



Adoption of Project Scheduling Tools in the Nigerian Construction Industry

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Article information

ABSTRACT

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Many studies have reported the benefits of using Project Management scheduling tools. Their use in building projects in Nigeria has however not been given adequate attention. This study identified the project management scheduling tools used in the building construction industry in Southwestern Nigeria, examined the motivations for their adoption and assessed the impact of the tools. Primary data were collected using three sets of questionnaire administered on 50 Project Managers, 50 project clients and 150 Project Workforce from 25 purposively selected firms from Lagos, Oyo and Osun States in Southwestern Nigeria. The study revealed that 68% of the firms performed their project management scheduling activities with dedicated software, 32% executed theirs manually while another 32% used both methods. The study further shows that the most commonly adopted scheduling tool was Microsoft Project (84%), followed by Primavera (10%) and Customized software (6%). The study also revealed that project scheduling activities were shortened by about 32 hrs using scheduling tools. In addition, enhancing work performance, meeting stakeholder's expectations, and promoting interactiveness among others were found to have an impact on the motivation to adopt scheduling tools. The adoption of scheduling tools was found to have a positive impact on parameters such as meeting customer expectations, completing projects within budget and estimated time and finishing projects. The study recommended as management practice the adoption of scheduling tools in the construction industry in Southwestern Nigeria.

Keywords:

Project Management, Project Success, Scheduling Tools

1.0. Introduction

It has been observed that there are many challenges confronting projects in the building construction industries. In the last few decades, the building construction industry has witnessed tremendous institutional and organizational transformations across the globe. Continuous modification of the building process, pace and complexity of work and increasing demand for higher quality and productivity have become common features of this industry (Ibem *et al.*, 2011). These factors have necessitated the development and introduction of project management tools for managing building projects (Newton, 2006). Project management has been developed over the past few decades as it has become apparent that without a structured approach, people are not very good at completing projects successfully.

The aim of project management is to ensure that projects are completed and at the end point a new product is achieved. More than this, project management is about reaching that end point predictably at a given cost and within a planned period of time (Newton, 2006). Scheduling projects in the building construction industry entails the act of putting together a timetable for the various tasks or activities of a building construction project. It also prevents project delays and obstacles that can arise as a result of poor planning. By creating schedules, workers remain well-informed, better organized and more productive. This helps to reach project completion goals. Moreover, building construction scheduling helps construction teams stay within their allotted budgets (Sheahan, 2011). In scheduling a project, one must take into consideration the planning object, the depth of the planning and the methods to be used. The project scheduling can either be the entire project, or portions thereof, such as individual project phases (Gower Handbook, 2000; Kerzner 2001).

Sheahan (2011) noted that for a building construction project to be a success, it must not only be completed according to the building plans but also finished on schedule. Building Construction projects must be properly scheduled or else construction teams risk running out of time and resources (Sheahan, 2011). However, optimizing and managing a project schedule can be a very mathematically demanding process in which a scheduling tool can help manage the large number

of options and decisions to help find the preferred schedule (Crowe, 2011). The application of scheduling tools for the management of projects in the building construction industry in Southwestern Nigeria is being examined by this study.

2.0. Focus of Study

The successful achievement and management of building projects requires careful planning, scheduling and coordination of numerous interrelated activities. The project manager in the building construction industry is frequently faced with the problem of having to reduce the scheduled completion time of a project to meet deadlines. However, additional labour and resources cost money and thus increases the overall project cost and as such, the decision to reduce the project duration by reducing the time of one or more of the critical path activities. Adebowale and Oluboyede (2011) even noted that the use of project management tools may trim down building collapses in Nigeria. Due to the advantages of using project management scheduling tools, it may be necessary to examine the project management scheduling tools used in the building construction industry in Nigeria, the factors that determine their adoption and how these scheduling tools impact project success in the building construction industry.

3.0. Literature Review

3.1. Definition of project

A project according to the Project Management Institute (PMI) (2010) is a temporary endeavor undertaken to create a unique product, service, or result. Although Kerzner (1997) characterises a project as having “a specific objective to be completed within certain specifications, with defined start and end dates, funding limits (if applicable), and resources (i.e. money, people, equipment)”, the definition from the PMI has since been adopted as the standard for defining a project. Projects must have clearly defined objective which must be achieved within a set amount of time and cost. At the end, the project will have produced the pre-defined deliverables. The deliverables are for the project customer (project sponsor) and are created by the project team (workforce), under the guidance of the project manager (Newton, 2006).

3.2. Definition of project management

Project Management according to Kerzner and Harold (2003) is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives. However, Newton (2006) defines Project management as a formal discipline for managing projects. Project management has been developed over the past few decades as it has become apparent that without a structured approach, people are not very good at completing projects successfully. Most definitions of project management would be similar with respect to; (a) integration of the work of others needed to assure project success the single point of integrative responsibility (Archibald, 1997) and; (b) the application of certain project management practices. It is the extent of application of these practices, and the nature of the integration, that leads to differences in definition.

3.3. Challenges of project management

The primary challenge of project management is to achieve all of the project goals and objectives while adhering to classic project constraints which are usually scope, quality, time and budget. The secondary and more ambitious challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. However, Project Management Institute (2004) states that Project management is the process of the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.

3.4. Definition of project success

Defining project success by Suchan (2012) seems simple; deliver on time and on budget. A standard must be established by which to define and measure project success. A project manager may think that delivering business results is the customer's problem to solve. A standout project manager, however, is one that takes the time to partner with the customer, understand the business drivers, and care enough to ensure that the project they lead delivers the business results for which it was designed (Suchan, 2012; Harrin, 2007).

Fundamentally, project success is the delivery of the required product, service, or result on time and within budget. The success or failure of a business

or any firm is to be understood and judged in terms of profit and loss. To meet these objectives is to deliver a quality project. PMI illustrates project quality through the concept of the triple constraint: project scope, time and cost. Project quality is affected by balancing these three interrelated factors. The relationship among these factors is such that if any one of the three factors change, at least one other factor is likely to be affected. The Figure 1.0 below illustrates this constrained relationship, sometimes called the “iron triangle.” or “scope triangle” that one of these factors is fixed and the other two will vary in inverse proportion to each other. For example “Time” is often fixed and the “Quality” of the end product will depend on the “Cost” or resources available. Similarly “Quality” and “Cost” of the project will be largely dependent upon the “Time” available (Jenkins, 2006).



Figure 1.0: Project Management Success Constraints
Source: Crowe (2011)

Cost and time are intuitive, but the role played by scope warrants further discussion. To understand the significance of scope, one must appreciate the relationship between scope and the project objectives. For the scope to contribute to project quality, it must be managed to meet the demands of the project objective by reliably providing the required functions, nothing more or nothing less. It is not simply a matter of keeping the scope from creeping, or a matter of completing the cheapest and fastest project; it is establishing the appropriate scope and delivering the commensurate product, service, or result.

The triangle illustrates the relationship between three primary forces in a project. Time is the

available time to deliver the project, cost represents the amount of money or resources available and quality represents the “fit-to-purpose” that the project must achieve to be a success. The normal situation is establishing these targets at the front-end and managing the evolution of the project to achieve optimal business success is increasingly a theme of contemporary project management practice. There is much interest, and work, in melding traditional project management knowledge, of defining and delivering a successful outcome as it evolves through the project life cycle, with the knowledge of the sponsor’s business objectives and operating characteristics.

Not only does this new, broader view take project management further into the front-end (Concept) – and indeed the back-end (Operations and even Decommissioning) of the life cycle. With contemporary moves towards much more integrated supply chain (partnering, framework contracts, etc.), it brings the whole project organization into a more sophisticated view of what successful project accomplishment means.

3.5. Project management scheduling

In project management, a schedule is a list of a project's milestones, activities, and deliverables, usually with intended start and finish dates. Those items are often estimated in terms of resource allocation, budget and duration, linked by dependencies and scheduled events (PMI, 2010). In scheduling a project, one must take into consideration the planning object, the depth of the planning and the methods to be used. Scheduling is not an exact process. It is part estimation, part prediction, and part educated guess work. Due to the uncertainty involved, the schedule is reviewed regularly, and it is often revised while the project is in progress. It continues to develop as the project moves forward, changes arise, and new risks are identified. The schedule essentially transforms the project from a vision to a time-based plan.

According to Crowe (2011), project scheduling activities includes;

a) **Project activity sequences:** This refers to the understanding and diagramming the relationship that scheduled activities have with each other by arranging the activities in the

order they must be performed and the amount of time each activity is expected to take.

- b) **Project activity durations:** The duration of an activity is a function of many factors, including those who will be doing the work, when they are available, how many resources will be assigned to this activity, and the amount of work contained in the activity.
- c) **Resource leveling:** this is when resource needs meet up with the organization’s ability to supply resources.
- d) **Project cost control:** This is the quintessential monitoring and controlling process for ensuring that costs stay on track and that change is detected whenever it occur.
- e) **Project activity resource requirements:** This is the effort needed to perform the activity, the number of resources that will be applied to it, and resource availability.

Others scheduling activities may also include; Project Activity Schedule Constraints, Project Activity List and Attributes, Project Time Estimating, Project Schedule Compression, Project Communication, Project Claims and Schedule Network Analysis.

3.6. Project management scheduling tools

Bram (2011) stated that Scheduling aims to predict the future, and it has to consider many uncertainties and assumptions. As a result, many people believe it is more of an art than a science. The schedule is a critical part of an effort. It identifies and organizes project tasks into a sequence of events that create the project management plan. A variety of inputs and tools are used in the scheduling process, all of which are designed to help understand resources, constraints, and risks. The end result is a plan that links events in the best way to complete the project efficiently. Basically through the use of tools to schedule construction projects, the project manager may set target dates, determine degree of project completion, identify individuals responsible for any action, update all schedules and re-organize work in order to cater for problems that may happen during the construction phase. This can be done with ease through the provision of varieties of tools such as Gantt chart and graphs provided to help make scheduling work easier (Gareis, 2002). Bram (2011) stated that it can be hard to find the perfect software tool for projects when planning a project schedule with certain features like the ability to

display Gantt and PERT charts. Then there are pricing concerns where some software tools assume a much larger budget than project may have. There may also be the need to consider usability to ascertain if team members will have a steep learning curve with a particular piece of software tool. For this research, the following project scheduling software packages were identified for review.

a. Microsoft Project

Makar (2012) observed that few project scheduling tools provide the robustness of Microsoft Project in a web-based environment. In the same view, Matzen (2012) noted that Microsoft Project produced by Microsoft which is a world leader and powerhouse in software development is a type of scheduling tool that contains the robust functionality and stability construction industry professionals rely on every day to control their business operations. Bram (2011) observed that many project managers like Microsoft Project because it is relatively easy to learn. It is a pricier option (\$599.95 for the Standard version and \$999.95 for the Professional version), making it less ideal for managers who need project scheduling tools that fit tight budgets. Microsoft Project is highly integrated, allowing the monitoring of a large number of variables and the production of Gantt charts and network diagrams.

b. Customized Tools

There are several features and types of customized tools such as 'ZOHO Projects' which is a web-based application. This Scheduling tool can be assessed from anywhere ZOHO Projects is free and can generate Gantt charts. The tool however does not offer PERT charts. FastTrack Schedule 9 is another customized scheduling tool available for both Mac and Windows operating systems. It has an extremely effective set of resource management tools built in. As facets of a project change, FastTrack is easy to update. The cost of a license for FastTrack is significantly lower compared to one for Microsoft Project. For newer project managers, FastTrack offers an easy introduction to the software and a gentle learning curve. It is also robust enough for any experienced project manager that wants to put it through its paces (Bram, 2011).

c. Primavera

The Primavera name is well-known for project management solutions. This tool is flexible and has the ability to handle everything from time sheets to resource management. However, the tool has more extensive hardware requirements than some other project management applications. It is intended for use by larger organizations, and may not be ideal for managers working with smaller projects (Bram, 2011). Each of these project schedule software tool options has different strengths, but they offer the best options for a variety of management needs. Additionally, most developers offer an online demo, allowing prospective users to try it out before buying it. In addition, SimulTrans uses other tools for scheduling as requested by clients. For example, some customers prefer tracking project schedules in Excel (since they may not have a project management application) while others prefers the use of customized tools like; Project Insight and Project X for the Macintosh, or OmniPlan.

3.7. Project management scheduling in the building construction industry

Building construction according to Sherman (2011) is the technique and industry involved in the assembly and erection of structures, primarily those used to provide shelter. Sheahan (2011) stated that building Construction projects must be properly scheduled or else building construction teams risk running out of time and resources. Sheahan (2011) further stated that scheduling serves to ensure the correct match between labor, equipment and materials with a time line of project activities.

Cost, quality and time are the factors that typically determine project success and yet of all of these, time is the least understood and least often approached with rigour and support of formal models, benchmarks or tools. Time management in construction project management is nothing like the simplistic management models which seek to improve personal productivity, but is fundamentally linked to the productivity of the contractor and effective management of the project's supply chain. It sits behind the dependable achievement of incremental project goals and milestones as well as to the successful on-time delivery of the total project (Tyerman and Bamforth, 2011).

Schedules for building construction are developed by project managers and/or engineers. The schedule is delineated into diagrams that often depict a sequence of figures, and each figure represents a specific activity to be carried out. Before a project schedule can be created, the schedule maker should have a work breakdown structure (WBS), an effort estimate for each task, and a resource list with the availability of each resource. If these components for the schedule are not available, they can be created with a consensus-driven estimation method like Wide band Delphi. The reason for this is that a schedule itself is an estimate. Each date in the schedule is estimated, and if those dates do not have the buy-in of the people who are going to do the work, the schedule will be inaccurate (Stallman and Greene, 2005).

According to Cutting and Thomas (2009), in order for a project schedule to be healthy, the following criteria must be met:

- a) The schedule must be constantly updated preferably weekly.
- b) The EAC (Estimation at Completion) value must be equal to the baseline value.
- c) The remaining effort must be appropriately distributed among team members (taking vacations into consideration).

Building Construction scheduling prevents project delays and obstacles that can come as a result of poor planning. By creating schedules, workers remain well-informed, better organized and more productive, which helps them reach their targeted completion goals. Moreover, construction scheduling helps construction teams stay within their allotted budgets.

3.8. Project success in the building construction industry

Project success is typically generated when the stakeholders, sponsors and constituents express their collective satisfaction according to the degree of their involvement. Project management also includes planning, organizing, directing and controlling activities or schedules in addition to motivating what is usually the most expensive resources on the project (Harvey, 2002). Poor project scheduling is a big reason why many projects are not considered successful. It is critical to spend the appropriate time and map out exactly

how long each task will take in order to complete the project by the desired date (Dantheman, 2008). According to Cleland and Ireland (2004) one of the vaguest concepts of project management is project success. Since each individual or group of people who are involved in a project have different needs and expectations, it is very unsurprising that they interpret project success in their own way of understanding.

For those involved with a project, success is normally thought of as the achievement of some pre-determined project goal (Lim and Mohamed, 1999). However, the public may have different views which are commonly based on user satisfaction. A classic example of different perspective of successful project is the Sydney Opera House project, which went 16 times over the budget and took 4 times the estimated project completion time to finish than originally planned (Thomsett, 2002). But the final impact was that the Opera House created was so big that no one remembers the original missed goals. The project was a big success for the people and at the same time a big failure from the project management perspective.

On the other hand, the Millennium Dome in London was a project on time and on budget but in the eyes of the British people was considered a failure because it didn't deliver the awe and glamour that it was supposed to generate (Cammack, 2005). In the same way that quality requires both conformance to the specifications and fitness for use, project success requires a combination of product success (service, result, or outcome) and project management success (Duncan, 2004). The difference between criteria and factors is fuzzy for many people.

Success criteria have changed considerably through time and moved from the classic iron triangle's view of time, cost and quality to a broader framework which includes benefits for the organisation and user satisfaction. As for success factors, there are contradicting views on the issue of how critical a project manager is to the final success of the project. A common factor mentioned by many authors is senior management support for the project and it is recognized as one of the most important factor of all. Early definition of success

criteria can ensure an undisputed view of how the project will be judged and early detection of success factors will guarantee a safe path to deliver success.

4.0. Research Methodology

4.1. Scope of the study

The scope of coverage of this work was limited to building construction firms in Lagos, Oyo and Osun in Southwestern Nigeria where many construction firms are domiciled. The restriction to Lagos, Oyo and Osun States was further informed by the fact that since the creation of Lagos state in 1967 and in spite of the movement of the nation’s capital to Abuja, the State has never ceased to be the center of the country’s economy, and commerce. According to US Census Bureau (2006), Lagos is the economic hub of Nigeria and the largest city in Africa. Furthermore, Ajanlekoko (2001) confirmed that Lagos State accounted for 60% of the construction industry’s activities in Nigeria. Similarly, high levels of building construction activities are also found in neighbouring States of Oyo and Osun (Ajanlekoko, 2001).

4.2. Population, sample and sampling technique

The population of the study comprised of all building construction firms located in Lagos, Oyo and Osun States. The research sample covered 25 registered/licensed building construction firms purposively chosen from the selected States. This was compiled from the Federation of Construction Industry Nigeria and State Ministry of Works listings. Simple Random sampling techniques were employed in taking a sample of 20 building construction firms that are based in Lagos, 3 from Oyo and 2 from Osun states from this list.

4.3. Characteristics of the study population

The study covers random selection of two (2) project managers, two (2) project clients and six (6) project workforce making a total of ten (10) respondents per building construction firm across the States in the study area. This totals 250 respondents.

4.4. Data collection / research instruments

Primary data were identified as being relevant to the effective conduct of this research. The primary data was obtained through the use of 3 sets of

questionnaire. The first set of questionnaire was administered on the Project Managers to elicit information on the Project Management Scheduling tools used in the project activities of the firms as well as technical background on various projects handled by the firms with Project Management Scheduling tools. The questionnaire also elicits information on factors influencing the adoption of the Project Management Scheduling tools used by each firm in the industry. The second set of questionnaire was administered on the Project clients to elicit information on the Project Success Criteria (scope, time, and cost) on various projects that have been accepted or rejected. The third set of questionnaire was administered on the Project Workforce to collect information on Scheduling impact on communication management between the Project Manager and Project Workforce during project execution from the firm.

4.5. Data analysis

Descriptive statistics such as percentages, means and frequency counts were used to describe the observations. Similarly, inferential statistics such as Analysis of Variance (ANOVA), and Duncan Multiple Range test were also employed.

5.0. Results and Discussion

5.1. Types of adopted project management scheduling tools

Table 1 revealed that most (84%) of the respondents adopted Microsoft project as their preferred scheduling tool.

Table 1: Types of project management scheduling tool adopted

Description	Respondent	
	Frequency	Percentage (%)
1) Project Management Tool		
Microsoft Project	42	84
Primavera	5	10
Excel	-	-
Customized Tools	3	6
2) Project Management Scheduling Services		
Manual	-	-
Electronically	34	68
Combination of Manual and Electronic	16	32
Total	50	100

This result is supported by Makar (2012) who reported that few project scheduling tools provide the robustness of Microsoft Project in a web-based environment. This may be because the tool is highly integrated, allows the tracking of a number of variables and produces Gantt charts as well as network diagrams. It is also relatively easy to learn and cheaper than other scheduling tools. This makes it ideal for managers who need a project scheduling tool that fits into a tight budget.

The low (10%) adoption of primavera among the respondents could be attributed to the claim by Makar (2012) that although primavera is flexible and has the ability to handle everything from time sheets to resource management it lacks extensive hardware requirements compared with other project management applications. Primavera is also intended for use by larger organizations, and may not be ideal for managers working with smaller projects (Makar, 2012).

Table 2 shows that 82.5% and 5% of the respondents in Lagos make use of a combination of manual and electronic methods (Microsoft project and customized tools) to schedule project activities while only 12.5% used primavera as an electronic tool. About 83% of the respondents in Oyo State make use of Microsoft project and customized tools as their preferred scheduling tool using a combination of both manual and electronic methods, while all (100%) of the respondents in Osun state perform Project Management Scheduling activities using both manual and electronic methods and using Microsoft project as the only preferred tool.

The study revealed that most project managers in the Southwest adopt Microsoft project as seen in Table 1 probably because it is cheap, flexible and can be purchased anywhere. This makes it the preferred choice of project managers.

5.2. Impact of project management scheduling tools

Table 2 shows that 42%, 40% and 42% of the respondents indicated that determining project resource requirement, sequencing project activities and listing project activities and their attributes respectively were completed in more than 40hrs before the introduction and adoption of a

Table 2: Duration of scheduling activities before adoption of scheduling tool

Task	< 8hrs	8-15hrs	16-23hrs	24-31hrs	32-39hrs	40hrs	>40hrs
Resource Requirements	1(2)	2(4)	2(4)	6(12)	4(8)	14(28)	21(42)
list and attributes	-	3(6)	1(2)	5(10)	3(6)	17(34)	21(42)
Project schedule network diagrams	1(2)	2(4)	2(4)	2(4)	2(4)	16(32)	25(50)
Activity duration estimates	-	3(6)	1(2)	4(8)	3(6)	12(24)	27(54)
Activity Budgeting	1(2)	2(4)	3(6)	1(2)	6(12)	12(24)	25(50)
Resource calendars	-	3(6)	3(6)	1(2)	2(4)	14(28)	27(54)
Resource levelling	1(2)	2(4)	1(2)	3(6)	1(2)	18(36)	24(48)

Figures in parentheses are percentages.

scheduling tool. Furthermore, 50%, 54% and 50% of the respondents indicated that developing Project schedule network diagrams, and estimating project activity duration, and project budgets respectively were also completed in more than 40hrs before the adoption of a scheduling tool. Fifty four percent and 48% of the respondents further indicated that developing project resource calendars and resource levelling respectively were completed in more than 40hrs before the introduction and adoption of a scheduling tool.

However, in Table 3 all (100%) of the respondents indicated that the task/ activities listed above were completed in less than 8hrs after the adoption of a scheduling tool. This means that the project management scheduling tools adopted had an effect and reduced the duration of scheduling project task/ activities.

Table 3: Duration of scheduling activities after adoption of scheduling tool

Task	< 8hrs	8-15hrs	16-23hrs	24-31hrs	32-39hrs	40hrs	>40hrs
Resource Requirements	50(100)	-	-	-	-	-	-
Sequencing	50(100)	-	-	-	-	-	-
list and attributes	49(98)	1(2)	-	-	-	-	-
Project schedule network diagrams	50(100)	-	-	-	-	-	-
Activity duration estimates	50(100)	-	-	-	-	-	-
Activity Budgeting	50(100)	-	-	-	-	-	-
Resource calendars	50(100)	-	-	-	-	-	-
Resource levelling	50(100)	-	-	-	-	-	-

Note: Figures in parentheses are percentages.

Table 4 shows the motivations for adopting project scheduling tools in the sector. There was a significant difference ($F=3.68$; $p<0.05$) in the ratings of enhancing work performance as an influence on the adoption of scheduling tools. The mean rating of respondents who adopted Microsoft Project (4.34) was significantly higher than those who adopted Primavera (4.00) and customized tools (4.00). The ratings of enhancing work performance as an influence on adopting Microsoft

project, Primavera and customized tools were not significantly different from each other. The average mean rating of respondents that use scheduling tools to enhance work performance is 4.11. This shows that the use of scheduling tools has a high impact on enhancing work performance by the respondents and thus enhances the project progress. Using the scheduling tools will make the project perform better against the plan.

Motivation	Project Management Scheduling tools				F-Value	P-Value
	Microsoft Project	Primavera	Customized Tools	Average Mean		
Enhance Work Performance*	4.34 ^a	4.00 ^a	4.00 ^a	4.11	3.68	0.03
Meet Stakeholders Expectations*	4.51 ^b	4.00 ^a	4.00 ^a	4.17	7.46	0.00
Promote Interactiveness among stakeholders*	4.83 ^b	4.33 ^a	4.11 ^a	4.42	14.13	0.00
Improve Quality Of Work*	4.09 ^a	4.83 ^b	4.56 ^{ab}	4.49	3.77	0.03
Enhance Information Distribution*	4.20 ^b	3.33 ^a	3.89 ^{ab}	3.81	4.86	0.01

Table 4: Motivations for Adopting project management scheduling tools

Note: * Significant difference at $p<0.05$

Key: (1) – no impact (2) – slight impact (3) – moderate impact (4) – high impact (5) – very high impact. Means with the same letters along the same row are not significantly different.

Table 4 further revealed that there was a significant difference ($F=7.46$; $p<0.05$) in the ratings of managing stakeholder expectations as an influence on the adoption of scheduling tools. There was no significant difference in the mean ratings of respondents among those who adopted customized tools (4.00) and Primavera (4.00). Both mean ratings were however significantly lower than the ratings of respondents who adopted Microsoft Project (4.51) to manage stakeholder expectation. The average mean rating of respondents that adopted scheduling tools to manage stakeholder’s expectation was 4.17. This implies that respondents who adopted Microsoft project found it to have a very high impact on managing stakeholder expectations while those who adopted customized tools and Primavera found it to have a high impact. The use of scheduling tools identify and resolve stakeholders concerns in a proactive and timely manner to ensure that no issues raised by stakeholders mushroom into problems that could jeopardize the project thus, letting them know what information they will receive and when and how they will receive it.

interactiveness among stakeholders as an influence on the adoption of scheduling tools. The mean rating of respondents who adopted Microsoft Project (4.83) to promote interactiveness was significantly higher than those who adopted Primavera (4.33) and customized tools (4.11). The average mean rating of respondents that use scheduling tools to enhance work performance was 4.42. Respondents who adopted Microsoft project found the need to promote interactiveness among stakeholders to have a very high impact on the adoption of a scheduling tool while those who adopted Primavera and customized tools found it a high impact on adoption. This reveals that the use of scheduling tools may enhance effective interactiveness among project workforce and with the project manager during the execution of projects.

In Table 4, there was a significant difference ($F=14.13$; $p<0.05$) in the ratings of promoting

Also in Table 4, there was a significant difference ($F=14.13$; $p<0.05$) in the ratings for enhancing the quality of work as an influence on the adoption of scheduling tools. There was a significant difference in the mean ratings for enhancing the quality of work as an influence on the adoption of scheduling tools among respondents who adopted Microsoft Project (4.09), customized tools (4.56) and

primavera (4.83). The average mean rating of respondents that use scheduling tools to enhance the quality of work is 4.49. This implies that the desire to improve on the quality of work generally had a high impact on the adoption of scheduling tools although had a very high impact for those who adopted primavera. The use of scheduling tools helps the project team identify what the quality specifications are for the project and how these specifications will be met to ensure the resulting product is of acceptable quality.

Table 4 further revealed that there was a significant difference ($F=7.46$; $p<0.05$) in the ratings of information distribution as an influence on the adoption of scheduling tools. The mean rating of respondents who adopted Microsoft Project (4.20) was significantly higher than respondents who adopted primavera (3.33) and customized tools (3.89). The average mean rating of respondents that use scheduling tools to enhance information distribution is 3.81. This indicates that the need to distribute information among project team members had a high impact on the adoption of Microsoft project and customized tools and a moderate impact for those who adopted Primavera.

Scheduling tools enhance the distribution of information by generally updating stakeholders on the progress of the project according to the communication management plan.

5.3. Impact of project management scheduling on firms’ project success.

Table 5 shows the impact of project management scheduling tools on project success. From the study, There was a significant difference ($F=6.24$; $p<0.05$) in the mean ratings of the impact of project management scheduling tool adopted on meeting customer expectations by the respondents. Those who adopted Primavera (4.00) and Microsoft Project (4.20) rated the impact of those tools on meeting customer expectations high and significantly the same but lower than the mean rating of those who adopted customized tools (4.67) who rated the impact very high. This reveals that the acceptable deliverables on the project expected by the customer can be enhanced with the use of the scheduling tools.

There was a significant difference ($F=8.13$; $p<0.05$) in the mean ratings of the impact of project management scheduling tool adopted on executing

Table 5: Impact of project management scheduling tool on project success criteria

Project Success Criteria	Project Management Scheduling Tools			F-Value	P-Value
	Microsoft Project	Primavera	Customized Tools		
Customer Expectation*	4.20 ^a	4.00 ^a	4.67 ^b	6.25	0.00
Budget scheduled*	4.40 ^b	4.17 ^b	3.67 ^a	8.13	0.00
Time Scheduled*	4.77 ^a	4.50 ^{ab}	4.33 ^b	3.76	0.03
Project Completion*	4.17 ^b	3.50 ^a	4.22 ^b	3.63	0.03
Quality Of Project*	4.89 ^b	4.33 ^a	4.33 ^a	10.95	0.00

Note: * Significant difference at $p<0.05$

Key: (1) – no impact (2) – slight impact (3) – moderate impact (4) – high impact (5) – very high impact.

Means with the same letters along the same row are not significantly different

the project within the budgeted estimates. Those who adopted Primavera (4.17) and Microsoft Project (4.40) rated the impact of those tools on executing the project within the defined budget high and significantly the same but higher than the mean rating of those who adopted customized tools (3.67) who indicated that the adopted tool had a moderate impact. This however indicates that the use of the scheduling tools has a considerable impact on managing the cost of executing the project because the scheduling tool adopted will reveal how much the project is expected to cost so that the project can be completed within the scheduled budget.

There was a significant difference ($F=3.79$; $p<0.05$) in the mean ratings of the impact of project management scheduling tool adopted on executing the project within the scheduled time by the respondents. Those who adopted Primavera (4.50) and customized tools (4.33) rated the impact of those tools on executing the project within the defined time significantly the same but lower than the mean rating of those who adopted Microsoft Project (4.77). This result agrees with Crowe (2011) who stated that optimizing and managing a schedule can be a very mathematically demanding process but the use of scheduling tools can help to manage the large number of options and decisions

to help find the preferred schedule so that project can be completed within the scheduled time.

There was also a significant difference ($F=3.63$; $p<0.05$) in the mean ratings of the impact of the different tools adopted by the respondents on project completion. Those who adopted Microsoft Project (4.17) and Customized Tools (4.33) rated the impact of those tools on project completion significantly the same but higher than the mean rating of those who adopted Primavera (3.50). This reveals that scheduling tools have a high impact on project completion. All project deliverables are periodically reviewed before execution using scheduling tools. This enhances the chance that these deliverables will be achieved.

There was also a significant difference ($F=10.95$; $p<0.05$) in the mean ratings of the impact of project management scheduling tools adopted on quality of project by the respondents. Those who adopted Primavera (4.33) and customized tools (4.33) rated the impact of those tools on quality of project high and significantly the same but lower than the mean rating of those who adopted Microsoft Project (4.89) who rated it very high. This agrees with Hill, (2011) and Hurley (2010) who stated that without quality control which involves checks and balances to ensure that deliverables are being met, it is impossible to track non-conformances, which could have a severe impact on the project's success. Thus, the use of scheduling tools has a high impact on the quality of the executed project. All the project success criteria were revealed to be significantly positively impacted by the adoption of project management scheduling tools.

5.4. Conclusion

The study has shown that the adoption and use of project management scheduling tools reduced duration of scheduling project activities and further enhanced project success in the building construction industry in Southwestern Nigeria. Building projects by firms that adopted project management scheduling tools to schedule project activities were successful.

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