orders.
- Continuous changes in specifications and drawing due to incomplete drawings.
- Owner's delay for contractor’s payments

- Right of Way Problems
- Bad weather condition especially in winter.
- Fluctuation in the cost of construction materials.
- Poor feasibility study which amended after the contract has been signed allowing high cost variation and
- Adversely relationship between the stakeholders, project delay and increase political pressure are the major impact/effects of cost overrun.

❖ **Consultant opinion**

The consultant staff considered that the most important causes and effect of cost overrun are the following:

- Owner's delay for payments of contractor.
- Natural disaster
- Lack of materials delivery to the site.
- Poor project site management and supervision
- Cash problem during construction and
- Supplementary agreement and negative attitude towards the construction industry by the public experts and the society are the major impact/effects of cost overrun.

❖ **Owner opinion**

Owner opinion about the cost overrun cause and effects can summarized as following:

- Slow delivery of materials by contractor to the site.
- Poor management of the project.
- Financial problem of contractor
- Mismanagement of consultant and contractor to complete work on time.
- Lack of materials delivery to the site.
- Cash problem of contractor during construction.
- Lack of experienced personnel and
- Dissatisfaction by project owner and made the client for additional cost for supervision and loss its investment return money by the project.

Table 4.15 Summary of the Case Study

Project Name	Case Study-1	Case Study-2	Case Study-3	Case Study-4	Case Study-5
Project Location	Burie IAIP	Injibara RTC	Chagni RTC-access	All building Chagni RTC	Dangila RTC
Procurement Method	Direct	Direct	Direct	Direct	Direct
Type of Contract	Admeasurement	Admeasurement	Admeasurement	Admeasurement	Admeasurement
Planned Contract Amount (ETB)	704,446,300.63	41,472,494.52	9,048,754.73	195,254,615.07	37,000,096.99
Actual Contract Amount (ETB)	683,016,906.19	45,718,632.25	20,628,420.63	142,117,170.07	37,122,190.20
Cost overruns (ETB)	-21,429,394.44	4,246,137.73	11,579,665.90	-53,137,445.00	122,093.20
Cost overruns (%)	-3.04%	10.24%	56.13%	-27.21%	0.33%

Conclusion

In general the above cases could give a clear picture of the extent of severity of poor cost performance problem in Amhara Industry Park Projects. Besides, the following points could be noted.

- All the projects used for the case study are suffering cost overrun by increasing/decreasing.
- For some of the project the additional cost required to be even more than 40% the original contract amount.
- Most of the major problems observed in the projects are similar like contractors poor planning and management, financial problem and project abundant which are the contractor's inefficiency, inadequate design and specification, slow design modification, late possession of the site (RoW problem), variation orders, lack of sufficient skill and experienced personnel, price escalation, etc.

- Most of the major impact/effect of cost overrun observed in the projects are like dissatisfaction by project owner and made the client for additional cost for supervision and loss its investment return money by the project, supplementary agreement, negative attitude towards the construction industry by the public experts and the society, adversely relationship between the stakeholders, project delay and increase political pressure.
- The mitigation measure observed in the projects are Proper cost control, Hire and motivate experienced and qualified workforce, appropriate scope of definition for the project 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 Construction of industry park projects in developing countries like Ethiopia incurs a huge investment taking loan sourced investment with interest rate. Due to the huge capital investment of the sector and economical contribution of such projects to the country, researches on cost overrun assessment of industry park projects gives a bench mark for corrective measures for further project implementations. The identification of the most influential group of cause factor on cost overrun helps to take a focus area on projects to minimize project cost overrun and it shows assignments of related departments of the Amhara Industry Park Development Corporation to overcome cost incremental of the projects.

5.2. Conclusions

The results obtained in the analysis of the questionnaire survey, SEM modeling of cost overrun and the Archival findings 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:

Using SPSS and AMOS software to analyze, estimate and interpret the data. The model suggests 15 hypotheses, from 15 hypothesis 10 hypothesis are fully supported. The results of extensive research and inspection indicate that the top five common related factors that lead to the poor cost performance of Amhara Industry Park Development include the following.

Contractor Inefficiency (CONIE) are the most significant construct or group of factors causing cost overrun. Following Contractor Inefficiency (CONIE) Improper Project Design (IMPD) are the second significant construct or group of factors causing affects cost overrun.

Client Incompetence (CLICOM), An Ineffective Contract Management (ICOM) and Construction Material Related Problems (MAT) are the third, fourth and fifth significant construct or group of factors causing affects cost overrun. As indicated most of the causing factors are contractor related.

It is shown 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 cost performance have been affected.

It is found that government owned enterprise performance have a great impact on the construction industry in such a way that their poor cost performance will create supplementary agreement, delay the projects, eroding mutual trust and respect among the parties, and it creates negative attitude towards public authority

5.3. Recommendations.

From the study of the research paper; the following major recommendations are forwarded to the Employer and other researchers;

- Amhara Industry Park development Corporation is advised to have well developed and finalized feasibility study and employer's requirement prior to contract agreements.
- Should finalize and handle Right of Way issues and temporary sites prior to commencement of projects.
- Schedule reviews should be always on desk tasks, works which are not inter Sequential can be done independently, reviewing contractors progress should be done in well enhanced manner.
- Empowering Project Managers for better leadership and assigning the right professionals to the right task.
- Establish training program and knowledge transfer on modern project management techniques, tools and practices are essential.

5.4. Recommendations for further research:

The author would like to suggest future research to be carried out on: Comparative study of project overrun on Amhara Industry Park's Construction projects. It is believed that they will contribute a better towards industry park construction and to the country's construction development as a whole.

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Appendices

Appendix A: Questionnaire

Code: __________

BAHIR DAR UNIVERSITY

BAHIR DAR INSTITUTE OF TECHNOLOGY

SCHOOL OF RESEARCH AND POSTGRADUATE STUDIES

FACULTY OF CIVIL AND WATER RESOURCE ENGINEERING

Questionnaire Survey

Dear respondent;

My name is Melkie Fenta and I am student of Master of Construction Technology and Management, (CoTM), at Bahir Dar University Institute of Technology. As partial fulfillment of the program, I am undertaking a research on the topic of **Investigation on Cause and Effect of Cost Overrun Using SEM: (A Case of Government Owned Industry Park Construction Projects).** The research result could be used as an input for decision makers, professionals, academician and other interested groups to play their respective role for the achievement of project objectives.

It is believe that your participation in this research will contribute in achieving the objectives of the research. Therefore, the quality of your response to the items in question determines the quality of the research results. So, please answer the questions as thoroughly, objectively and honestly as possible according to the instructions contained in the body of the questionnaire. Finally, I want to promise you that all information provided in this questionnaire will be used only for academic research and will be strictly confidential. After all questionnaires are collected and analyzed, interested participants of this study will be given feedback on the overall research results.

Thank you for your kind Cooperation. For further information, you can contact me. Tel:(0910043074)

By: Melkie Fenta

March 2022
Bahir Dar, Ethiopia

Part 1: General Information

The following questions are related to the general information of respondents and the companies. Please provide the appropriate information for each question.

A) Please put a tick √ or X in the Box only one that represents you most appropriately.

1. Type of Organization:
   A. Owner ☐ B. Consultant ☐ C. Contractor ☐

   1.1. Company Name (optional): ---

2. Job title of the respondent:
   A. Project Manager ☐
   B. Resident Engineer ☐
   C. Material Engineer ☐
   D. Site Engineer ☐
   E. Office Engineer ☐
   F. Contract Engineer ☐
   G. Others (specify) ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

3. Years of experience of the respondent (including previous tenure)
   A. less than 5 years ☐
   B. 5-10 years ☐
   C. More than 10 years ☐

4. What is your highest Educational Level?
   A. PhD Degree ☐
   B. Master's Degree ☐
   C. First Degree ☐
   D. Diploma ☐

Part 2: Factors affecting cost overrun of Construction Project.

Below are list of factors affecting cost overrun of construction projects? From your experience, please express your opinion on the importance of the following factors that affect industry park construction projects in Amhara Industry Park Corporation. (Please put a tick mark in the appropriate column according to their degree of rank).

2.1 How do you rate the government owned enterprise's performance on most projects?

Good ☐ Fair ☐ Poor ☐

2.2 Does these projects suffer from cost overrun?

Yes ☐ No ☐

2.3 If your answer is Yes for question 2.2., which of the following are most contributing factors for government owned enterprises' low performance leading to cost overrun in industry park construction projects?

1) Very low contributing
2) Low contributing
3) Medium contributing
4) High contributing
5) Very high contributing

Table 2.1 Factors causing of cost overrun.

No	Causes of Cost Overrun	Degree of Rank				
		Very low contributing (1)	**low contributing (2)**	**medium contributing (3)**	**high contributing (4)**	**Very high contributing (5)**
A:An Ineffective Contract Management (ICOM)						
1	Poor project planning & administration system					
2	Delay of payments					
3	Slow and poor decision making					
4	Lack of appropriate project supervision & reporting system					
5	Lack of coordinating & managing project stakeholders					
6	Failure of taking law enforcement measure					
7	Resource management problems					
B: Client Incompetence (CLICOM)						
1	Weak project management leadership skills & institutional capacity					

No	Causes of Cost Overrun	Degree of Rank				
		Very low contributing (1)	low contributing (2)	medium contributing (3)	high contributing (4)	Very high contributing (5)
2	Extra work order					
3	Lack of arranging & delivering project site free of complain					
4	Financial problems					
5	Holding key project decision					
6	Not scheduled construction inputs delivery					
7	Lack of knowledge related to construction work					
8	Late project fund preparation & allocation process					
C: Improper Project Design (IMPD)						
1	Inadequate design & specification					
2	Lack of sufficient skill and experience of the consultant teams					
3	Inadequacy of the procurement process					
4	Lack of full feasibility study before the design					
5	Frequent design change					
6	Inadequate project time and cost estimation					
7	Slow design modification approval process					
D: Construction Material Related Problems (MAT)						
1	Unscheduled delivery of construction materials					
2	Escalation of construction materials price					
3	Inefficient construction materials quality test					
4	Poor resource usage & controlling on the project site					
5	Use of low-quality construction materials					
6	Depending on the import construction inputs					
E:Project Stakeholders Coordination Influence (PSCIN)						
1	Lack of unified project planning system among project party’s					

No	Causes of Cost Overrun	Degree of Rank				
		Very low contributing (1)	low contributing (2)	medium contributing (3)	high contributing (4)	Very high contributing (5)
2	An existence of fraudulent practices among project parties					
3	Lack of commitments to perform as an agreement					
4	Lack of effective communication and coordination among project parties					
F: Contractor Inefficiency (CONIE)						
1	Poor capacity of contractors (financial, technical, skill and experience aspects)					
2	Poor project site management & supervision					
3	Project overload					
4	Project team commitment problems					
5	Activities sequence problems					
6	Lack of use of up-to-date construction types of equipment					
7	Incompetent sub-contractor					
8	Absence of satisfactory skilled construction professionals on the project site					
9	Use of unqualified workforce					
G: External Factors (EXT)						
1	Riot around the Project Site					
2	Laws and Regulatory Framework					
3	Accidents during construction					
4	Political Interference					
5	Currency Exchange Fluctuations					
6	Access to Project Sites					
7	Natural disasters/Acts of God					
8	Surrounding Social and Cultural Impacts					

Part 3: Major Impact of cost overrun of Construction Project.

Below are list of major impact of cost overrun of construction projects? From your experience, please express your opinion on the importance of the following impacts that related to cost overrun of industry park construction projects in Amhara Industry Park Corporation. (Please put a tick mark in the appropriate column according to their degree of rank).

(Please put a √ **or x** in the box) Each scale represents the following rating:

(1) Never
(2) Rarely
(3) Sometime
(4) Mostly
(5) Always

Table 3.1 Major Impacts of cost overrun.

Item No	**Major Impacts**	**Degree of impact**				
		Never (1)	**Rarely (2)**	**Sometime (3)**	**Mostly (4)**	**Always (5)**
1	Adversarial relations among stakeholder					
2	Delay					
3	Bad reputation in ability to secure project finance					
4	Supplementary agreement					
5	Dissatisfaction by project owners and consequently by industry park users/the public,					
6	Increase political pressure/ instability					
7	Project abandonment					
8	Made the employer for additional cost and loss its investment return money lately					
9	Lead to poor cash flow to the contractor and lowering contractor’s capacity development					
10	Effect on the overall growth of the country					
11	Negative attitude towards the construction industry by the higher public expert and by the society as a whole,					
12	High fee (cost) of supervision and contract administration for consultants					

3.1 Please write additional Impacts of poor cost performance of government owed enterprise in the industry park construction. (If any)

____

____

Part 4: Methods of Minimizing cost overrun of Construction Project.

Below are list of methods of minimizing cost overrun of construction projects. From your experience, please express your opinion on the importance of the following methods that minimize cost overrun of industry park construction projects in Amhara Industry Park Corporation. (Please put a tick mark in the appropriate column according to their degree of rank).

(Please put a √ or x in the box) Each scale represents the following rating

(1) Very low effective
(2) Low effective
(3) Medium effective
4) High effective
5) Very high effective

Table 4.1 Methods of minimizing of poor cost performance (cost overrun).

Item No	Proposed Method	Degree of effectiveness				
		Very low effective (1)	Low effective (2)	Medium effective (3)	High effective (4)	Very high effective (5)
1	Allow adequate time for feasibility studies, design, planning and tender submission					
2	Appropriate contractual frame work					
3	Appropriate scope of definition					
4	Good coordination and communication between designer and contractor					
5	Hire and motivate experienced and qualified workforce to improve productivity and quality of workshops					
6	Increase supply of material					
7	Elimination of waste at both professional and trade practice level					
8	Bulk purchase of material					
9	Proper cost control/cost performance management					
10	Risk management during project execution					
11	Studying of project history for possible application on another similar project					
12	Establish training programs					

4.1 Please write additional method of minimizing poor cost performance of government owed enterprise in the industry park construction. (If any)

___

Thank You for Your Cooperation and help.

Appendix B: Interview

BAHIR DAR UNIVERSITY

BAHIR DAR INSTITUTE OF TECHNOLOGY

SCHOOL OF RESEARCH AND POSTGRADUATE STUDIES

FACULTY OF CIVIL AND WATER RESOURCE ENGINEERING

Interview

Dear:

I would like to extend my heartfelt thankfulness for your participation in this study in advance. This is an invitation of you to participate in the study by Melkie Fenta, MSc student in Construction Technology and Management (CoTM), in Bahir Dar University Institute of Technology. The aim of this study is to assess the cost overrun of government owned enterprise in Amhara Industry Park construction project. The research result could be used as an input for decision makers, professionals, academician and other interested groups to play their respective role for the achievement of project objectives. All the necessarily information shared will keep confidential and will use only for this study.

Thank you for your kind Cooperation. For further information, you can contact me. *Tel:(0910043074)*

Interview template

Interviewee ID:	
Interview duration:	
Interview date:	
Interview time	
Type of interviewee's organization:	

1. How many years of construction industry experience do you have?

   ----

2. What is your current job designation?

   ----

3. From your experience of construction projects, what are the main factors to the cost overrun of government owned enterprise in Amhara industry park construction projects?

   ----

4. From your experience of construction projects, what are the main impact of cost overrun of government owned enterprise in Amhara industry park construction projects?

   ----

5. From your experience of construction projects, what will be the proposed method for mitigation of cost overrun of government owned enterprise in Amhara industry park construction projects?

Appendix C Exploratory Factor Analysis (Using SPSS)
Normality

Appendix C1 Results for Normality (Skewness and Kurtosis)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ICOM1	158	1	5	3.44	.833	-.299	.193	-.313	.384
ICOM2	158	1	5	3.46	.826	-.269	.193	-.241	.384
ICOM3	158	2	5	3.22	.817	-.061	.193	-.870	.384
ICOM4	158	2	5	3.41	.815	-.032	.193	-.522	.384
ICOM5	158	2	5	3.39	.820	-.120	.193	-.609	.384
ICOM6	158	2	5	3.42	.816	-.072	.193	-.532	.384
ICOM7	158	2	5	3.35	.766	-.273	.193	-.618	.384
CLICOM1	158	2	5	3.09	.812	.113	.193	-.871	.384
CLICOM2	158	2	5	3.17	.792	.075	.193	-.671	.384
CLICOM3	158	2	5	3.17	.767	-.045	.193	-.787	.384
CLICOM4	158	1	5	3.02	.810	.184	.193	-.570	.384
CLICOM5	158	2	5	3.07	.791	.188	.193	-.690	.384
CLICOM6	158	2	5	3.21	.799	.061	.193	-.642	.384
CLICOM7	158	1	4	2.77	.722	-.141	.193	-.215	.384
CLICOM8	158	2	5	3.13	.720	-.091	.193	-.827	.384
IMPD1	158	2	5	3.46	.834	-.178	.193	-.579	.384
IMPD2	158	2	5	3.33	.863	.030	.193	-.715	.384
IMPD3	158	1	5	2.84	.805	.086	.193	-.254	.384
IMPD4	158	1	5	3.14	.856	.037	.193	-.754	.384
IMPD5	158	1	5	3.14	.856	.037	.193	-.754	.384
IMPD6	158	2	5	3.14	.802	.118	.193	-.705	.384
IMPD7	158	2	5	3.31	.881	-.085	.193	-.898	.384
MAT1	158	2	5	3.35	.844	.038	.193	-.627	.384
MAT2	158	2	5	3.27	.761	-.138	.193	-.672	.384
MAT3	158	2	5	3.38	.803	-.124	.193	-.570	.384
MAT4	158	2	5	3.40	.757	-.187	.193	-.448	.384
MAT5	158	2	4	3.32	.659	-.445	.193	-.727	.384
MAT6	158	2	5	3.42	.776	-.053	.193	-.410	.384
PSCIN1	158	1	5	3.66	.803	-.663	.193	1.166	.384
PSCIN2	158	1	5	3.62	.811	-.651	.193	.980	.384

PSCIN3	158	1	5	3.59	.749	-.652	.193	1.026	.384
PSCIN4	158	1	5	3.54	.834	-.955	.193	1.272	.384
CONIE1	158	1	5	3.51	.812	-.114	.193	-.099	.384
CONIE2	158	1	5	3.55	.810	-.457	.193	.747	.384
CONIE3	158	1	5	3.50	.804	-.484	.193	.312	.384
CONIE4	158	1	5	3.40	.798	-.159	.193	-.153	.384
CONIE5	158	1	5	3.16	.826	-.509	.193	-.112	.384
CONIE6	158	1	5	3.37	.891	-.247	.193	-.183	.384
CONIE7	158	1	5	3.59	.882	-.237	.193	-.094	.384
CONIE8	158	1	4	3.10	.660	-.245	.193	-.190	.384
CONIE9	158	1	5	3.18	.694	-.147	.193	-.007	.384
EXT1	158	1	5	2.65	.814	.594	.193	.093	.384
EXT2	158	1	5	2.77	.861	.716	.193	.226	.384
EXT3	158	1	5	2.80	.804	.757	.193	.363	.384
EXT4	158	1	5	2.91	.862	.535	.193	-.051	.384
EXT5	158	1	4	2.62	.635	-.084	.193	-.162	.384
EXT6	158	1	5	3.07	.952	.084	.193	-.706	.384
EXT7	158	2	5	2.78	.760	.913	.193	.868	.384
EXT8	158	1	5	2.85	.853	.297	.193	.229	.384
MI1	158	1	5	3.23	.742	.163	.193	.278	.384
MI2	158	2	5	3.36	.784	-.011	.193	-.460	.384
MI3	158	2	4	3.05	.646	-.047	.193	-.579	.384
MI4	158	2	5	3.49	.796	.021	.193	-.423	.384
MI5	158	2	5	3.40	.813	.081	.193	-.470	.384
MI6	158	2	5	3.35	.813	-.001	.193	-.558	.384
MI7	158	1	5	3.22	.809	.026	.193	-.346	.384
MI8	158	2	4	3.05	.730	-.078	.193	-1.105	.384
MI9	158	1	5	3.47	.835	-.132	.193	-.238	.384
MI10	158	1	5	3.08	.727	-.218	.193	-.198	.384
MI11	158	1	5	3.41	.890	-.196	.193	-.064	.384
MI12	158	1	5	3.28	.828	.188	.193	-.157	.384
Valid N (listwise)	158								

Communalities

Appendix C2 Results for Communalities

Communalities

	Initial	Extraction
ICOM1	1.000	.762
ICOM2	1.000	.695
ICOM3	1.000	.694
ICOM4	1.000	.692
ICOM5	1.000	.787
ICOM6	1.000	.731
ICOM7	1.000	.810
CLICOM1	1.000	.743
CLICOM2	1.000	.793
CLICOM3	1.000	.815
CLICOM4	1.000	.785
CLICOM5	1.000	.769
CLICOM6	1.000	.778
CLICOM7	1.000	.611
CLICOM8	1.000	.707
IMPD1	1.000	.736
IMPD2	1.000	.753
IMPD3	1.000	.763
IMPD4	1.000	.834
IMPD5	1.000	.807
IMPD6	1.000	.691
IMPD7	1.000	.767
MAT1	1.000	.760
MAT2	1.000	.652
MAT3	1.000	.704
MAT4	1.000	.801
MAT5	1.000	.627
MAT6	1.000	.661
PSCIN1	1.000	.820
PSCIN2	1.000	.889
PSCIN3	1.000	.852
PSCIN4	1.000	.782
CONIE1	1.000	.812
CONIE2	1.000	.752
CONIE3	1.000	.789

CONIE4	1.000	.806
CONIE5	1.000	.571
CONIE6	1.000	.747
CONIE7	1.000	.749
CONIE8	1.000	.790
CONIE9	1.000	.613
EXT1	1.000	.588
EXT2	1.000	.717
EXT3	1.000	.762
EXT4	1.000	.847
EXT5	1.000	.616
EXT6	1.000	.740
EXT7	1.000	.754
EXT8	1.000	.763
MI1	1.000	.677
MI2	1.000	.721
MI3	1.000	.625
MI4	1.000	.852
MI5	1.000	.678
MI6	1.000	.837
MI7	1.000	.802
MI8	1.000	.505
MI9	1.000	.811
MI10	1.000	.595
MI11	1.000	.727
MI12	1.000	.799

Extraction Method: Principal Component Analysis.

Appendix D: Reliability Test Results

Appendix D1 Results for Methods of Minimizing of poor cost Performance

Reliability Statistics

Cronbach's Alpha	N of Items
.807	12

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
MM1	34.61	30.826	.375	.800
MM2	34.75	32.951	.193	.812
MM3	34.11	29.452	.530	.786
MM4	34.18	29.208	.548	.785
MM5	34.06	28.385	.547	.784
MM6	34.29	29.380	.542	.785
MM7	34.66	31.386	.289	.808
MM8	34.50	29.933	.481	.791
MM9	34.03	29.566	.459	.793
MM10	34.78	29.393	.417	.797
MM11	34.73	28.900	.505	.788
MM12	34.22	28.960	.540	.785