An Investigation into Project Planning Techniques Used by Contractors in Kumasi Metropolis

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Abstract

This paper aimed to identify frequently used Project Planning Techniques (PPT) by contractors in Kumasi Metropolis. Three objectives were formulated to guide the study; 1) To identify PPT used by contractors, 2) To identify the mostly used PPT by contractors, and 3) To identify benefits of using PPT in executing projects. Snowball sampling technique was adopted for the study due to the nature of the construction site scattered around the Kumasi metropolis. The research sampled 49 contractors in the Kumasi Metropolis for collection of data for analysis. From the study, seven (7) PPTs were identified through extensive review of literature; Brainstorming, Critical Path Analysis, Cause & Effect Diagrams, Bar Charts or Gantt Charts, Line of Balance, Network Method and Program Evaluation& Review Technique (PERT). The results indicate that Bar Chart or Gantt Chart was the most widely used PPT with a RII of 0.91. Reasons for using the Bar Charts or Gantt Charts were evaluated as; Easy to use, not complex and easy to implement. Ten (10) benefits of using PPT were identified and top ranked benefits were; improve service quality and customer satisfaction. In conclusion, seven (7) PPTs were identified. Bar Chart or Gantt Chart was identified as the mostly used PPT by contractors in the Kumasi Metropolis. It is recommended that construction firms should organized training periodically for the employees on various types of PPT. Also, project planning should be part of the curriculum at tertiary level of education since every project success depends largely on adequate and effective project planning.

Key words: Project management, Project Planning Techniques, Contractor, Construction industry

Introduction

The concept of project planning is to make a conscious efforts to achieve the required level of quality for a project which is well planned and organized by guiding and organizing resources such as materials and manpower through the lifespan of the executing building. From the perspective of a construction company, project planning in construction means maintaining the quality of construction works from the inception to commissioning at the required standard so as to achieve client’s satisfaction. Project management may be defined as the overall planning, co-ordination and control of a project from inception to completion, aimed at meeting a client’s requirements in order to produce a functionally
and financially viable project that will be completed on time, within authorized cost and to
the required quality standards (CIOB, 2002).

Traditionally, management functions are grouped under six headings, namely planning, organizing, staffing, directing and controlling, and coordination (Harris and McCaffer, 2005). The main focus of project planning is to ensure that the activities performed in the execution phase of the project are properly sequenced, resourced, executed and controlled (Chitkara, 1998).

Planning involves the following: decision making, information gathering, identifying/defining activities, creativity, flexibility and interrelationships (CIOB, 2002). The success of a project depends on various types of construction project management but will like to focus on project planning. Project planning helps to meet the expectations in terms of budget, deadline, and product quality. It goes a long way to have a cordial and professional partnership with your clients (Lemma, 2014).

Planning is often cited as the most critical of the management functions in determining the overall project success. Project planning results in significant cost and schedule savings (reference). Therefore, planning is identified as extremely important project management function for the success of project outcomes (Donnelly et. al., 1998).

Projects are needed to be completed within the time frame, budgeted cost and required quality, and these can only be achieved through planning (CIOB, 2002). However, unfortunately many projects take longer time to complete, cost more than necessary and some projects are cancelled because of various factors directly and/or indirectly related with it. This is as a result of poor project planning prior to the commencement of the project. If the project takes longer time it requires additional resources, and budgets and this increases labour, material, machinery and equipment cost. This affects the contractor budget, work schedule and if not careful there will be charge of Liquefied and Ascertained Damages (LAD) and in general, it affects the economy of the country (Lemma, 2014). Variables that cause poor performance of project success (cost overrun, time delay, quality deficiency) are caused by either in selection, planning, execution or control phase of the project and other factors. However, according to Lemma (2014), one of the main reasons of project failure in developing countries is lack of effective planning processes.

In this regard, different researchers show the effects of project planning on project performance. The studies by Wang and Gibson (2008), shows that time spent on project planning activities will reduce risk and increase project success. Other researchers on the project planning activity such as Jacques et al. (2008), shows inadequate analysis and planning will lead to a failed project but the more planning there is in a project, the more successful the project will be. Therefore, according to this evidence even if all the resources are available, poor project planning will result to project failure. The researcher believed that project success requires careful use of PTT to plan the project before the project is undertaken or implemented. Hence, investigation into project planning techniques used by construction firms in the Kumasi metropolis.
Project

Project as defined in a Guide to the Project Management Body of Knowledge (PMBOK, 2000), is a provisional activity carry out to form an exceptional product or service. Provisional means that every building project has a certain beginning and end. Exceptional means that the product or service is dissimilar in some characteristic from all other projects or services. “A project is an organization of professionals dedicated to a specific purpose or objective (reference). Projects generally involve large, expensive, unique, or high risk undertakings which have to be completed by a certain date, for a certain amount of money, with some expected level of performance (reference). At a minimum, all projects need to have well defined objectives and sufficient resources to carry out all the required tasks” (Nilsson & Söderholm, 2005).

Characteristics of a Project

According to Nilsson & Söderholm (2005), majority of building projects are characterize by most if not all of the five characteristics as follows; A beginning and an end, A schedule, An participation of diverse professionals on an ad-hoc basis, An amount of resources and A planning of activities and phases.

Project Management

Project management involves planning, scheduling and controlling all of the project activities to achieve its objectives. In other words, project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. (PMBOK, 2000). Project management is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring, controlling and closing (Duncan, 2000).

Project Management Functions

Management has been defined as a social procedure including obligation for economic and effective planning and regulation of operation of an enterprise in the fulfillment of given purposes. It is a dynamic process consisting of various elements and activities. These activities are different from operative functions like marketing, finance, purchase etc. Rather these activities are common to each and every manager irrespective of his level or status. According to George and Jerry (2016), “There are four fundamental functions of management i.e. planning, organizing, actuating and controlling”. According to Henry Fayol, “To manage is to forecast and plan, to organize, to command, and to control”. The functions of construction Management are Planning, Scheduling, Organizing, Staffing, Directing, Controlling, Coordinating, etc. The first function under project management is planning which depicts that to achieve success; one must endeavor to make a conscious effort to plan before the commencement of the project activities by employing effective PPT.
Planning

As mentioned by Nilsson & Söderholm (2005), planning and plans are inherent features of projects. Plans are destined to establish and serve as control to the project professional as they work to achieve whatever project goals set. A plan can only have a certain degree of complexity. In practicing project management on a daily basis activities are observed and plans appear to close become less narrow.

Project Planning

The classic definition of planning is “working out in broad outline the things that need to be done and the methods for doing them to accomplish the purpose” (Gulick, 1936). Koontz (1958) defines project planning as “the conscious determination of courses of action designed to accomplish purposes”. Mintzberg (1994) describes planning as the effort to formalizing decision making activities through decomposition, articulation and rationalization. In construction, pre-project planning is defined as the phase after business planning where a deal is initiated and prior to project execution (Gibson & Gebken, 2003). PMBOK, (2008) has a similar definition for the planning phase. “The Planning Process Group consists of those processes performed to establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives”. The greatest difference between the definitions is that construction project planning specifically includes analysis and evaluation steps.

Importance of Project Planning

McGraw (2011) identified the following points as importance of planning in project management; 1) To help to minimize the cost by optimum utilization of available resources, 2) It reduces irrational approaches, duplication of works and inter departmental conflicts, 3) It encourages innovation and creativity among the construction managers, and 4) It imparts competitive strength to the enterprise.

Project Planning Techniques

- **Bar Charts or Gnatt Charts**

The Bar chart also called Gantt chart, which was invented by Henry Gantt in 1900 initially for the Management of industrial production and subsequently being extensively used in the management of construction projects (Bhavikatti, 2012; Abubakar et.al., 2008). The bar chart is a graphic device that comprise two co-ordinate axes, one showing the time and the one indicating activities of the project operations, and each operation (activity) is represented by a bar (Bhavikatti, 2012). The period of the project operations are specified by the distance of the bar; the left side of the bar displays the start of the time, the right side displays the ending period for each activity (Ravindra, 2010). The simplicity and visual clarity of the Bar chart makes it a very valuable medium for displaying job schedule information. It is immediately intelligible to people who have no knowledge of network diagrams. It offers a stress-free and suitable way to display job improvement, schedule equipment and crews and to keep records of project progress (Bhavikatti, 2012; Krishnamurthy and
According to Chitkara (2012), the bar chart is greatest advantageous for schedules presentations. It is normally useful for reporting and communicating the levels of project schedules (Roberts and Wallace, 2004). Passenheim (2009) asserts that bar chart is used as a benchmark chart for tracing the performance of project schedules. Bar chart is an easily understandable pictorial formats according to Passenheim (2009), making bar chart the advantageous tool for project schedules. Hence, the bar chart is commonly used as a supplement of other techniques, specially the critical path method (Passenheim, 2009; Abubakar et al (2008); Roberts and Wallace, 2004). However, bar charts have well standard and deficiencies if use as a unique expansion of management of project information (Abubakar et al (2008).

It inadequacies according to Bhavikatti, (2012); Krishnamurthy and Ravindra, (2010); Abubakaret. al., (2008) it does not show the interrelationship between the constructional activities, therefore, the consequence of delay of any activity on others cannot be easily seen; it does not specify whether or not activity is critical and in which extra time is accessible, therefore, it does not carry to managers and workers what attention to be given to the preceding activities; it does not indicate the actual progress of the work on the day of assessment, in an event of uncertainties in expected time requirement of an activity, management cannot effectively work. In an effort to limit the inadequacies of the bar charts, linked bar charts was presented. Linked bar chart holds the pictorial benefits of bar chart with improved emphasis on dependencies (Seeley, 1986). It earn the form of vertical links between the finishing point of one activity and the beginning of another, which with greater emphasized on organization and construction sequence (Harris and McCaffer, 2005; Seeley, 1986). According to Chitkara (2012), the bar chart is most suitable for demonstration of schedules, but not as a planning technique. It is frequently used for broadcasting and communication purposes (Roberts and Wallace, 2004), hence, it is mostly used as a supplement of other project planning techniques, specially the critical path method, and as a rough initial strategy (Abubakar, Grenwood and Osborne, 2008; Bailey, Farmer, Crocker, Jessop and Jones, 2008; Roberts and Wallace, 2004).

- **Line of Balance**

Line of balance (LOB) is also known as elemental trend analysis which is design as a planning technique for projects of repetitive works, the ideologies used were derived from the processes of planning and control of manufacturing items/ goods. The LOB technique is illustrated in a form of pictorial graph that has a horizontal timescale and calendar, with accumulative output shown vertically. Bar lines indicates the various activities inclined at different slopes to show the productivity rate (Harris and McCaffer, 2005; Seeley, 1986). According to Kraemer, et al. (2014), it is easy to understand the development of each project activity and it gives actual data for a likely decision making procedure. However, LOB technique according to Seeley (1986) is not so easy to appreciate like the bar chart nonetheless it highpoints the relevance of the finished activity, productivity rates and connection between certain activities. The technique is appropriate for firm operational sequencing and allows a great degree of control (Harris and McCaffer, 2005; Seeley, 1986). However, the LOB planning technique has some deficiencies due to its being originally designed for simple repetitive production process (Kraemer, Henrich et al (2014). Firstly, it
shows only a restricted amount of data and a restricted degree of complexity (Henrich et al, 2014). Secondly, LOB can only find any delay in a unit or other variations in activities but cannot show any supplementary delay in the total project completion (Suhail and Neale, 1994 in Kraemer, Henrich et al (2014). Modern construction projects according to Chitkara (2012) and Hughes (2012), are complex, less repetitive and with a lot of systems. Hence, the LOB technique cannot sufficiently deal with the demands of projects planning and controlling, consequently, considered unsuitable for project planning in the construction industry.

- **Network Method**

According to Bhavikatti (2012) the network method comprising demonstration of all levels of a project explicitly in the arrangement of a network diagram with arrows and nodes representing activities and durations as well as sequence of operations. It is merely a precedence diagram with activity durations in a consistent way (Roberts and Wallace, 2004). Program evaluation and review technique (PERT), and critical path method (CPM) are the two main network systems in the construction industry.

- **Program Evaluation and Review Technique (PERT)**

PERT was established by the US Navy in 1958 for assessing the viability of schedules of Polaris. PERT were found appropriate for projects that are non-repetitive in nature, in which there is no exact knowledge about the period necessary for several activities (Bhavikatti, 2012). However, evaluating the time for various activities in construction is not a problem, as a lot of earlier information and knowledge are obtainable. Therefore, according to Bhavikatti (2012), PERT is not a chosen technique in planning and scheduling of construction works.

- **Critical Path Method (CPM)**

The CPM was established in 1960 by the DuPont Corporation in order to permit the programming of maintenance work in an event of the closure of chemical plant. CPM is a deterministic method to project planning that make use of estimating duration of activity also known as Practical accurate (Roberts and Wallace, 2004). CPM determines the lowest finishing time for a project, beside the likely commencing and completing times for the project activities (Bhavikatti, 2012; Roberts and Wallace, 2004). CPM provides the following benefits when adopted in the management of construction projects (Chitkara, 2012; Bhavikatti, 2012; Krishnamurthy and Ravindra, 2010; Kerzner, 2000). It indicates critical activities, which is useful to management such that this activities can be focused to sustain the construction schedule; aids in crashing the project finishing period by recognizing all activities to be crashed; the greatest cheapest construction schedules can be recognized and resource scheduling may be organized to suite that; resource mobilization can be strategized well in advance; should anything goes incorrect, the activities to be hurried up can be identified and necessary actions may be initiated; it assist in identifying the best amalgamation of equipment and labour; it helps in finding slack times for several activities of operations, which help in allocating labour to retain the labour force; it justifies construction, costing and financing and; it offers the basic structure for broadcasting data.
Nonetheless, the CPM technique is been disapproved because (Kerzner, 2000): time, labour, and concentrated effort is essential to use them and the ability of upper-level management to add to decision making have been condensed. In spite of its inadequacies, the CPM according to Olatunji (2010), have the ability to find the key construction activities of a project and this quality permits it to positively influence some project delivery. In addition, the CPM is perceived by many to be the most desirable planning technique for construction projects, due to its suitability for construction projects planning and scheduling (Bhavikatti, 2012; Krishnamurthy & Ravindra, 2010; Passenheim, 2009; Abubakar et. al., 2008; Bailey, Farmer, Crocker, Jessop & Jones, 2008; Roberts & Wallace, 2004).

Research Methodology
This paper based on one methodological approach of data collection: quantitative. With the application of the quantitative data collection, a survey questionnaire was designed and administered to Project Supervisors of Construction firms in the Kumasi Metropolis to gather data on the PPT and the mostly used PPT as well as its benefit to projects success. The questions were ethical and feasible covering respondents’ profile, evaluation of identified PPT, mostly used PPTs, reasons and benefits using PPTs. Due to the nature of the construction industry, construction site are scattered around the Kumasi metropolis making it impossible to determine the population. However, a non-probability sampling techniques known as snowball was strategically adopted in selecting all the construction sites for the study. In order to reach the right and experience respondents who are involved in the use of PPTs in project planning. In a typical snow-ball fashion, one construction site was identified and who in turn identify the next site(s) and it continued in that same manner until all the sites required were identified. In all, 50 questionnaires were distributed to Site Supervisors of Construction firms in the Kumasi metropolis and 49 (96%) were retrieved for analysis. All questionnaires were administered personally to the respondent during which advantage was taken to inspect the type of PPT used. The quantitative data was analyzed using statistical tools such as SPSS 20, percentages of tabulated results.

Findings and Results

Identified Project Planning Techniques
An extensive review of literature were conducted, Seven (7) PPTs were identified as follows with each having its strength and Shortcomings; Brainstorming, Critical Path Analysis, Cause & Effect Diagrams, Bar Charts or Gantt Charts, Line of Balance, Network Method and Program Evaluation & Review Technique (PERT).

Mostly Used Project Planning Technique
The study identified Seven (7) Project Planning Techniques via an extensive literature review. From the Table 1 below, Bar Charts or Gantt Charts were ranked as the mostly used Project Planning Technique with RII value of 0.91, Brainstorming was ranked second with RII value of 0.85 followed by Program Evaluation and Review Technique (PERT) being the third with RII of 0.75 from the table. Critical Path Analysis was ranked the forth with
RII of 0.72. The fifth, sixth and seventh ranked project planning technique were Cause and Effect Diagram, Network Method and Line of Balance respectively. Irrespective of the shortcomings of the Bar chart or Gantt chart it is considered as the most used planning techniques. It shortcomings according to (Bhavikatti, 2012; Krishnamurthy & Ravindra, 2010; Abubakar et. al., (2008); it shows not the interrelationship and interdependences between the activities. This causes delay of an activity on the preceding activities cannot clearly shown. Also critical activity cannot be identified and visible; thus, making managers and workers difficult when considering and allocating of resources to the prerequisite activities. It does not depict the actual progress of work and these affect project planning since where there are uncertainties in anticipated time for the activities.

Table 1. Mostly used Project Planning Techniques

<table>
<thead>
<tr>
<th>Project Planning Techniques</th>
<th>WEIGHTING OF FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Charts and Gantt Charts</td>
<td>0.91</td>
</tr>
<tr>
<td>Brainstorming</td>
<td>0.85</td>
</tr>
<tr>
<td>Program Evaluation and Review Technique (PERT)</td>
<td>0.75</td>
</tr>
<tr>
<td>Critical Path Analysis</td>
<td>0.72</td>
</tr>
<tr>
<td>Cause and Effect Diagrams</td>
<td>0.70</td>
</tr>
<tr>
<td>Network Method</td>
<td>0.67</td>
</tr>
<tr>
<td>Line of Balance</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Source: Survey data, 2017

**Reasons for using project planning technique**

Table 2 shows that, 26 (53%) of the respondents selected “Time saving” as their reasons for using a type of Project Planning Technique, Also 10 (20%) ticked “not complex” whiles 7 (14%) of the chose “easy to implement” as their reasons for selecting Project Planning Technique. 5(10%) selected “easy to use” as a reason for a using a Project Planning Technique. This affirm that the easiness and pictorial precision of the Bar chart or Gnatt Chart enable it a much appreciated medium for showing schedule of activity data (Bhavikatti, 2012; Krishnamurthy & Ravindra, 2010). This influences the contractor’s choice of Project Planning Techniques hence the Bar Chart or Gnatt Chart as the mostly usedin spite of its shortcomings as recounted by Abubakeret. al., (2008).

Table 2: Reasons for using the Project Planning Techniques

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to use</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Not complex</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Time saving</td>
<td>26</td>
<td>53</td>
</tr>
<tr>
<td>Easy to implement</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Survey data, 2017
Benefits of Project Planning Techniques

Table 3 indicates that, out of the ten (10) identified benefits of project planning techniques, the top ranked benefit is Improve service quality and customer satisfaction with RII of 0.916, followed by to complete work within budget with RII of 0.908. The third, fourth and fifth benefits were Prevention of Contractors LAD’s, Improved efficiency and productivity at work and to complete work within time respectively. McGraw, (2011), affirm that Project planning when put into practices would invariably lead to “maximum production at least cost”. A good project planning techniques, results in completion of a construction project within the stipulated budget.

Table 3: The benefits derived from using Project Planning Techniques

<table>
<thead>
<tr>
<th>Benefits Derived from Project Planning Techniques</th>
<th>MEAN</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve service quality and customer satisfaction</td>
<td>4.58</td>
<td>0.916</td>
<td>1st</td>
</tr>
<tr>
<td>To complete work within budget</td>
<td>4.54</td>
<td>0.908</td>
<td>2nd</td>
</tr>
<tr>
<td>Prevention of Contractors LAD’s</td>
<td>4.54</td>
<td>0.902</td>
<td>3rd</td>
</tr>
<tr>
<td>Improved efficiency and productivity at work</td>
<td>4.52</td>
<td>0.904</td>
<td>4th</td>
</tr>
<tr>
<td>To complete work within time</td>
<td>4.42</td>
<td>0.884</td>
<td>5th</td>
</tr>
<tr>
<td>Efficient use of Labour, Materials and Plant</td>
<td>4.32</td>
<td>0.864</td>
<td>6th</td>
</tr>
<tr>
<td>Reduce the waste rate of materials</td>
<td>4.26</td>
<td>0.852</td>
<td>7th</td>
</tr>
<tr>
<td>Maintaining the quality of construction work at the required standard</td>
<td>4.24</td>
<td>0.848</td>
<td>8th</td>
</tr>
<tr>
<td>Encourages innovation and creativity among the construction managers</td>
<td>4.08</td>
<td>0.816</td>
<td>9th</td>
</tr>
<tr>
<td>Avoidance of confusion, uncertainties, risk, wastages etc.</td>
<td>4.06</td>
<td>0.812</td>
<td>10th</td>
</tr>
</tbody>
</table>

Source: Survey data, 2017

Conclusion

As the saying goes if you fail to plan, you rather plan your failure. Based on this saying it is very important for every project to always plan before the commencement of any project. Project Planning Techniques are intended to establish and lead project professionals as they work on achieving the set project goals. From the study, Seven (7) Project Planning Techniques were identified through extensive review of literature; Brainstorming, Critical Path Analysis, Cause and Effect Diagrams, Bar Charts or Gantt Charts, Line of Balance, Network Method and Program Evaluation and Review Technique (PERT). The mostly used PPT is the Bar Charts or Gantt Charts which was the top ranked with a RII of 0.91. Their reasons for using the Bar Charts or Gantt Charts in ascending order were evaluated as follows Easy to use, Not complex, Not complex and Easy to implement. Benefits derived from using Project Planning Techniques were identified and analyzed using relative importance index to assess their level of importance. The top ranked benefits were as follows; Improve service quality and customer satisfaction, To complete work within budget, Prevention of Contractors LAD’s. Every project require to be completed within the
stated time, budgeted cost and required quality; all these project objectives can be achieved through project planning techniques.

**Recommendations**

First, Project Planning Techniques should be part of curriculum at tertiary level of education. This will ensure that the upcoming professional would be knowledgeable in various project planning techniques. All construction firms must ensure that the right Project Planning Technique is employed depending on the type of project before any construction is carried out. Also, construction firms should periodically train their employees on the various types of Project Planning Techniques for effective delivery of projects.

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