



Impact of Network Analysis in Contemporary Construction Firms in Nigeria

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Abstract

The study looked into the meanings of network analysis in theory and practical terms. The study went further to expose the tools used in network analysis, especially, in construction firms in Nigeria and some of the impacts and/or effects of network analysis in construction firms within Nigeria. The study is exploratory and qualitative in nature and as such does not make use of any population. The study concluded that network analysis is as important as the materials to be used for any project and recommended that there is much need for the use of network analysis particularly, the critical path analysis and Project Evaluation and Review Technique (PERT).

Introduction

In construction, network analysis is a visual representation of the many alternative flows of construction work in order to determine the best and shortest flow that will be both cost-effective and most helpful to a firm's ability to complete the project on time. "A network is a graphical representation (schematic model) of a project, exhibiting both the flow and the sequence of well-defined activities and events," according to Mac'Odo (2005). (Mac'Odo, 2005) Network analysis is a word that refers to a collection of related approaches that have been developed to aid management in the planning and control of projects.

In business, network analysis is a technique that is used for assessing, regulating, and monitoring the flow of business processes and project workflows (Draheim, 2010). In contrast to a work breakdown structure, a network analysis diagram takes into account the chronological order of activities, milestones, and tasks, as well as their durations and dependencies, and visualizes them graphically or as a table, such as in a Gantt chart, as well as their dependencies and dependencies between activities.

Umoh (2012), the primary concern of the construction firm when conducting network analysis is to avoid keeping expensive equipment on site idle. However, network analysis can also show the relationship between time and cost as well as the relationship between time and cost, according to Umoh (2012). When developing a project plan, project managers may use network analysis to take into consideration a variety of issues, including; (1) Dependencies between activities; (2) Buffer times between activities; (3) Earliest and latest start and end dates; (4) Duration of activities; (5) Critical path

The network analysis approach is often used in procurement and manufacturing to improve the efficiency of project operations and to ensure that projects are completed on time and within budget constraints (Kerzner, 2022). Maintaining project timeliness and finishing projects on schedule are two of the most difficult project management tasks (Avots, 1969; Oberlender,

2014). As a result, the purpose of this research is to avoid discussing the potential consequences of network analysis on modern Nigerian construction enterprises.

Methods

Because the research is exploratory and qualitative in nature, it is not necessary to collect primary data for the purposes of the study. Furthermore, there is no requirement for a population and sample, as well as for a study analysis tool, in this situation. We exclusively used secondary data from textbooks, published publications, and other relevant sources to compile our findings.

Results and Discussion

Gantt Chart

The activities associated with the project are shown on a Gantt chart. The individual activities, as well as the matching start date, are often included in the text portion of the document. Dates and durations are typically displayed in tabular form in the text portion of the document. Horizontal bars depict the duration, start date, and finish date of each activity on a time axis in a graphical representation proportionate to the time axis. The length of the bar indicates how long the activity will take.

A Gantt chart is a visual representation of project aspects such as summary activities, activities, milestones, tasks, dependencies, restrictions, buffer, and critical path that are shown on a timeline. The existence of a previously determined work breakdown structure is a prerequisite for the production of a Gantt chart (Haugan, 2001). It is necessary to identify and label all summary actions and activities, as well as to organize them in the appropriate logical and chronological sequence. They are then inserted into the Gantt chart in the sequence in which they were received, and they may subsequently be modified further within the project.

Additionally, you must be aware of the working time schedule on which the Gantt chart will be built in advance. Working and non-working hours influence the length of time required for specific tasks and, therefore, the duration of the project as a whole. Without a doubt, it makes a difference if the working week is 35 or 60 hours long, whether the resource works the day or night shift, and whether or not the time is considered a working day. The amount of public holidays and holidays included in the project schedule also has an impact on the project's overall length.

Additional time limits influence the placement of a bar on the graph, as is shown in the following figure: Some projects have a start and completion date that is set in stone. It is fairly frequent to see limits such as "no earlier than" and "no later than." A client presentation, for example, may be planned for a certain day; thus, all preparations must be finished by the end of that day.

A Gantt chart is a visual representation of the logical and temporal connections that exist between activities. When designing a Gantt chart, you should consider include dependencies, such as the basic end-start connection, to ensure that the chart is complete. For example, as soon as the graphic designer has finished the print file, it may be transmitted to the printer for printing. If, on the other hand, the completion of the print file is delayed, the transfer of the file will be automatically postponed in the event of a logical connection between the two computers. A set date, on the other hand, would necessitate the need for human correction.

Critical Path

A critical path is a series of interconnected actions or tasks that must be completed before a project can be considered complete and successful. It is the most time-consuming option, that

is, the one that takes the greatest amount of time to complete the project from its inception to its conclusion. At the same time, the longest route is the path that displays the shortest amount of time that a project may be finished in order to be successful. If there is a delay in one of the activities along the route, the whole project will be delayed by the same amount.

By visualizing tasks and activities in a network diagram, such as a Gantt chart, the critical path method (CPM) is a particularly useful tool for scheduling tasks and keeping track of activities. In such a diagram, activities are represented by a network of arrows that link two event nodes in a sequential manner. It is critical that all interconnected activities be properly defined in order to create a network of events and activities that functions smoothly and efficiently. One of the most significant benefits of the critical path technique is that it enables for changes to be made over the course of a project.

Project Network Diagram

According to Tran (2019) the InLoox project management glossary, a project network diagram is "a network in project management that displays the duration of project activities and the dependencies between activities graphically or as a table." A project network diagram is also known as a network diagram in project management (Lu & Lam, 2009; Lock, 2017). Nodes (rectangles) in a network reflect the actions and events that take place. Nodes are connected to one another by arrows. The relationship between the actions or occurrences is shown by arrows.

People often use the words Work Breakdown Structure and project network diagram to mean the same thing. There is, however, a significant distinction between the two: A work break down structure allows you to see the project as a whole, rather than as a series of events on a timeline, and it allows you to see logical linkages in a hierarchical tree diagram. A network diagram also takes into consideration the chronological sequence of actions and displays them via the use of dependencies. Bar charts, such as Gantt charts, are a sort of network that is distinct from the rest.

Define Activities, Durations and Dependencies

Make a list of all of the actions involved in your project and estimate their time. Then, determine the chronological sequence of the actions, as well as the dependencies that exist between each one of these activities. Everything should be entered into a table.

Display all activities in nodes (rectangles) and enter the duration (d) into the node.

Each node is displayed as follows:

EST = Earliest Start Time = When can I start the activity at the earliest?

EFT = Earliest Finish Time = When can I complete the activity at the earliest?

LST = Latest Start Time = When is the latest possible date to start the activity to complete the projection time?

LFT = Latest Finish Time = When is the latest possible date to complete an activity if I want to complete the project on time?

D = duration of an activity (usually in hour)

CBT = Cumulative buffer time = extra time you can use to complete an activity without compromising the project end date.

BT = free buffer time = extra time you can use to complete an activity without compromising the completion time of its direct successor(s).

Link Activities

Define the relationships that exist between activities. A connecting arrow connects the predecessor and successor activities; this allows you to identify which action or activities you need to finish before you can begin the following activity.

Forward Planning

Forward planning means that you start at the first activity, and go through the activities #1-#8 chronologically. Add the EST (earliest start time) and EFT (earliest finish time).

Backward Planning

This step enables you to calculate the latest start time (LST) and the latest end time (LFT). Start from activity #1.

Calculate the Buffer Times

The next step is to identify the cumulative buffer time (CBT) and the free buffer time (BT) for all activities.

Determine the Critical Path

The critical path is the longest path, that is, the path with the longest duration from the start to finish. The activities and milestones on this path have no buffer time. This means that even the slightest delay of one activity, the project's completion will be displayed accordingly.

In a network diagram every activity (node) without any cumulative or free buffer time belongs to the critical path: $CBT = BT = CP$

As a result, the critical route defines the bare minimum project time and allows the project manager to identify activities that are more vulnerable to delays if they occur in those areas. This allows them to design counter-measures from the beginning of the process. It is crucial that they maintain a careful check on the activities that are taking place on the key pathway. You may shorten the time of the project, on the other hand, if you are able to finish a vital task faster than anticipated.

Limitations of Network Analysis

However good a method may be, there will always be some obstacle to its proper execution, no matter how amazing the approach is. As a result, network analysis is subject to the following limitations: (1) Network analysis is a disciplinary mechanism that ensures that things are completed in the manner in which they were intended; yet, for some individuals, it is only after finishing a task that they begin to consider what comes next. Network analysis will be a challenge for this group of individuals. (2) Network analysis, according to Umoh (2012), is only an addition to the previously existing project management processes, and not in any way a replacement for the already existing procedures. Some managers, on the other hand, regard it as a manner of removing them from their responsibilities, which is not the case. Instead, network analysis is intended to supplement their authority and make the performance of their obligations more manageable.

Advantages of Network Analysis

In Umoh (2012), the following were listed as the merit that network analysis renders to the construction firm that makes use of it; (1) Network analysis provides the means for more effective control over the project; (2) Network analysis provides a systematic and logical basis

for project planning; (3) The time analysis of the network provides a realistic analysis of the project duration, and identifies those activities which determine it; (4) The network analysis provides a clear plan of what is involved in the project; (5) The relative importance of individual activities can be specified; (6) The network can be an effective means of communication between different areas of the business.

Conclusion

Although network analysis is a very exact approach, it is also a somewhat difficult one due to its high level of precision. When working on smaller projects with a lesser number of events, such as our teambuilding event, this is a viable option. However, if you have a complicated project plan with a large number of activities, not only is it difficult to construct a network diagram, but it is also difficult and time-consuming to maintain it up to date. This is why most people who develop network diagrams do it using project management software. Even so, knowing how to manually do a network analysis is beneficial since it allows you to have a better understanding of your project's overall design. The most significant advantage of using a project management tool is that it calculates end and start times automatically based on the dependencies and constraints you have defined, calculates the critical path automatically, and – most importantly – that it takes significantly less time and effort to create a project plan than it does without one.

According to the findings of this research, there is a great need for the effective and efficient use of network analysis tools such as the PERT and critical path analysis to serve as a guide in determining the most lucrative and efficient method and manner in which to complete any project. This will prevent projects from being abandoned or from being too time-consuming, both of which might result in late delivery of project results.

Recommendation

Managing directors of construction companies are highly recommended to utilize network analysis to their advantage and efficiency even before bidding for works and after signing the contract for the job, that is, before the project begins. The use of network analysis, such as critical path analysis and the Project Evaluation and Review Technique (PERT), was reported to be similar except for the consideration of activity time (Mac'Odo, 2005), albeit the two methodologies were said to be different.

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