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Causes of Project Implementation Delay in the Ethiopian Electric Utility Enterprise: The Case of Construction Projects in Universal Electric Access Program

Meaza Alemayehu¹

Abstract

This study identifies the major sources of delay in the implementation of construction projects in the Ethiopian electric utility enterprise. It also investigates the magnitude of schedule variance and cost overrun experienced by the Universal Electric Access Program (UEAP) due to implementation delay. Primary data were generated from 239 individuals working for UEAP in Amhara, Tigray, Oromia, SNNP, Afar, Gambela, Benshanguel Gumuz, Harari, and Somali regional states and from Dire Dawa city administration. Of these, 168 were employees and 71 of them were contractors. Samples were drawn through stratified sampling procedure. Secondary data were collected from documents that have information about the 41 project examined. Data were analyzed both quantitatively and qualitatively. Quantitative data were analyzed using the Relative Importance Index (RII), schedule variance index, cost performance index and paired t-test. Qualitative data were analyzed using frequency and percentages as well as qualitative description of interview responses. The results showed that 28% of the delays are due to factors related to the employers followed by 23% to factors associated to contractors. Delay in material supply and redesigning of plans accounted 17% and 12% respectively. The overall average time delay of the 41 projects was 2.48 years while they were expected to be completed in 8 months. The projects encountered a 44% cost overrun compared to their initial budget plans. The paired t-test analysis showed a statistically significant difference between planned completion time and actual completion time, and planned budget and budget at completion. Therefore, the major sources of delay should be the focus of the Ethiopian Electric Utility Enterprise.

Keywords: *Delay, construction projects, cost overrun, schedule variance, sources of delay, Electric utility enterprise and Ethiopia.*

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1. Introduction

1.1 Background of the study

In construction projects, delay could be defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery of project outcomes (Assaf and Al-Hejji, 2006). They stated that only 30% construction projects were completed within the scheduled completion date globally. The average time overrun lies between 10% and 30%. Delays have a negative effect on projects in terms of performance, time and cost. Thus, it is essential to identify the types of delays that normally occur in a project. Delays can be broadly classified in to two as: compensable delays(caused by the client) and non-excusable delays (caused by the contractor), critical or noncritical delays, and concurrent or non-concurrent delays. The identification of the types of delays helps to identify the causes of delays, and take mitigation strategies. Mitigation of delays can be achieved by adopting the process of knowledge management and project learning which gives insight into the various problems and their solutions. Prevention of delays by adopting innovative and teamwork helps in planning and analyzing the requirements in detail which will allow the mapping of resources and identifying the risks (Hasseb *et al.*, 2011).

1.2 Statement of the Problem

In the electric energy sector, there are construction projects in the generation of electricity, in substation &transmission line construction, and in the distribution network construction. This study covers construction projects in the distribution line that aimed at providing electricity to rural towns and villages in the country. The Ethiopian Electric Utility Enterprise is established in December 2013 when the Ethiopian Electric Power Corporation (EPCO)was split in two companies as Ethiopian Electric Utility Enterprise

and Ethiopian Electric Power Enterprise. The mission of the Enterprise as presented in the Council of Minister Regulation No.303/2013, is to construct and maintain electric distribution networks, to purchase bulk electric power and sell electric energy to customers (FDRE, 2013). The case organization in this study is the Universal Electricity Access Program (UEAP), which is administered under the Ethiopian Electric Utility Enterprise (Council of Minister Regulation No.382/2016). UEAP is established in 2005 to electrify rural towns throughout Ethiopia. In GTP I UEAP had a plan to electrify 10,164 rural towns and up to the end of the GTPI 5,542 rural towns were electrified which is 54.6% of the plan (Ethiopian Electric Power Enterprise, 2008).

Stakeholders assessment of the overall performance of the Ethiopian electric power enterprise in August 2015 against its plan identified and forwarded major problems of the enterprises that resulted in high power interruption, project delays, poor customer handling, and unsatisfactory overall performance. The rural electrification project performance report achieved only 54.6% percent of its plan and 45.4% of the projects showed implementation delay (Ethiopian Electric Power Enterprise 2008). In addition to this the 2007 EC performance report of the Universal Electricity Access Program (UEAP) indicated that there is 64.5% delay of project construction completion for which the causes needed to be studied (Ethiopian Electric Power Enterprise, 2007).

In case of UEAP, delays due to contractor's performance, material shortage is raised in different discussion forums. However, research was not conducted to assess the cause of delay in Electric Access Program distribution line construction in Ethiopia. This research is therefore aimed at investigating the major sources of project implementation delay in the case of UEAP. The

general objective of the study is to assess the sources of delay of the projects in the case organization and finally forward suggestions on how to minimize the project delay. More specifically it assess the extent to which the enterprise is forced to incur additional costs to complete the delayed projects, and identifies the main sources of construction delay in UEAP construction project, and forward possible recommendations. The scope of this study is limited to assess the factors causing for delay of the electric power distribution line construction projects in Universal Electricity Access Program in Ethiopian Eclectic Utility in GTP I (2011–2015).

2. Review of Related Literature

2.1 Concepts of Project Implementation Delay

The inability to complete projects on time and within budget continues to be a chronic problem worldwide (Ahmed *et al.*, 2000). According to Azhar and Farouqui (2008) observation that the trend of cost overruns is common worldwide. The debate in the construction industry on how to minimize or eliminate delays and cost overruns has been on for some time among professionals, clients and/or end users, and policy makers. As the construction industry continues to grow, so do planning and budgeting problems. This is because it is common for projects not to be completed on time and within the initial project budget. There are quite many examples at the national and international scene. For instance, most of the construction projects in Ethiopia have had problems with time and cost overruns and this has caused a lot of concern (Becker and Behailu, 2006). Because of construction delays and cost overruns, less and less work is performed despite the increase in construction budgets.

It is common to see construction projects failing to achieve their mission within the specified cost and time. Hardly few projects get completed on time and within budget since construction projects are exposed to uncertain environments because of such factors as construction complexity; presence of various interest groups such as the project owners, end users, consultants, contractors, financiers; materials, equipment, project funding; climatic environment; the economic and political environment and statutory regulations. Time and cost overruns occur in most construction projects and the magnitude varies considerably from project to project. So, it is essential to define the actual causes of time and cost overruns to minimize and avoid the delays and increasing cost in any construction project (Ahmed *et al.*, 2000).

Different researchers have studied the main causes of delay in the construction industry. Lo *et al.* (2006) summarized some of the studies that took place from 1971 to 2000, which is presented in the table below.

Table 1: Summary of Previous Studies on the Causes of Delays

Researchers	Country	Major causes of delay
Baldwin <i>et al.</i> (1971)	United States	<ul style="list-style-type: none"> • inclement weather • shortages of labor supply • subcontracting system
Arditi <i>et al.</i> (1985)	Turkey	<ul style="list-style-type: none"> • shortages of resources • financial difficulties faced by public agencies and contractors • organizational deficiencies • delays in design work • frequent changes in orders/design • considerable additional work
Okpala and Aniekwu (1988)	Nigeria	<ul style="list-style-type: none"> • shortages of materials • failure to pay for completed work • poor contract management

Mansfield <i>et al.</i> (1994)	Nigeria	<ul style="list-style-type: none"> • improper financial and payment arrangements • poor contract management • shortages of materials • inaccurate cost estimates • fluctuations in cost
Semple <i>et al.</i> (1994)	Canada	<ul style="list-style-type: none"> • increases in the scope of the work • inclement weather • restricted access
Al-Khal and Al-Ghafly (1999)	Saudi Arabia	<ul style="list-style-type: none"> • cash flow problems/financial difficulties • difficulties in obtaining permits • “lowest bid wins” system
Al-Momani (2000)	Jordan	<ul style="list-style-type: none"> • poor design • changes in orders/design • inclement weather • unforeseen site conditions • late deliveries
Lo <i>et al.</i> (2006)	Hong Kong	<ul style="list-style-type: none"> • inadequate resources • unforeseen ground conditions • exceptionally low bids • inexperienced contractor • work in conflict with existing utilities • poor site management and supervision • unrealistic contract duration
Abubeker (2015)	Ethiopia	<ul style="list-style-type: none"> • Delay to deliver the site (Right of way problem) • Financial problems • Improper planning • Weather condition • unrealistically imposed contract duration

2.2 Classification of Project Implementation Delay

Delays are classified into two different types according to liability: excusable and inexcusable. When the contractor is responsible for the cause of the delay,

it is called an inexcusable delay. The contractor cannot obtain a time extension for inexcusable delays. The contractor is also liable for damages incurred by the owner because of the inexcusable delay. Theodore (2009) mentioned that there are four basic ways to categorize type of delays:

- Critical or noncritical
- Excusable or non-excusable
- Compensable or non-compensable
- Concurrent or non-concurrent

In the process of determining the effect of a delay on the project, the analyst must determine whether the delay is critical or noncritical. The analyst must also assess if delay is concurrent. All delays that are identified in the analysis will be either excusable or non-excusable. Delay can be further categorized into compensable or non-compensable delays.

Critical versus Non-Critical Delays: Delays that affect the project completion; or in some cases a milestone date; are considered as critical delays; and delays that do not affect the project completion; or a milestone date; are noncritical delays. If these activities are delayed, the project completion date or a milestone date will be delayed. The determining which activities truly control the project completion date depends on the following:

- a) The project itself
- b) The contractor's plan and schedule (particularly the critical path)
- c) The requirement of the contract for sequence and phasing
- d) The physical constraint of the project, i.e. how to build the job from a practical perspective

Excusable versus Non-Excusable Delays: All delays are either excusable or non-excusable. An excusable delay is a delay that is due to an unforeseeable

event beyond the contractor's or the subcontractor's control. These are some examples of non-excusable delays:

- Late performance of sub-contractors
- Untimely performance by suppliers
- Faulty workmanship by the contractor or sub-contractors
- A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices

Compensable Delays versus Non-Compensable Delays: A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension. Whether a delay is compensable depends primarily on the terms of the contract. In the most cases, a contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension Categories (Theodore, 2009).

Concurrent Delays: The concept of concurrent delay has become a very common presentation as part of some analysis of construction delays. The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension

without additional compensation. Contractors will often cite concurrent delays by the owner as a reason why liquidated damages should not be assessed for its delays. Unfortunately, few contract specifications include a definition of concurrent delay and how concurrent delays affect a contractor's entitlement to additional compensation for time extension or responsibility for liquidated damages.

2.3 Causes of Delays in Construction Projects

1) Contractor related Delay Factors

There are several studies by numerous researchers identified the factors of contractor related delays. Murali *et al.* (2007) identified the improper planning contractor, poor site management and inadequate contractor experience problems with subcontractors contribute to causes of delays. Fong *et al.* (2006) note that delay in interior finishes (tiles, painting, ceiling), delay in handover of plant room/plinth/water tank, improper electrical and mechanical coordination and management contribute to causes of delays. Essam (2006) identified the subcontracting problems, contractor is not well organized, contractor financial problems and bad quality of contractor's work contribute to causes of delays.

Sadiet *et al.* (2006) identified the conflicts in subcontractors schedule in execution of project, rework due to errors during construction, conflicts between contractor and other parties (consultant and owner), poor site management and supervision by contractor, poor communication and coordination by contractor with other parties, ineffective planning and scheduling of project by contractor, improper construction methods implemented by contractor, delays in sub-contractors work, inadequate contractor's work, frequent change of subcontractors because of their

inefficient work, poor qualification of the contractor technical staff, delay in site mobilization contribute to causes of delays.

Yaw *et al.* (2003) noted that planning and scheduling deficiencies, deficiencies in cost estimates prepared, waiting for information, mistakes during construction contribute to causes of delays. Abdalla *et al.* (2002) identified the subcontractor, site management, construction method, improper planning and inadequate contractor experience contributes to causes of delays. Sweis *et al.* (2007) identified the lack of contractor administrative personnel, shortage of technical professionals in the contractor organization, insufficient coordination among the parties by the contractor, delay in mobilization, safety rules and regulations are not followed within the contractor's organization, incompetent technical staff assigned to the project, improper technical study by the contractor during the bidding stage, poor planning and scheduling of the project by the contractor, improper handling of the project progress by the contractor, ineffective quality control by the contractor, use of unacceptable construction techniques by the contractor, financial difficulties faced by the contractor, and delay in contractor payments to subcontractors contribute to delay in the implementation of projects.

2) Client related Delays

There are several studies by different researchers identified client related factors as causes of project implementation delays. According to Chabota *et al.* (2008) identified the economic problems, and contract modification contributes to causes of delays. Murali *et al.* (2007) identified owner's interference, slow decision making, unrealistic contract duration and requirements imposed contribute to causes of delays. Fong *et al.* (2006) identified the client type, lack of timely making decision; unrealistic imposed contract and client initiated variations contribute to causes of delays. Essam

(2006) identified the change or variation orders, delay caused by owner, oral change orders by owner contribute to causes of delays. Sadi *et al.* (2006) identified the delays to furnish and deliver the site to the contractor by the owner, change orders by owner during construction owner, late in revising and approving design documents by owner, delay in approving shop drawings and sample materials, poor communication and coordination by owner and other parties, slowness in decision making process by owner, conflicts between joint-ownership of the project, unavailability of incentives for contractor for finishing ahead of schedule, suspension of work by owner contribute to causes of delays.

Abdalla *et al.* (2002) noted that owner's interference, slow decision making by owner, unrealistic impose contract duration contribute to causes of delays. Sweis *et al.* (2007) identified the delays in site preparation, delay in contractor's claims settlements, work suspension by the owner, too many change orders from owner, slow decision making from owner, inference by the owner in the construction operations, delay in progress payments by the owner. There are a lot of factor that were get from previous study about the factor cause the delay in construction project. Most of the researchers agree that are the factor that always happen relate to the client:

- i. Inference by the owner in the construction operations change orders by owner during construction owner.
- ii. Poor communication and coordination by owner and other parties.
- iii. Slow decision making from owner.

3) Material Supply Related Delay Factors

Several studies identified the factors of material related delays. According to Hyunjoo *et al.* (2007) identify the material delivery were identified as factors to causes of delays in construction project. Murali *et al.* (2006) identify the

quality of material and shortage in material contributed the cause. Koushki *et al.* (2004) revealed that the material selection duration contributes to causes of delays. Sweis *et al.* (2007) identify the shortage of materials, delay in materials delivery contribute to causes of delays. Aibinu *et al.* (2002) identify the material management problems that contribute to causes of delays.

Abdalla *et al.* (2002) identify the poor quality of material and shortage having high influence to causes of delays. Murali *et al.* (2007) identify the shortage in material and quality of material that contributes to causes of delays. Sadi *et al.* (2005) identify the shortage of construction materials in market, changes in material types and specifications during construction, delay in material delivery, damage of sorted material while they are needed urgently, delay in manufacturing special building materials, late procurement of materials and late in selection of finishing materials due to availability of many types in market that contributes to causes of delays. Sweis *et al.* (2007) identified the shortage of materials, delay in materials delivery, modifications in materials specifications that contribute to causes of delays. There are a lot of factor that were get from previous study about the factor cause the delay in construction project. Most of the researchers agree that are the factor that always happen relate to the material:

- i. Shortage of construction materials in market.
- ii. Unpunctually material delivery.
- iii. Poor quality of material in construction.

4) Labor related Delays Factors

Group of labor related delays, one of the groups of causes identified earlier, was commonly cited in the literature that caused of delays. Several factors that related to labor can be distinguished and categorized under the principle

cause. The methodology of establishing the factors of this group of causes was like that of the material related delays.

Several studies identified the factors of labor related delays. According to Murali *et al.* (2006) identified the labor supply and labor productivity that contribute to causes of delays. Abdalla *et al.* (2002) identified the labor supply and labor productivity that contributes to causes of delays. Yaw *et al.* (2003) identified the labor shortages that contribute to causes of delays. Sadiet *et al.* (2006) identify the shortage of labors and low productivity level of labors that contribute to causes of delays. Sweis *et al.* (2007) identified the shortage of manpower (skilled, semi-skilled, unskilled labor) and presence of unskilled labor that contribute to causes of delays. There are a lot of factor that were get from previous study about the factor cause the delay in construction project.

3. Research Methodology

3.1 Research Approach and Design

There are two basic approaches to research: quantitative and qualitative (Leedy *et al.* 2005). The former involves the generation of data in quantitative form which could be subjected to accurate quantitative analysis in a proper and rigorous manner and in the form of a data base from which to realize characteristics or relationships. In quantitative research, samples of a population are studied (observed or questioned) to establish its characteristics whereas qualitative approach is concerned with subjective evaluation of opinions, behavior and attitudes. According to Patto (1993) both qualitative and quantitative approaches have advantages and disadvantages. Quantitative approaches lack flexibility and doesn't enable one to get in-depth information as the data is mostly collected through close ended questionnaire. In addition, it doesn't consider the respondents' natural context during data collection process. On the other hand, qualitative approach provides little base for

scientific generalization since randomly selected sample is not used. Thus, in order to substantiate their limitations and capture the strength of the two approaches the researcher used both of them. Moreover, because of descriptive type of research design helps to depict accurately the characteristics of individual, situation and a group (Zikmund, 2003), this study adopted a descriptive research design.

Data Sources and data collection Methods

The researcher used both primary and secondary data sources. The primary data were collected through structured questionnaire and interview. The secondary data were collected from relevant documents, newspapers and magazines of the enterprise that were related to the study. The organization project management manuals and policy documents, newsletters, website and annual reports were used to obtain reliable information that help for the study. For this research, structured questionnaire was designed, distributed and filled by the sampled respondents to collect primary data. Because, the questionnaire survey method is usually cheap, easy to administer to many respondents, and normally gets more consistent and reliable results. The structured questionnaire was employed with five ranking scale. Interviews were conducted with concerned management bodies of the employer and contractors to gather the relevant primary data.

The following 3 types of data collection technique were used and a triangulation research method was applied thereby reliable research finding can be produced.

Interview method: Using semi structured interview guide, interviews were conducted with 5 purposely selected interviewees (5 technical employees) to

collect in-depth information about their view about the efforts in addressing the factors of delays in constructing distribution projects.

Survey method: Self-administered questionnaires were distributed to 324 sample representatives of the total population to assess their view as to why the projects of the UEAP are delayed from the contractual period.

Document review method: Different and relevant contracts, amendments, performance reports, contractor's compliant letters, minutes, manuals, etc. will be reviewed to supplement information to be gathered through questionnaire and interview.

Data Collection Procedures

The procedures mentioned below were implemented

- Request the organizations permission to communicate the respective offices.
- The researcher discussed with the organizations respective higher officials by briefing the purpose and benefit of the study.
- Distributing the questionnaire to the selected employees and conducting interview with the respective managers at their work place.
- The researcher has given a week period to the respondents in order to have adequate time to fill the questionnaires and collect the questionnaires from each employee.
- Finally, pre-pilot and pilot test will be conducted to determine the reliability and validity of the instruments and for the sake of accuracy

3.4 Population and Sampling

Target population is defined as the entire group a researcher is interested in. According to Zikmund (2003) the definition of population was identifiable total set of elements of interest being investigated by a researcher Leedy (1997) also defined that the population can be viewed as a group or individual or object that would illustrate common feature that would be advantageous to the researcher's interest. The target population for the study is professional

staffs who are working in Head Office and regional branch offices of UEAP and the contractors' staff. The sample from the population based on the scope of work is stratified as follows:

Table 2: Respondent Stratification

Sampled Employees			Contractors Sample size
Name of work place	Scope of work/share of projects (%)	Sample size	
Head Office		25	0
Oromia, Diredawa and Harari	36	73	34
Amhara	23	47	22
SNNPR	17	35	17
Tigray	9	17	8
Ethio Somali	6	12	6
Afar	4	9	4
BenishangulGumuz	3	6	3
Gambella	2	4	2
Total		228	96

Among all work units and project offices of the Ethiopian Electric Utility (EEU), UEAP was selected purposely because the distribution projects are constructed by this program office. The total population size of the research is 530 internal staff and 126 contractors. The researcher used the following formula to calculate sample size with 95% confidence level and 0.05 sampling error are assumed for the equation (Yamane, 1967).

$$n = N / (1 + N(e)^2)$$

Where N=Population size

n=sample size

e=acceptable magnitude of error.

Based on the equation the total sample size is 324. Among this, 228 are employees and from UEAP head office and regional offices, and 96 are contractors. And for the qualitative information, technical managers of the UEAP head office were selected purposely. A total of 324 questionnaires were distributed among the respondents of managers, regional staff and their woreda level staff members and contractors working on UEAP distribution construction projects. The distribution mainly focused to the people working in project owners, contractors and employees. Out of 324 questionnaires distributed, 239 (74%) were returned. There were 71(74%) questionnaires from contractors/TVET and 168(73.7%) were from UEAP employees at all level. Out of the total 168 employees' respondents 36(21.4%), 86(51.2%), and 36(21.4%) are from head office, regional offices and woreda coordination offices respectively and 10(6%) respondents were not stated their work place.

Sampling is the process of selecting a suitable sample for determining parameters or characteristics of the whole population. To carry out a study, one might bear in mind what size the sample should be, and whether the size is statistically justified and lastly, what method of sampling is to be used (Leedy, 1997). The researcher used proportional stratified random sampling techniques for the target population to collect primary data through structured questionnaires and interview. Finally, to collect additional information pertaining to reasons of construction project delays, the researcher conducted interviews with project managers in both the owner and the contractors' side.

Data analysis

First the qualitative data were analyzed using content analysis technique. Content analysis is the process of extracting desired information from a text by systematically and objectively identifying specified characteristic of the text (Smith, 2000 in Hoyle *et al.*, 2002). Finally, analytical generalization was made on the selected theories (their applicability in the Ethiopian context will be commented). More specifically, analysis of qualitative data followed the following procedures recommended by Cresswell (2003),

1. The data were read a number of times to identify points that are significant for the study
2. Thematic contents were formulated based on the major research questions
3. Emerging theme titles were listed out on a separate sheet in to find connection between them.
4. A master list of themes was produced and ordered coherently
5. Sub-themes, which go with each master theme, were identified
6. The relevant information was organized under each theme and analyzed.

Then quantitative data were analyzed using Statistic Package for Social Science (SPSS) by use of Relative Importance Index (RII). The contributions of each of the factor to overall delays were examined and ranking of attributes in terms of their criticality as perceived by respondents was then made by use of Relative Importance Index (RII) which was computed using the following equation.

$$RII = \frac{\sum W}{A * N}, \quad \text{where, } 0 \leq RII \leq 1$$

W is the weight given to each factor by the respondents and ranges from 1 to 5, (where “1” is “Not Important/Significant at all” and “5” is “Extremely Important/Significant”)?

A is the highest weight (i.e. 5 in this case) and;

N is the total number of respondents. The results were represented using tables and descriptive statistics such as the bar charts, pie charts.

4. Results and Discussion

This chapter presents the results of statistical tests and analysis carried out with the aim to investigate the magnitude of project implementation delay in terms of schedule and cost variance and the sources of delay. The results are discussed in the subsequent sections.

4.1 Cost overrun and Time Delay of UEAP power distribution line construction Projects

During the desk study forty-one distribution line construction projects were examined. Relevant contracts, amendments, performance reports, and minutes of the projects were reviewed and evaluated in terms of their planned and actual completion time and budget. The schedule variance shows there is an average 2.39 years delay on each contract and the rate of time overrun ranges from a minimum of 56% to the maximum of 767% of the contract time. This shows the project is susceptible to delay. The data gathered through questionnaire revealed that 97.1% the projects of UEAP experienced delay. The respondents agreed that 79% of UEAP distribution construction projects delayed for more than one year, and about 35.5% of the projects were delayed for more than four years. The vulnerability to delay might result in cost and time over runs. Most of the projects were expected to service the rural community but the projects could fail to give service timely to the community and the government was also forced to incur additional cost.

Cost and time overrun have been critical problems of many projects in the Ethiopian Electric Utility (EEU) in general and in Universal Electrification

Access Program (UEAP). One of the objectives of this research is to assess the extent to which the utility is forced to incur additional costs to complete the delayed projects. Cost overrun and time delays have substantial implications from an economic, social and political point of view. Due to delays in project implementation, the local communities as well as the economy need to wait longer than is necessary for the provisions of electricity services. Thus, time delay and cost overrun restrict the growth potential of the rural community.

Cost overrun is the difference between the final and originally estimated cost of the projects. The estimated costs are defined as budgeted or forecast costs which are estimated to construct a project at the beginning of the project. Even if the project planning and scheduling process varies with project type, time and country, it is possible to locate for a project a specific point in the procedure that could be identified as the time where the formal decision is made to construct the project. Actual cost is real, accounted cost determined at the time of completing a project. UEAP power distribution construction projects are subject to cost overruns and the company is forced to pay additional resource from its limited budget.

UEAP projects were delayed from the scheduled time for up 3.25 years in Amhara region, 4.42 years in Oromia region, 4.62 years in SNNP and 3.5 years in Tigray region. The projects were completed behind their schedule, and their average regional schedule variance in Amhara, Oromia, South and Tigray was -1.86, -2.38, -2.71, and -2.53 respectively. The magnitude of time overrun ranges from a minimum of 56% to the maximum of 767% of the contract time.

UEAP distribution projects also experienced cost overruns. From the desk study a variety of power distribution construction projects of UEAP were surveyed. During the desk study all the documents of each project such as correspondence letters, project report, payment certificate, the contract amount and actual cost were thoroughly investigated. These helped to understand the reasons behind each project for cost overrun, and to investigate how the actual cost at completion deviated from the contract amount. The results showed that UEAP projects experienced a minimum rate of cost overrun of 8% of the contract amount and a maximum rate of cost overrun of 389%. This indicated that UEAP distribution construction projects required additional cost of 8% to 389% to accomplish the project. The average contract cost of the projects with cost overrun is around ten million and fifteen additional projects would have been constructed with this additional outlay paid to complete the surveyed projects. The average cost overrun per region was 35% in Amhara, 53% in Oromia, 34% in Tigray, and 51% in SNNPR and the overall cost overrun was 46%. UEAP paid additional cost of ETB 145.7 million to complete the surveyed projects. There are many rural towns, villages and kebeles which are on the waiting lists due to the limited resources but in contrary to the demand of the community, the company paid additional costs.

The researcher further carried out a performance difference analysis between planned and actual performance using the paired t-test analysis for the two project performance indicators such as time and cost. The analysis result presented below shows that, on average the planned project contract period were 8 months (0.67 years), and the actual completion period was 3.14 years. The mean completion time difference between planned and actual was found to be 2.5 years, which is statistically significant at $P < 0.01$. This means that the projects, on average, completed after 2.5 years (delay) of the planned

completion period. Similarly, it was found out that the mean planned budget for the projects was ETB 10, 028,095, while the budget at completion was ETB 14,442,549. The mean budget difference between planned and actual used budget was ETB 4,414,454.28, which is again statistically significant at $P < 0.01$. Therefore, the projects, on average, consumed ETB 4,414,454.28 more budget (cost overrun) compared to their planned budget (see table below).

Table 3: Mean Difference between Planned and Actual Performance

Performance Indicators	Planned	Actual Performance	Performance Difference	t value (St. Error)
Time (Years)	0.67 years	3.145	2.48 (Delay)	-14.42 ^{***} (0.17)
Cost (ETB)	10,028,095	14,442,549	4,414,454.28 (Cost overrun)	8.49 ^{***} (5.19)

^{***} Significant at $P < 0.01$

Source: Own analysis from survey data

4.2 Causes of Delay Factors in UEAP distribution line construction projects in Ethiopia

Among the causes of project implementation delay, shortage of materials/logistics received the highest rank followed by capacity problem and project management related factors (Table below).

Table 4: Views of Internal Staff about Causes of Project Implementation Delay Factors in UEAP, Ethiopia

Delay Factors	Low	Medium	High	RII	Rank
----------------------	------------	---------------	-------------	------------	-------------

Material shortage	24	57	155	0.77	1
Capacity problem	19	99	122	0.63	2
Project management related problems	50	97	81	0.50	3
Feasibility related problems	38	119	66	0.42	4
Design related problem	50	111	64	0.41	5
Lack of awareness	73	101	46	0.33	6
Supervision related problem	74	103	45	0.33	7

Source: Own survey

An interviewee in Bahir Dar explained that absence of clear feasibility study, and problems related to design issues which come to the office for approval causes cost overrun. Both UEAP and contractors sides there is limited clarity about what, when, at what level and why something is needed? The project management skill of the employer is poor (RII=0.4990). there is no sufficient follow up from feasibility study up to the completion of the according to the set procedure and schedules. The employer lacks proper supervision, timely decision for shortage of materials & contractors' request/claims, timely inspection & commissioning of completed projects and dealing & solving of issues related to local governments. The respondents indicated that UEAP had staffing plan to its projects but no enough engineers are assigned at head office, regions and their woreda coordination offices and therefore the project management at all level is weak.

The respondents also revealed that the feasibility study of the projects is not done properly (RII= 0.4177). Several towns, villages and kebeles were constructed with the interest of the government and residents by ignoring whether the projects are feasible or not.

Contractors also agreed that material/logistics shortage takes the lion's share for the delay of distribution line construction projects. The contractors

differed in that they put lack of awareness at the fourth step contrary to the internal staff. The contractors gave slightly less weight to the first and second ranked delay factors than the internal staff.

Table 5: Views of Contractors about Causes of Delay Factors in UEAP

Delay Factors	Low	Medium	High	RII	Rank
Material shortage	8	18	45	0.75	1
Capacity problem	5	28	35	0.63	2
Project management related problem	18	30	21	0.45	3
Lack of awareness	20	33	18	0.39	4
Design problem	13	42	16	0.33	5
Feasibility problem	18	41	12	0.26	6
Supervision problem	36	28	4	0.12	7

Source: Own survey

The internal staff of UEAP ranked the first three delay factors similarly with the contractors. Shortage of materials and capacity problems of contractors stood first and second followed by project management. Even if both the contractors and employees put the first three delay factors similarly, the employees gave more weight to each delay factors than the contractors.

4.3 Stakeholders responsible for project delay in UEAP

As agreed by 64% of the respondents the owner (UEAP) is the most responsible for the delay of distribution line construction projects in Ethiopia followed by contractors in which 23% of the respondents rated them as important stakeholders causing delays. The community which was expected to be beneficiaries from the projects contributed very minimal for the delay but the most affected party due to the delay. The local governments have their own contributions, but compared to the employers and the contractors, its share is only 10%.

Table 6: Major contributors to Project Implementation Delay in UEAP

Stakeholders	Frequency	Valid Percent
EEU/UEAP(Owners)	148	64.1
Contractors	53	22.9
Regional Government	23	10.0
Others	4	1.7
Community	3	1.3
Total	231	100

Source: Own survey data

Delays in distribution line construction projects happen because of various factors. These causes are classified in the following groups: (1) Employer related factors, (2) Contractors/TVET related factors, (3) Engineering/Design Related Factors, (4) Material/logistics related factors, (5) External Factors and (6) Labor related factors. In this respect, the respondents were asked to rank the importance of the delay factors using a five points scale (5=Extremely Important, 4=Important, 3=Moderately Important, 2=Slightly Important, and 1=Not Important at all). Participants were also asked to add their general comments at the end of the questionnaire. The ranking of delay factors using the RII weighting is presented below.

Table 7: Summary of relative importance delay factors by Sources

Rank	Delay Causes	RII	Category
1	Submit claims with mistakes	0.88	Contractor
2	Shortage of capital	0.78	Contractor

3	Late delivery of materials	0.76	Material
4	Shortage of construction materials	0.75	Material
5	Inadequate availability of raw material	0.73	External
6	Delay in procurement process	0.72	Material
7	Delay in progress payments	0.718	Employer
8	Inadequate experience of contractors	0.71	Contractor
9	Incompetent construction team	0.70	Contractor
10	Weak material requirement plan	0.69	Material
11	Ineffective project planning/ scheduling	0.68	Contractor
12	Contract Amendment/design modifications	0.68	Employer
13	Slow in decision making	0.68	Employer
14	Poor communication and coordination	0.67	Contractor
16	Unrealistic contract period	0.665	Employer
19	Inefficient utilization of vehicles	0.661	Material
20	Low motivation and morale of labor	0.659	Labor
22	Selection of inappropriate contractors	0.658	Employer
23	Improper project feasibility study	0.651	Employer
24	Poor quality of construction materials	0.650	Material
25	Inefficient quality control system	0.648	Contractor

Source: Own survey result

1) Employer Related factors

The results of analysis on the causes of client/employer related delays factors revealed that delay in progress payments (RII=0.7175) is the factor that always happens in UEAP projects. Scarcity of finance to complete a project, and/or delays in effecting progressive payments for services rendered by contractors lead to delays in the projects. Delays on progressive payments sometimes provoke the contractor to claim for interest rates. As many of the power distribution contractors in Ethiopia are young and inexperienced TVET graduates, they face difficulties to bear the daily construction costs if the progress payments are approved/released late. The delayed progress payment may result in weak cash flow capacity of the contractors to cover construction costs because they are not financially strong. The second common factor

ranked by the respondents is contract amendment/design modifications with a relative factor of $RII=0.6736$. During project construction, issues which need timely decision of the management are not properly taken care of ($RII=0.6717$). The contractors stop their activities until they receive decision from the management and they claim for additional costs and/or time due to delays in decision making. The respondents agreed that slow decision is the common phenomena of EEU/UEAP management. Most of the cost and time overrun seen on the power distribution projects are the results of sluggish decision making by the management.

2) Contractor Related Delay Factors

Submitting incorrect claims by the contractors is the key factor that causes delay in UEAP's project implementation($RII=0.876$). This finding implies that the contractors failed to analyze the projects properly before signing an agreement and this unfortunately leads to errors, carelessness and recklessness during project execution where all these errors lead to time and cost overruns when an attempt is made to rectify them at a later stage. In addition, contractor's ineffective planning, lack of proven experience, low capital and less understanding of the project schedules are factors that bring delays in project implementation.

3) Engineering/Design related Factors

The results of the questionnaire survey showed that design changes by employer or the representative during construction ($RII=0.647$), design errors and omissions made by designers ($RII=0.627$), lack of experience of the design team in distribution construction projects ($RII=0.608$), mistakes and delays in producing design ($RII=0.599$), unclear and inadequate details in drawings ($RII=0.593$), and incomplete project design($RII=0.591$) are the

factors that bring delays in distribution line construction projects in their order.

4) External Related Factors

Inadequate availability of raw material in the country (RII=0.731) is the most important factor causing delay in project implementation in the context of UEAP. Concrete pole is the key material required for the projects and this is expected to be produced locally. But, the capacity of local producers is weak and they failed to supply the needed quantity of pole for the projects. The respondents revealed that poor site conditions (location, ground, road status etc.) with relative importance index of RII=0.639 is the second most important factor for the delay of power construction projects under UEAP. Price fluctuations with relative importance index rate of RII=0.620 followed by unfavorable weather conditions with relative importance index rate of RII=0.592 are the 3rd and 4th most important factors causing delays of power distribution construction projects under UEAP.

5) Labor Related Factors

Low motivation and morale of employees with the relative importance index value of RII=0.659 and low productivity of labor with relative importance index value of RII=0.614 contributed a lot for the delay of the projects. From feasibility study to energizing stage of the projects, the roles of the employees are very critical and if the employees failed to support the construction, the projects may be subject to cost & time overruns. Slow mobilization of labor (RII=0.518), absenteeism (RII=0.503), lack of design team experience in distribution construction projects (RII=0.608), and shortage of labor (RII=0.492) are labor related factors that cause delays in the implementation of UEAP distribution construction projects.

6) Material/Logistics Related Factors

Late delivery of materials with relative importance index factor of $RII=0.757$ followed by shortage of construction materials with relative importance index factor of $RII=0.751$ are the factors that bring delays in the implementation of UEAP construction projects. Ethiopia is a land locked country and that most construction materials are to be imported from abroad and the procurement system of EEU/UEAP is not efficient.

As indicated on the table above, 25 most important factors causing delay in UEAP power distribution construction projects are summarized and presented as per the rank set by respondents. The respondents revealed that submitting claims with mistakes ($RII=0.876$) and shortage of capital by contractors ($RII=0.778$) are suggested as the most important factors causing delays on power distribution construction projects under UEAP. This is closely followed by late delivery of materials ($RII=0.757$) and shortage of construction materials by employer ($RII=0.751$). Inadequate availability of raw material in the country ($RII=0.731$), delay in procurement process ($RII=0.720$) and weak material requirement plan ($RII=0.689$) are also important factors of delay in the order they rated.

According to the respondents' ranking, 28% originated by the employer, 23% originated by contractors, 17% originated by material, 13% originated by external factors, 12% originated by engineering/design, and 8% originated by labor related factors. The respondents showed that 51% of the delay causes were employer and contractor/TVETs related factors. To decrease the delay time and reduce cost over runs of the distribution construction projects, the most important player of the delay (employer and contractor related) need to be addressed.

5. Conclusion and Recommendations

Fast economic development for developing countries like Ethiopia is mandatory, hence project construction delay related issues in the power distribution construction industry are sensitive and has multiple effects in the development of the country. Therefore, carrying out a research in this area will have a paramount importance. The main objective of this research is, therefore, to identify and investigate the critical causes and effects of delay in distribution construction projects in UEAP. Questionnaire was used to identify the causes and effects of delays. Managers, employees and contractors were asked to identify the variables of delay factors in UEAP distribution construction projects. Relative importance index and the analysis of the results from the open-ended part of the questionnaire were carried out using descriptive analysis.

The overall result shows that most important of the causes of delay in the power distribution construction projects area originates from weakness observed on the owners. To minimize these causes, owners should have an available fund for project and avail necessary construction materials and the capacity of contractors especially TVETs should be improved. Besides, the contractors should be financially sound.

The cost and time needed to construct the projects with quality and schedule of individual project needs to be accurately estimated and any potential project risks that can lead to delay should be adequately identified and managed accordingly. Moreover, the regional governments and UEAP should capacitate the TVET contractors so as to improve the delay of distribution construction projects.

Finally, recommendations are made to substantially minimize the impacts of these critical factors causing delays. Blaming each other on who causes delay is not very helpful and a lot of work is expected to be done by each of the parties (especially the employer and contractor) to minimize the problems of distribution construction projects delays in UEAP.

Based on the literature reviews, the results of questionnaire responses and case studies the following conclusions are drawn.

1. Mistakes and discrepancies in design documents, frequent design change and variation order during construction, unclear and inadequate details in drawings, slow response and supervision, poor contract management, inaccurate site investigation and change in material type during construction as owners' responsibility;
2. Delayed progress payment, slow management decision, unrealistic project construction time, change and variation of project costs and prolonged procurement system are also owner's responsibility
3. low capacity, submitting repeated claims, signing contracts without proper investigation of projects, less financial capacity, and poor structural arrangement as contractors'/TVETs responsibility
4. change of town/villages to be electrified, slow handover of projects/towns, poor communication with the project management and less support to capacitate the TVET contractors as government/external responsibility
5. Shortage of budget, shortage of construction materials, wastage & damage of materials, slow mobilization of materials, low productivity of labor, limited production capacity of local manufacturers and availability corruptive employees are also among the key delay factors.

5.3. Recommendations

The problems related to delay are badly affecting the power distribution construction projects in UEAP. All stakeholders (employer, contractors, federal government and regional governments) should work together to achieve successful projects within the stipulated time and budget, and exceed the anticipated quality standard. Especially capacitated contractors/TVETs, construction supervisor' and management should pay close attention from feasibility study to commissioning to keep the construction project on budget and schedule, and play an important role in preventing projects from delay. The regional government and the local community should give due attention to project selection and think strategically to avoid changing of villages or town prioritized to get electricity access.

Therefore, assuring the supply of required material with efficient procurement system, capacitating contractors, availing sufficient fund, improving decision making system and improving supervision through skilled, competent and trustworthy employer staff and contractors is vital, following are the recommendations which should be given due attention by key players of the power distribution projects to minimize delays.

5.3.1 Recommendations to Contractors

- Contractors should prepare proper plan and achievable schedule using the appropriate scheduling techniques and revise as appropriate before signing the agreement.
- Contractors should apply effective site management system for different activities of the project to avoid rework of activities and low labor productivity that will result delays of the projects.

- Contractors should capacitate themselves and move out from short-term planning system. They must consider each project as a learning institution and improve their capacity through time.
- Contractors should give due attention for time value of money.
- Contractors should carefully estimate the costs during pricing and proper working methodology to be adopted.

5.3.2 Recommendations to EEU/UEAP

Project owners are one of the most important parties who invest their money for realization of the project, and they are the key role players starting from feasibility study through construction up to energizing of the project. The following recommendations are expected from project owner.

- EEU/UEAP should revise the lengthy procurement system, material quality inspection techniques and shortage of finance to avail required materials for the projects under construction. Material requirement plan should also be prepared ahead of time. to start the projects as soon as the contracts are signed.
- Top management and experts of EEU/UEAP should efficiently and effectively manage the feasibility study and design process to give the best information possible for smooth implementation of the project;
- Continuous coordination and direct communication with regional governments and contractors/TVET, which will eliminate design and feasibility discrepancies and errors as well as omissions in design.
- Adopt efficient information distribution systems with government and community to create sense of ownership by avoiding communication gaps; make timely decision to contractors/TVET to requests for clarification and claims to avoid associated delays and confusions.

- Owners should allow sufficient time for proper feasibility studies, planning, design, information documentation and selection of contractors. This helps to avoid errors and omissions that consequentially help in avoiding or minimizing delays.
- Fulfill contractual obligations, especially as regards to payment of contractor's works duly executed. Owners should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement.
- Select suitable contractors not only based on price and time offerings, but also on experience, financial standing, capacity and expertise.

5.3.3 Recommendations to the Federal and/ Regional Governments

The power distribution construction projects are mainly financed by the government; hence, the government is one of the key role players in the construction of the projects. The following recommendations are expected from regional and federal governments.

- The government should select the town or villages by discussing with local community and the access roads to the project sites must be constructed before the projects begin construction.
- The government must avail sufficient budget to UEAP for the construction of the projects and strive to maintain local community ownership.
- The government should release the approved budget to UEAP as per the annual power distribution construction projects plan and if there is any budget shortage timely information should be disseminating to UEAP to revise plans.
- Carry on continuous capacity building programs for contractors especially TVETs. There must be programs for institutional

strengthening and man power development of the TVET contractors in the areas of power distribution construction because they were established with the support of government.

- Work with financiers to co-finance the power distribution construction projects to overcome problems related with finance.

This finding could help the practitioners in power distribution construction projects to gain better understanding about the problems of delay of projects during construction stage. By taking care of these potential causes in their present and future projects, construction participants can reduce and control the extent of delays. All stakeholders such as the regional & federal governments, community leaders, and TVETs can have chances to discuss the trends of the projects to take care of next constructions.

Further studies are recommended to be undertaken in other areas of power construction projects to come up with a nationwide and the industry as a whole mechanism to minimize delays in the general electric power construction industry.

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