

# Delays in Construction of Electrical Power Transmission Lines in Zambia

Moses Nundwe<sup>a\*</sup>, Michael N Mulenga<sup>b</sup>

<sup>a</sup>University of Zambia ,P,O Box 32379,10101, Lusaka ,Zambia

<sup>b</sup>Senior Lecturer, University of Zambia, School of Engineering, P,O Box 32379,10101, Lusaka ,Zambia

<sup>a</sup>Email: [mmundwe7@gmail.com](mailto:mmundwe7@gmail.com)

<sup>b</sup>Email: [mnmulzme@yahoo.com](mailto:mnmulzme@yahoo.com)

## Abstract

Construction is one of the major industries contributing significantly to national economies, in terms of Gross Domestic Product (GDP), especially in developing countries. However, most of the projects world over are faced with challenges of schedule overruns. In Zambia, construction of electricity transmission lines is usually delayed, such that some towns are still powered by diesel generators to cushion such delays. Delays in construction of electricity transmission lines in the energy sector are a challenge faced by many other countries world over. A study was undertaken to establish the causes of delays in the construction of electricity transmission lines in Zambia and recommendations were made for the best practices that could be used to improve on the effectiveness and efficiency in the management of electricity transmission line projects, to address the causal factors. The methodology adopted for the study included; a comprehensive Literature review, structured interviews and a questionnaire survey. Purposive sampling was also conducted with key personnel such as project managers and engineers engaged on different projects from both clients and contractors. The three major causes of delays during the project execution stage, are; late advance payments, poor financial management by the contractor, and irregular payments to sub-contractors. To address the delay due poor financing by the contractor and subcontractor, it is recommended that employers conduct due diligence on financial standing of contractors, before contract award, and that the public procurement regulatory authority certifies availability of project funds before the tendering process, and that the client makes direct payments to sub-contractors.

**Keywords:** Delays; Constructio; Causes; Electricity; Transmission line; Project execution.

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\* Corresponding author.

## 1. Introduction

Electricity is central to the development of any economy and according to Government of Republic Zambia (GRZ)'s Revised Sixth National Development Plan (R-SNDP), a viable energy sector is key to achieving sustainable economic development in the country as it is a critical input into all sectors of the economy. In the recent past, Zambia has experienced an increase in the demand for power due to increased industrial activities and population increase. However, this increase in population has not moved at the same pace with electricity generation and transmission capacities in spite of the country having potential hydro solar and thermal power plants. According to [2] a construction delay is late execution of the project as compared to the planned completion period and these delays are often as a result of miscommunication between the Contractors, Subcontractors owners and Suppliers. Construction delay is a major problem facing the construction industry and Zambia has also been plagued by the challenge as concluded by [3]. Meeting the time limitation is usually listed among the main success criteria in project execution. The completion of projects within schedule is often a critical factor and a measure of project success [4]. Similarly [5] studied causes and effects of project delays and concluded that time overruns increase the final cost of the project, as well as wastage and under-utilization of man-power and resources and ties down the client capital due to non-completion of the of the project. It was established by [5] that delays occur in every construction project and the significance of these delays varies from project to project as concluded by Authors in [6]. Therefore, it is quite common that projects in the construction of Electricity Transmission lines are also prone to delays in the completion dates. An incident of delay can originate from within the organization or from any of the other factors interfacing during construction [7]. It is therefore imperative that project managers ensure that participants are responsive and remain focused on these factors if the project is to be completed on time. According to the Authors [8], Schedule overruns due to delays in projects are one of the major causes of loss of revenue to the Client because of rescheduling of production which result in higher cost to the contractor due to fixed costs in addition to the inflation effect manifested in the increasing prices of material. The study conducted by [9] concluded that the major effects of delays in construction projects are Time overrun, cost overrun, abandonment of work, court cases and disputes, and these effects are primarily caused by financial problems, late payments for completed work, change orders, increase in cost of labor, mistakes in the contract, changes in drawing and natural disasters

### 1.1 Causes of delays

In the study conducted by Authors in [10] about time overruns in India, it was established that the main causal delay factors reported by various project agencies were; delay in land acquisition, delay in equipment erection, inadequate mobilization by the contractor, delay in forest clearance, fund constraints, alteration in scope of work, annulment of tender, law and order problem, delay in supply of equipment, slow progress of civil work and escalation in cost. Authors in [11] observed that construction delays usually occur during the construction phase and this is mostly caused by poor coordination, ineffective planning and scheduling of projects, delays in approving major changes in the scope of work, delay in material delivery, late procurement of materials, inclement weather, and political interference.

A study by [12] on causes of delays in Kuwait reviewed that the major causal factors were; Using a lowest price

bidding and tendering system, Poor Performance of the main contractor , Inadequate experience or qualifications of the main contractors staff, Delays of payment from client to other parties , Poor performance of subcontractors, Shortage in the supply of general labor, frequent changes of subcontractors , Delay in decision making by the client , Poor management of subcontractors , Conflict between the main parties to the contract , Inappropriate methods used by the main contractor.

According to the Authors in [3], the major causes of delays in the construction projects in Zambia particularly road sector were delayed payments, Financial deficiencies on the part of the client or the contractor, Change orders, poor sub-contractor performance, unqualified manpower, Inclement weather conditions, poor management skills, Schedule mismanagement, Delayed work progress payments, Lack of equipment, Material procurement and Poor coordination on site.

## **2. Materials and Methods**

The main objective of the study was to establish the causes of delays in the construction of electricity transmission lines in Zambia. To achieve the objective, efficient, appropriate, flexible, economical and effective techniques were used. The research was conducted in three stages. Initially, literature review was conducted to understand the concepts and theory of the problem and to formulate a road map for the research. The review of Literature continued up to the report writing stage. The second stage of research involved data collection by way of oral interviews and questionnaire surveys. The third stage was development of a system flow chart model, and finally preparation of the report, highlighting best management practices that could help cushion the effects of delays in construction of electricity transmission lines in Zambia.

### ***2.1 Literature review***

Literature about delays in construction from various researchers and sources in Zambia and elsewhere was reviewed. This process resulted in establishing the core concept and theory of the study thereby creating a road map for the research.

The main objective of the literature review was to ascertain the causal factors of delays in construction industry which were applicable to the study of delays in construction of electricity transmission lines in Zambia. This exercise was undertaken to; avoid duplication of information, develop the research questions and to develop the theoretical framework for the study.

During the study, the sources of information about delays in construction industry; Journals Articles, Books, Government and corporate reports, Newspapers, Thesis and dissertations, and Internet publications.

### ***2.2 Data Collection***

Interviews were conducted to obtain preliminary data about the views of the respondents on the causal factors of the delays in construction of electricity transmission lines in Zambia. This was important because the causal factors of delays in the construction industry identified through literature review needed to be reviewed so as to

identify the ones that are applicable in the construction of electricity transmission lines in Zambia. This exercise was carried out with seven professionals engaged in electricity transmission lines projects in Zambia and the main participants were project managers and engineers from the client. The interviews were undertaken with key personnel from ZESCO, the main firm involved in electricity generation, transmission and supply, and the various contractors engaged in construction of electricity transmission lines in Zambia.

A questionnaire survey was the main instrument of data collection for the study owing to its advantages of being less expensive and to avoid biasness of the respondents. With this method, the respondents were able to make their contribution freely. It also allowed respondents to request clarifications.. Furthermore, the method allowed respondents to express themselves without any influence due to the presence of the interviewer.

The questionnaire was in two sections, with Section A, focusing on work experience and causal factor of delays while Section B involved ranking of causal factors of delays identified through literature review and recommendations for best practices.

### 2.3 Method of analysis

Descriptive statistical techniques were used to analyze data collected from the survey. The method of analysis needed to be accurate and reliable, therefore a computer software; statistical package for social scientist (SPSS) and excel were chosen as the best option for data analysis for the study conducted. In section B of the questionnaire, respondents were asked to rate the impact of the causal factors identified through literature review using the Likert scale, presented in Table 1 with the scale ranging from 1 to 5.

**Table 1:** Likert scale

Scale	Impact	Weight
1	Strong disagree	20
2	Disagree	40
3	Neutral	60
4	Agree	80
5	Strong Agree	100

The Relative Importance Index (RII) was used to determine the relative importance for each causal factor of delay.

$$RII = \frac{\sum W}{A * N} \quad (1)$$

Where;

W is the weight provided by each respondent ranging from 1 to 5

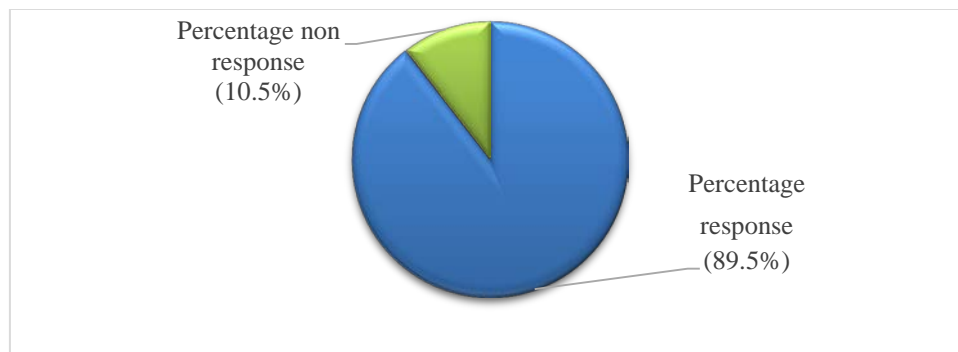
A= 5 (the highest possible weight on the Likert scale, fixed for all calculations)

N is the total number of respondents

RII is ranges from 0 to 1 and a higher value of RII implies a higher rating of the causal factor of delay. Based on the calculations of RII, the causal factors of delays were ranked in descending order according to their relative importance.

### 3. Results

Out of 19 questionnaires were distributed to the Client and Contractor key personal actively involved in transmission line projects and as shown in figure 1, 17 responded replied giving a response rate of 89.5%. The main reason why the small percentage could not respond was due to the process of seeking permission from their superiors to discuss the challenges on the project as per company policy.



**Figure 1:** Percentage response of respondents

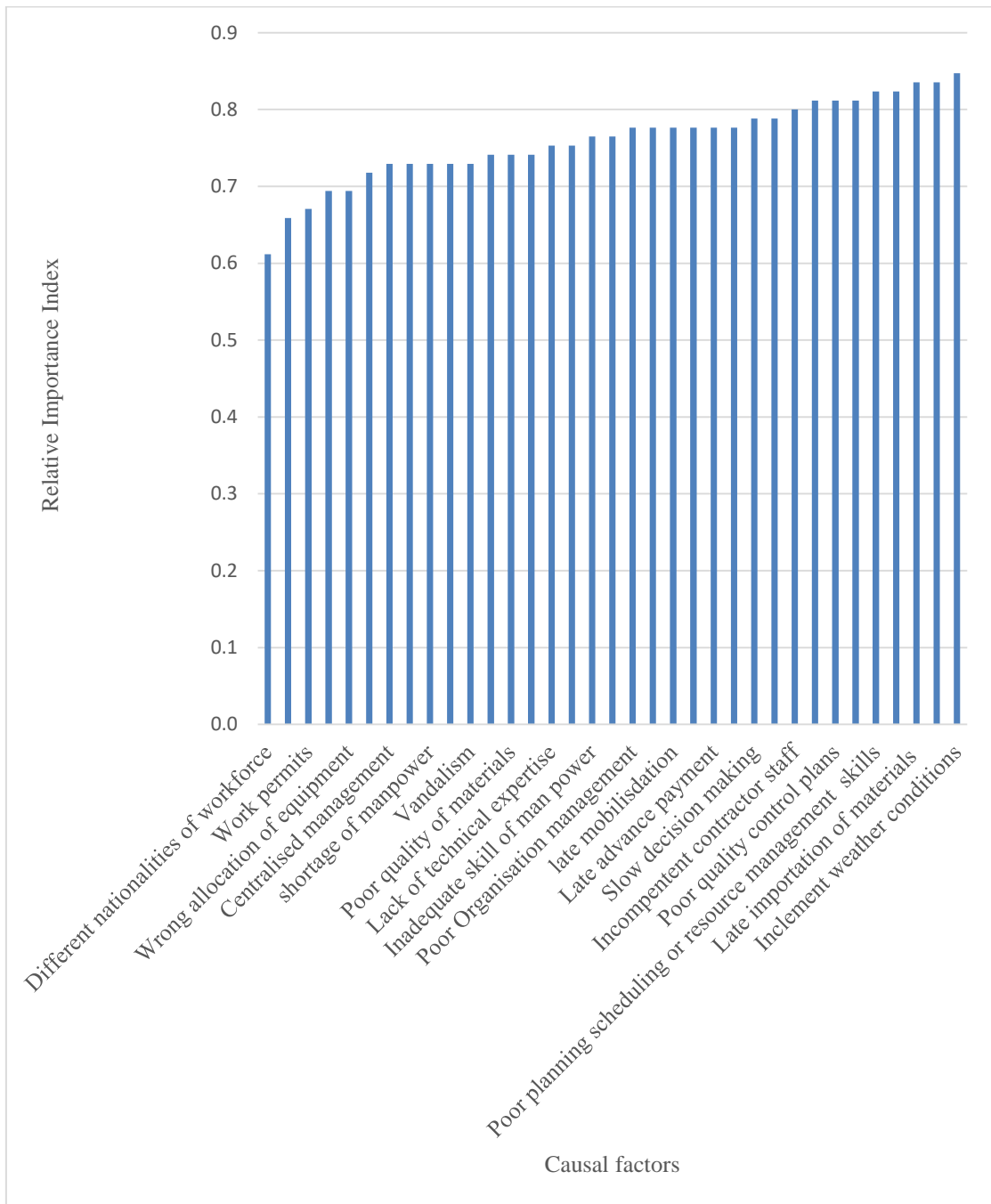
#### 3.1 Data Analysis

The factors that influence delays in construction were compiled from literature review and 73 causal factors were identified from Authors in [2, 14, and 15]. An interview survey was conducted to establish the causal factors that were applicable to electricity transmission line projects and the survey identified 34 causal factors.

In Section B of the questionnaire respondents were requested to rate the impact of these causal factors based on the Likert scale of 1 to 5. The scores of 5, 4, 3, 2 and 1 were used to indicate the respondent's view of level of impact for a causal factor and these scores represented; strongly agree, agree, neutral, disagree, and strongly disagree, respectively.

Figure 2 shows the ranking of the causal factors using the Relative Importance Index. From the figure most highly ranked causal factors (RII values of 0.60 to 0.85) were; Inclement weather conditions, Poor financing by the contractor, Late importation of materials, Irregular payment of subcontractors, Poor planning scheduling or resource management skills, delay of material delivery to site, Poor quality control plans, Poor coordination with project participants, Incompetent contractor staff, and Inexperience in similar works for the Client and

Contractor.



**Figure 2:** Ranking of the causal factors of delay

Table 2 shows the list of the causal factors and the ranking using the Relative Importance Index (RII). From the table, inclement weather condition was ranked first followed by Poor financing by the contractor. The least ranked factors were poor storage of materials and difference nationality workforce. It was alleged that the projects for Electricity transmission lines were adversely affected during rainy season due to wet conditions and the poor state of the access roads during that period.

**Table 2:** Ranking of the delay causal factors

Inclement weather conditions	0.847059	1
Poor financial management by the contractor	0.835294	2
Late importation of materials	0.835294	3
Irregular payment of subcontractors	0.823529	4
Poor planning scheduling or resource management skills	0.823529	5
delay of material delivery to site	0.811765	6
Poor quality control plans	0.811765	7
Poor coordination with project participants	0.811765	8
Incompetent contractor staff	0.800000	9
inexperience in similar works	0.788235	10
Slow decision making by the Client	0.788235	11
late progress payment	0.776471	12
Late advance payment	0.776471	13
Mistakes during construction	0.776471	14
late mobilization	0.776471	15
Poor internal and external communication	0.776471	16
Poor Organization management	0.776471	17
Unavailability of equipment on request	0.764706	18
Inadequate skill of man power	0.764706	19
Shortage of materials	0.752941	20
Lack of technical expertise	0.752941	21
low productivity	0.741176	22
Poor quality of materials	0.741176	23
design changes	0.741176	24
Vandalism	0.729412	25
Inadequate site investigations	0.729412	26
shortage of manpower	0.729412	27
Poor quality of materials	0.729412	28
Centralized management	0.729412	29
Misuse of materials	0.717647	30
Wrong allocation of equipment	0.694118	31
Unclear material specification	0.694118	32
Work permits	0.670588	33
Poor storage of materials	0.658824	34
Different nationalities of workforce	0.611765	35

The poor state of the roads was a hindrance to transportation of materials to site. Poor financing by the contractor was also pointed out as a major causal factor of delays which resulted from Contractors not setting priorities properly when funding the projects. Late importation of materials was also cited as one of the major causal factors resulting from late advance payment by the Client which made it difficult for the Contractor to plan for importation logistics. Poor planning scheduling and resource allocation was attributed to lack of human resource training by the Contractor and Subcontractors.

### **3.2 Interview survey data and analysis**

Key personal working for the contractor and employer were interviewed regarding the challenges causing schedule overruns in construction of electricity transmission line projects in Zambia. The study established that;

- At the project initiation stage, route identification, selection, line survey and soil investigations were not given the due attention by lack of involving all key technical personal and other stakeholders, resulting in issues such as disagreements between the Client and the Contractor on the appropriate line route, type of towers and foundations during the implementation stage. The main reason for disagreements by the parties was the cost implications for changing tower designs, foundations types, and line route (compensation for affected settlers). In this case both parties always wanted decisions that would not inflate any cost on their part.
- There was lack of capacity and experience on the part of nominated subcontractors to manage projects in construction of electricity transmission lines in Zambia because the field was relatively new and ZESCO was the only major player involved in ETL. However, it was also pointed out that the smooth tendering and selection of subcontractor's process was distorted by the submission of company profiles and curriculum vitae which were deceitful in terms of company experience, financial capabilities and availability of key personal.
- The public procurement procedures for Parastatals were lengthy such that a lot of time was lost between tender close out stage and contract signing, due to a number of stages required for approval. The result was that the contractors started requesting for additional cost arising from increase in the cost of input of materials due to fluctuations in inflation rates. Thus, there was late mobilization to site by the contractor and such discussions become so protracted that some of the time for implementation of the project was lost.
- Tied financing of projects negatively affected implementation. Under this arrangement, financing came from a particular country or region of the world, and the financiers requested the client to select a contractor from their country or region. This resulted in compromised standards and criteria in procurement of the contractor because of lack of any form of competition in the selection process. The undertaking of an Environmental Impact Assessment (EIA) for the project as required by the law, had no delays or effects on the projects for ETL. However, approval of the EIA depended on the completion of the line survey. Therefore if the survey was not completed on time the EIA could not be concluded and resulting in project delay. Furthermore, the respondents emphasized training for Clients surveyors in transmission line design to enable them execute complete line survey as opposed to the situation where surveyors could only plan the line route and survey it only in terms of corner points



while detail survey and tower spotting was left for the contractor to undertake. It was pointed out that if the process was executed by the client surveyors, it could save on time and cost of the project.

### **3.3 Online Project Management System Model (OPMS)**

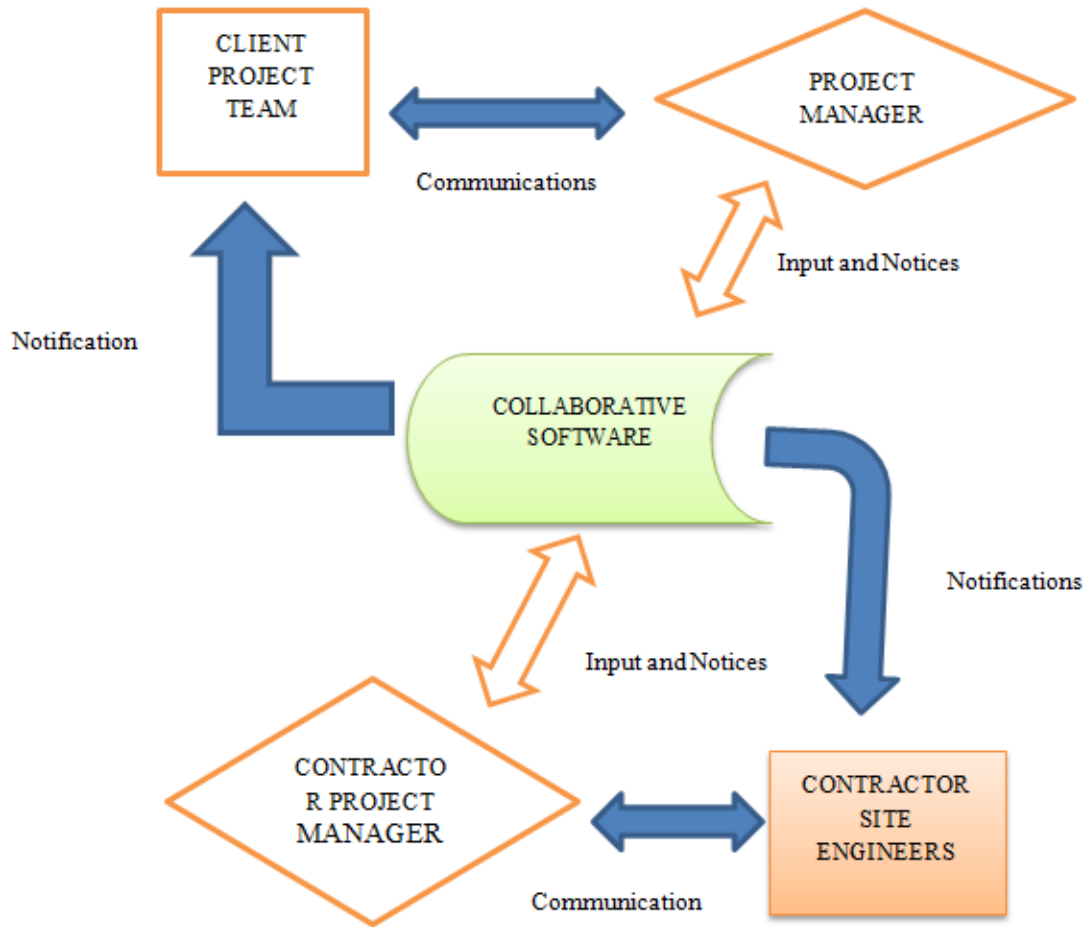
An interview survey was conducted to establish the type of tools and techniques used for time control during project execution. The respondents revealed that printed Gantt charts in Microsoft project format and monthly site progress meetings were the only contractual techniques in place. Furthermore, it was pointed out that delays on the project were brought to the attention of project participants during site meetings and that was the only opportunity presented to the project team to discuss the solutions to the challenges on the project collaboratively. Therefore, the effect was that the delay would have affected the project by the time it was being tabled to find solutions. And according to the findings of [13], lack of effective communication was a major factor causing project delays in construction. Therefore this finding necessitated the need for a management system that would engage all project participants through real time online notifications on the status of the activities taking place on the project so that if there was a delay, solutions and contributions could be raised through line managers using an online collaborative software for project management system.

The OPMS shown in figure 3 would provide all project participants and other stakeholders an opportunity to have an insight of the current state of the project activities, task assignment and challenges being faced on the project. Under this arrangement project participants have the opportunity to contribute solutions through line managers for the challenges on the project on real time basis without waiting for the site progress meeting. Furthermore, project participants receive online updates and notifications on the latest developments on the projects which are in distance places through the computers and other mobiles online electronic gadgets like phones, tablets and iPads.

The flowchart model in figure 3 illustrates the operation of project management system developed to cushion delays during the construction of ETL and other similar projects by improving effectiveness and efficiency in management operations.

In the flowchart diagram the participants will have the following roles to play;

- The Project Engineers - receive notifications and tasks on the activities from the online Gantt chart for the project and communicate work done through their respective line managers.
- The Project managers- to receive notifications about the status of the activities, make formal communication to all project participants through the collaborative software package and update the online Gantt chart and progress report.
- Collaborative software- this will be an online software package for the project activities and project participants will require passwords to log on. Notices about activities are communicated to the project team using emails on iPad, laptops and phones.

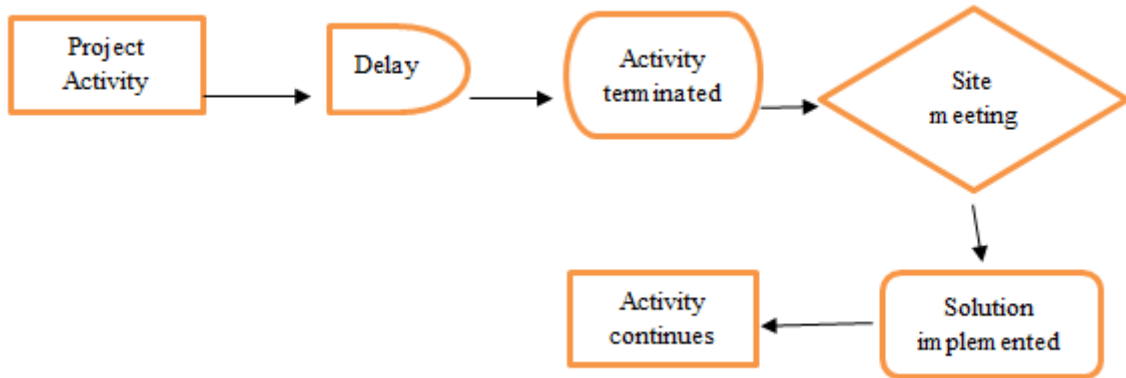


**Figure 3:** Online Project Management System

The online system was proposed to operate using collaborative project management (Coordination) tools such as;

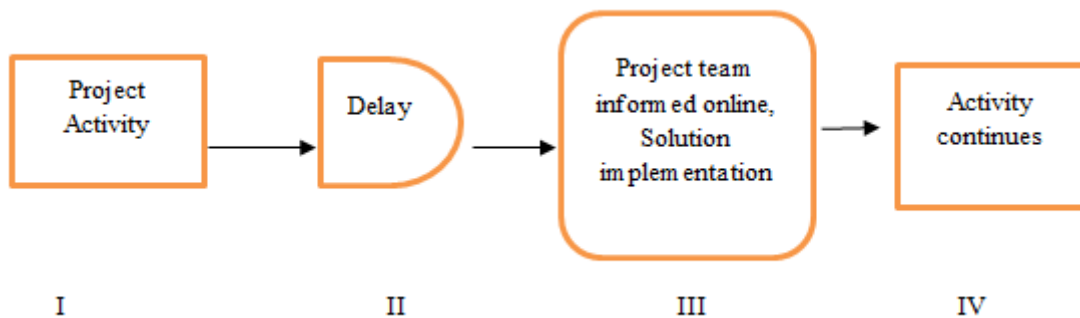
- **Electronic calendar-** to schedule events and automatically notify and remind the project team about the pending issues, tasks and activities. The electronic calendar is synchronized with the Gantt chart so that all project activities are online.
- **Workflow system-** collaborative management of tasks and documents for all the project participants (Client Consultant and Contractor). This provides the participants with information on who among the assigned personal has the task on a particular document thereby giving contributions collaboratively were solutions are required. This reduces the risk of personal decisions which have an effect of causing delays to be applied in the operation system of the project.
- **Online proofing-** to share, review, approve and reject proposals or designs on the project on real-time basis system. Under this arrangement every project participant gets access to the appropriate files and stays on the same page with regards to were the projects stands in terms of progress and other pending issues.
- **Online spread sheets-** automated updated latest work progress report that can be accessed anytime. This will provide a readily available updated work progress report that can be accessed by login in on the software

package. The online collaborative project management system provides senior managers with an opportunity to check where all the projects stand on a single dash board. Project managers will also have action oriented to do list to identify what next in each project and the problems that need to be corrected without waiting for monthly site progress meeting for issues delaying the project to be reviewed and solutions discussed.



**Figure 4:** Flowchart for current project management system.

From the interview survey conducted the current project management process was explained as shown in figure 4 above. The flowchart illustrates the various stages involved when a delay factor was realized on site. From the flowchart engineer reports to the project manager about a delay and if there was no solution the activity was stopped until the site meeting was held where all project team members are informed about the delay during the project progress presentation by the contractor. Once the delay was reviewed it was at that particular point that all project team members would become aware of the challenges affecting the project. Therefore the interview survey indicated that current the system created a gap between point of identification of the delay and solution implementation because site meetings were contractually held at the utmost once every month thereby by indicating that a delay could only be resolved collaboratively after one month of discovery.



**Figure 5:** Flowchart for Online Project Management System showing minimum delays.

Figure 5 illustrates how the online system could cushion the time gap for resolution of issues causing delays on a project thereby making the management system more effective and efficient. From the flowchart diagram in figure 5, the project team would be instantly notified about a delay on the project through the collaborative

software on the internet without waiting for one month for the site meeting to be held. Therefore a collaborative solution for the delay factor would be presented instantly through contributions from the project team thereby reducing the gap between delay identification stage and solution implementation.

#### **4. Conclusions**

The study established that there were a number of causal factors of delays during the construction of transmission lines in Zambia which needed to be adequately addressed to improve on the efficiency and effectiveness in the delivery of such projects.

The main causal factors identified were; Inclement weather conditions and Poor financial management skills by the contractor. The later was attributed to the contractor not binding project funds to direct and indirect costs of the project only. This was because specific project bank accounts were not assigned thus prompting general use of the projects funds on activities which were not for the project. It was further established that in projects where government was responsible for securing financing for the project, constraints in the process such as late approval of contracts and release of advance payment at ministerial level were critical causal factors of delays and were attributed to red tape system before final approval of documents. Other causal factors that were highly ranked included; Poor planning scheduling or resource management skills, delay of material delivery to site, Poor quality control plans, and Poor coordination with project participants. These factors were caused by lack of training in project management skills for all project participants on the part of the Client and Contractor. While late advance payment by the client was also a major causal factor at implementation stage which was attributed to non-allocation of specific project bank account. Advance payment was fundamental in project delivery because as per General Condition Contract it marked the project start date.

From the study it was concluded that delays in construction of electricity transmission lines in Zambia were obstacles to economic growth. This was established from the economic status of the towns which were not connected to national electricity grid. Despite having mineral resources, mining and other manufacturing industries could not be established in these towns because of lack of electricity.

#### **4.1 Limitations**

The main limitation of the study was that the main focus was on transmission lines projects executed by the main electricity supply company in Zambia, ZESCO. The private sector could have different challenges to those experienced by the public sector. However the public sector represented a holistic view since it was the main player in the transmission of electricity and had a broader coverage and customer base in Zambia.

#### **4.2 Recommendations**

To address the causal factors of delays in construction of transmission lines in Zambia there must be an understanding of the effects and this will help project managers to have an insight on the project and thereby plan holistically in advance in terms of materials, human resources, transport, tax issues, and financial resources including other major matters that may be realized to have a potential to causing delays. Other recommendations

on best practices to improve on the efficiency and effectiveness in the management of Electricity transmission line and other similar projects include:

- Employers should be given rights to inspect the banks accounts for the sub/contractor before contract award.
- Certification of availability of financial resources in a separate employer's project bank account by the relevant public procurement regulatory authority before tendering process.
- There should be Separate construction contracts for material supply and labor services.
- Contractors should avail to the Project Manager the same Key personal presented during bidding process at before commencement of the project failure to which appropriate punitive measures should be taken.
- Apply online project management system to reduce on the time gap for resolving challenges on site.

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### **References**

- [1] Republic of Zambia, (2014, October 3) Revised Sixth National Development Plan, Available; [www.zgf.org.zm](http://www.zgf.org.zm) (Sep 22, 2016)
- [2] A. Dinakar, "Delay Analysis in Construction Projects," *International Journal of Emerging Technology and Advanced Engineering*, vol. 4, Issue 5, pp. 784-788, May 2014.
- [3] C. Kaliba, M. Muya, & K. Mumba, "Cost escalation and schedule delays in road construction projects in Zambia." *International Journal of Project Management*, vol. 27(5), pp.522-531, 2009.
- [4] N. S. Gaturu and W. Muturi, "Factors affecting the timeliness of completion of donor-funded projects in Kenya," *European Journal of Business Management*, vol. 2(1), pp.189-202, 2014.

- [5] D. J. Owolabi, M. L. Amusan, O. C. Oloke, O. Olusanya, P. O. Tunji, D. Owolabi, J. Peter, I. Omuh ,  
“Causes and effects of delays on Project Construction Delivery Time,” *International Journal of Education and Research*, vol. 2, No 4, pp. 197-208, Apr 2014.
- [6] E. Hoseini, *Time Thieves and Bottlenecks in Projects*. MSc, Thesis, Norwegian University of Science and Technology, Norway, 2014.
- [7] S. A. H. Tumi, H. Oman and A. H. K. Pakir. “Causes of Delay in Construction Industry in Libya.” *International conference on Economics and Administration*, pp. 265-272, 2009.
- [8] M. Mukuka ,C Aigbavboa and W. Thwala, “Effects of Construction projects Schedule Overruns ,” Presented at the 6<sup>th</sup> International Conference on Applied human factors and Ergonomics and the Affiliated Conferences, Johannesburg, South Africa, 2015.
- [9] M. Haseeb, Xinhai-Lu, A. Bibi, M. Dyian and W. Rabbani, “Causes and Effects of Delays in Large Construction Projects of Partisan,” *Kuwait chapter of Arabian Journal of Business and Management Review*, vol. 1 No 4, pp.18-25, Dec 2011
- [10] A. A. Salunkhe and R. S. Patil, (2014), “Effects of Construction Delays on project time overrun; India scenario,” *International journal of research in engineering and technology* vol. 03, issue 01, pp. 543-547, 2014.
- [11] C. O. Aigbavboa, W. D. Thwala, and M. J. Mukuka, “Construction project delays in Lusaka, Zambia; causes and effects,” *Journal of economics and behavior studies*, vol. 6, pp. 848-857. 2014
- [12] N. S. Almutairi, “ Causes of Delays on Construction projects in Kuwait according to opinion of Engineers working in Kuwait,” *Journal of Engineering Research and Application*, vol. 6, issue 12, pp. 84-96, Dec 2016.
- [13] K. A. Mohammed and A. D Isah , “Causes of Delays in Nigeria Construction Industry” *Interdisciplinary Journal for Contemporary Research in Business* , vol.4, No 2, Jun 2012.
- [14] S. K Patil, A. K. Gupta, D. B. Desai and A. S. Sajane, “ Causes of Delay in Indian Transportation Infrastructure Projects,” *International Journal of Research in Engineering and Technology*, vol. 2, issue 11, pp. 71-80, Nov 2013.
- [15] M. Salama, M. A. El Hamid and B. Heogh, “ Investigating the Causes of Delay within Oil and Gas projects in the U.A.E, Presented at the 24<sup>th</sup> Annual Association of Researchers in Construction Management, Cardiff, UK, 2008.

- [16] M. E. A. El-Razek, A. H. Bassioni and M. A. Mobarak, "Causes of delays in Building Construction Projects in Egypt," *Journal of Construction Engineering and Management*. Vol. 134, No 11 pp. 831-841, 2008