Managing Ambiguity in Construction Projects in Nigeria: The case for Selecting and Achieving Set Milestones

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Abstract

Investigations that explore the knowledge, selection, and influence of milestone management practices on the performance of construction projects are limited. This study examined the dynamics involved in managing ambiguity and achieving set milestones in construction projects in Minna, Nigeria. Using the quantitative method, questionnaires (n = 150) were distributed to obtain data from construction professionals who adopted milestone management practices on their projects, of which 119 responded. This resulted in a remarkable 79% response rate, and high data reliability (0.962) was obtained. Notably, the findings underscore the pivotal role of specific milestone selection criteria in building construction projects as identified and ranked by the respondents. Scope of work (0.861) ranked first; schedule estimation (0.845) and quality assurance (0.845) ranked second; budget significance (0.844) and resource allocation (0.844) ranked third. Further findings show a significant relationship (i.e., p-value = 0.00) between the dynamics of milestone management and the performance of projects. The study accentuates the urgent need for appropriate selection and management of milestones for timely project completion in Nigeria. With this widely known practice, construction professionals would be able to represent and manage work activities and achieve set time expectations regardless of project disruptions.

Keywords: *construction, milestones, planning, professionals, project, time.*

Introduction

Construction projects often deviate from their planned trajectory, posing challenges for project managers striving to align activities with contractual time expectations. Given the capital-intensive nature of construction projects and clients' desires for timely completion, professionals often rely on project milestones to manage deviations from the plan. Numerous authors (Globerson et al., 2016; Olubajo et al., 2019; Orekan & Babatunde, 2020; Olugboyega & Windapo, 2022) have conceptualized milestones differently in the literature, ranging from clear targets set in a project, designated payment times, project segments, work packages, to project phases, highlighting the diverse perspectives on their nature and function. The literature

on construction management typically discusses milestones in two main themes. A study by Altahtooh and Alaskar (2018) focus on factors determining the size or content of milestones, while Scarbrough et al. (2012) view milestones as representations of time or work in a project. However, limited research delves into how professionals manage ambiguity in projects using milestones. This study aims to explore the dynamic relationship involved in managing ambiguity in selecting and achieving milestones in projects in Minna, Nigeria. Specifically, it seeks to examine the relationship between the level of knowledge and practice of milestone management and the influence of milestone management practices on construction time performance. The study presents the following hypotheses to test these relationships:

H0: There is no relationship between level of knowledge and the level of adoption of milestone management.
H1: There is a relationship between level of knowledge and level of adoption of milestone management
H0: There is no relationship between level of adoption of milestone management and time performance.
H1: There is a relationship between level of adoption of milestone management and time performance.

Literature Review

The literature on milestones not only delves into the factors influencing their creation but also highlights their role as representations of work packages or time. Scarbrough et al. (2012) investigated the use of milestone programmes in the context of computer game production. They explored how milestone programmes facilitated product design work across various developer groups. The authors argued that milestone programmes aid in coordinating the practices of different developer groups within time-constrained processes, particularly in managing emergent conditions. According to literature on milestones, various factors influence the size or content of work within them across different projects. For instance, Globerson et al. (2016) surveyed project managers to identify criteria determining the work content or size of project milestones and found organizational unit responsibility role in clear assignment of responsibilities. Additionally, Altahtooh and Alaskar (2018) explored the relationship between milestones and decision-making structures across projects, highlighting factors such as end phase or task, zero duration, and deliverables as commonly associated with milestones. Meanwhile, Sunmola (2020) investigated factors influencing milestone creation in IT projects, identifying conformance to requirements, deadlines, and time-to-market as primary considerations.

Implementing Key Performance Indicators (KPIs) and regular performance assessments, as recommended by Adabre et al. (2023), facilitates progress monitoring and allows for adjustments as needed. Thus, highlighting the importance of milestone management. Proactive risk assessment and mitigation strategies, as emphasized by Boateng et al. (2022) ensure timely identification and addressing of potential setbacks. Implementing quality control checks at milestone points, as suggested by Miranda (2019) and Altahtooh and Alaskar (2018), helps maintain construction quality and prevents rework and delays. These practices are essential for successful project completion within schedule and budget constraints. Sunmola (2020) expressed that effective project planning and scheduling, is foundational to milestone management and involves creating detailed timelines, identifying critical milestones, and efficient resource allocation. Time performance indicators are essential for evaluating the progress of construction projects, encompassing seven key aspects: predictability of time, quick

start, quick progress, quick finish, slow start, slow progress and slow finish (Gledson et al., 2018). These indicators play a vital role in project success. A quick start, quick progress, and quick finish are desirable outcomes, while slow counterparts can lead to delays and additional costs.

In summary, project planning, monitoring, and risk management are crucial for ensuring predictability and time performance in construction projects. The above studies collectively focus on a relationship between various project factors and milestones, emphasizing the importance of payment systems, responsibility assignment, and deadlines in milestones. However, they overlook the dynamics relationship between the level of knowledge, selection and adoption of milestone management in managing ambiguity and achieving set milestones.

Research Method

This research utilizes a descriptive survey approach to investigate the intricacies of managing and achieving predetermined milestones in projects characterized by ambiguity, focusing specifically on Minna, Niger State (Figure 1), Nigeria. Minna is situated in Niger State, located in the North-Central geopolitical zone of Nigeria (Figure 2). It is positioned between specific latitude 8020" and 11020" North and longitude 3040" and 7040" East. Data for the study was gathered through well-designed questionnaires distributed among construction professionals actively involved in milestone management on their projects. The study used a sample size of 150 respondents, with 119 filling out and returning the questionnaires, yielding a response rate of 79.3%. This response rate was excellent and sufficient to draw conclusions for the study.

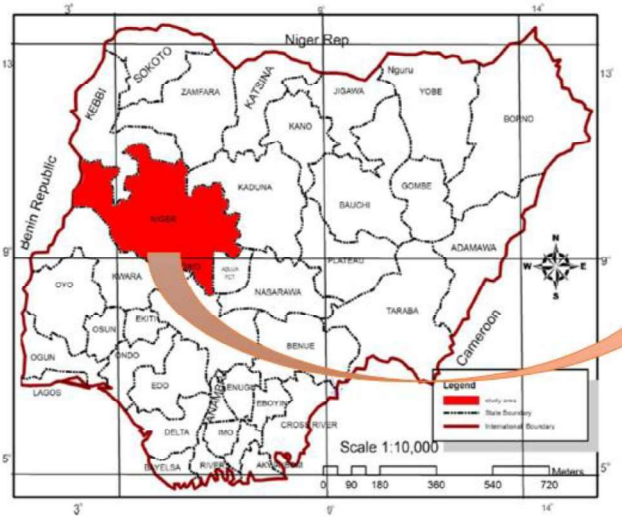

Figure 1: Map of Nigeria showing Niger State.

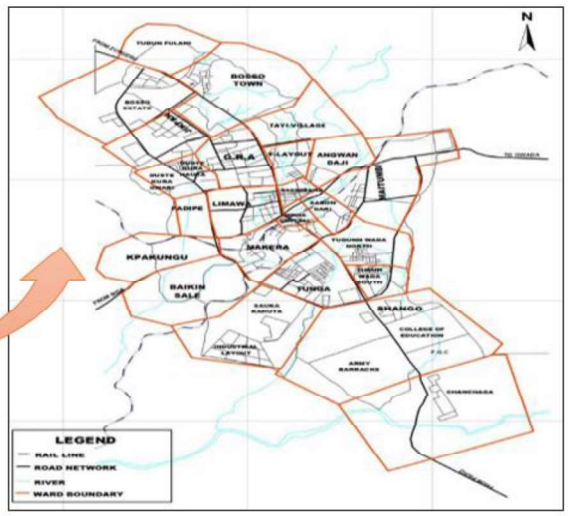

Figure 2: Map of Minna.

The survey encompassed inquiries pertaining to milestone management practices, criteria for milestone selection, and indicators of time performance. Utilizing a five-point Likert scale, respondents were prompted to assess the importance, level of knowledge, level of adoption, and various time performance indicators associated with milestone management. Statistical analysis of the collected data involved computing mean item scores and employing the Relative Importance Index (RII) method and correlations between milestone management practices and the time performance outcomes of construction projects.

Results and Discussion

Table 1 provides an overview of the characteristics of the study participants. It reveals that 16% of the respondents hold positions as contractors, 23.5% as construction managers, 24.4% as site managers, 8.4% as operational managers, and 27.7% in various other roles within their companies. Professionally, the majority identify as builders (61.3%), followed by quantity surveyors (18.8%), engineers (10.1%), and architects (5.9%). In terms of educational background, 47.1% of respondents hold B. Tech/B.Sc. degrees, 25.2% have second degrees, 10.1% are HND graduates, and 6.7% have PhDs. Professionally, 52.1% are associated with NIOB, 16.8% with NIQS, 10.9% with NIA, 7.6% with COREN, and 12.6% with other professions. Regarding experience, 31.9% have less than 5 years, 29.4% have 10 years, 26.1% have 15 years, and 12.6% have 20 years or more. Gender-wise, 81.5% of participants are male and 18.5% are female. Additionally, 59.7% have worked on projects for 0-5 years, 19.3% for 5-10 years, 10.1% for 11-15 years, 5.9% for 16-20 years, and 5.0% for over 20 years.

Table 1. Characteristics of respondents.

Characteristics	Description	Freq.	%
Role/position in your firm	Contract/Cost Manager	19	16
	Operations manager	10	8.4
	Project manager	33	27.7
	Construction manager	28	23.5
	Site manager	29	24.4
	Total	119	100
Work experience (Construction)	1 – 5	38	31.9
	6 – 10	35	29.4
	11 - 15	31	26.1
	16 – 20	10	9.17
	21 & above	5	4.58
	Total	119	100
How long working at your firm (in years)	1 – 5	71	59.7
	6 - 10	23	19.3
	11 - 15	12	10.1
	16 – 20	7	5.9
	21 & above	6	5.0
	Total	119	100
Highest Qualification	PhD	8	6.7
	MSc./MTech.	30	25.2
	BSc./BTech.	56	47.1
	HND	12	10.1
	OND	13	10.9
	Total	109	100
Gender	Male	87	79.82
	Female	22	20.18
	Total	119	100
Professional Background	Architect	5	5.9
	Builder	73	61.3
	Engineer	12	10.1
	Quantity Surveyor	20	18.8

	Surveyor	7	5.9
	Total	119	100

Relative importance index was used to examine and identify the critical milestone selection criteria in building construction projects and to rank each variable according to their importance. From Table 2, the critical milestone selection criteria as identified are: Scope of work was ranked first, Schedule estimation and Quality assurance were ranked second, Budget significance and Resource allocation were ranked third, cost estimation was ranked fourth, while client expectations were ranked fifth.

Table 2. Ranking of milestone selection criteria in construction projects.

Milestone selection criteria	Total weight	RII	Ranking
Project Complexity and scope	482	0.810	9
Critical path analysis	468	0.787	13
Project phases and key deliverables	475	0.798	11
Time based	491	0.825	7
Budget significance	502	0.844	3
Quality Assurance	503	0.845	2
Risk mitigation	471	0.792	12
Stakeholders communication	463	0.778	15
Resource allocation	502	0.844	3
Regulatory compliance	490	0.824	8
Client expectations	496	0.834	5
Organizational unit	465	0.782	14
Cost estimation	500	0.840	4
Schedule estimation	503	0.845	2
Deliverable basis	481	0.808	10
Scope of work	512	0.861	1
Risk management	495	0.832	6

Table 3 presents the respondents' knowledge levels on various milestone management practices. In project planning and scheduling, 41.2% demonstrate adequate knowledge, with 6.7% showing superior understanding, 26.1% having basic knowledge, 21% minimal knowledge, and 5% having very minimal to no knowledge, resulting in a mean value of 3.24, indicating a basic level of knowledge. Concerning the identification of critical paths, 37% exhibit adequate knowledge, 5.9% possess superior understanding, 23.5% have basic knowledge, 27.7% minimal knowledge, and only 5.9% very minimal to no knowledge, yielding a mean value of 3.09, also indicating a basic level of knowledge. In resource allocation, 41.2% showcase adequate knowledge, 15.1% have superior understanding, 21.8% basic knowledge, 18.5% minimal knowledge, and only 3.4% very minimal to no knowledge, resulting in a mean value of 3.46, indicating adequate knowledge in this aspect.

Table 3. Level of knowledge of milestone management.

Milestone management practices	V.M.K.	M.K	BK	A.K.	S.K	MIS	Rank
Planning & scheduling	6	25	31	49	8	3.24	6th
Indentification of critial path	7	33	28	44	7	3.09	7th
Resource allocation	4	22	26	49	18	3.50	4th

Regular monitoring & reporting	3	15	28	51	22	3.62	2nd
Communication & collaboration	4	10	27	52	26	3.72	1st
Control measures	4	19	22	57	17	3.54	3rd
Stakeholder involvement	6	23	27	45	18	3.39	5th

V.M.K.-Very minimal knowledge, M.K. - Minimal knowledge, B.K-Basic knowledge, A.K.-Adequate knowledge, S.K.-Superior knowledge

In terms of regular monitoring and reporting, 23.5% of respondents demonstrate adequate knowledge, with 18.5% showing superior understanding, 23.5% having basic knowledge, 12.6% minimal knowledge, and only 2.5% very minimal to no knowledge, resulting in a mean value of 3.62, indicating adequate knowledge. Regarding communication and collaboration, 43.7% exhibit adequate knowledge, 21.8% possess superior understanding, 22.7% basic knowledge, 8.4% minimal knowledge, and only 3.4% very minimal to no knowledge, yielding a mean value of 3.72, indicating adequate knowledge. In terms of control measures, 47.9% showcase adequate knowledge, 14.3% have superior understanding, 18.5% basic knowledge, 16% minimal knowledge, and only 3.4% very minimal to no knowledge, resulting in a mean value of 3.54, indicating adequate knowledge. Lastly, for stakeholder involvement, 37.8% demonstrate adequate knowledge, 15.1% possess superior understanding, 22.7% basic knowledge, 19.3% minimal knowledge, and only 9% very minimal to no knowledge, resulting in a mean value of 3.39, indicating a basic level of knowledge.

From Table 4, it's evident that respondents commonly adopt milestone management practices across various aspects. In project planning and scheduling, 36.1% often adopt these practices, with 27.7% always adopting them, resulting in a mean value of 3.66, indicating frequent adoption. Similarly, for identifying critical paths, 36.1% often adopt them, with 21% always adopting, yielding a mean value of 3.55, suggesting common adoption. Regarding resource allocation, 35.3% always adopt, and 31.9% often adopt, with a mean value of 3.8, indicating prevalent adoption. For regular monitoring and reporting, 44.5% always adopt, and 26.1% often adopt, resulting in a mean value of 3.92, indicating widespread adoption. In communication and collaboration, 36.1% always adopt, and 31.1% often adopt, with a mean value of 3.82, suggesting common adoption. Concerning control measures, 27.7% always adopt, and 34.5% often adopt, yielding a mean value of 3.63, indicating frequent adoption. Finally, for stakeholder involvement, 27.7% always adopt, and 29.4% often adopt, with a mean value of 3.55, indicating common adoption.

Table 4. Level of adoption of milestone management on projects.

Milestone management practices	Never	Rarely	Sometimes	Often	Always	MIS	Rank
Planning & scheduling	9	13	21	43	33	3.66	6th
Indentification of critial path	4	20	27	43	25	3.55	7th
Resource allocation	8	11	20	38	42	3.80	4th
Regular monitoring & reporting	8	11	16	31	53	3.92	2nd
Communication & collaboration	8	10	21	37	43	3.82	1st
Control measures	11	10	24	41	33	3.63	3rd
Stakeholder involvement	11	14	26	35	33	3.55	5th

The study aimed to determine whether there exists a relationship between the level of knowledge of milestones and the level of adoption of milestones, with a significance level of α=0.05. Hypotheses were formulated: H0 (no relationship) and H1 (a relationship). Results from Table 5 indicate a positive and significant relationship between the two variables. This suggests that as knowledge of milestone management practices increases, so does the level of adoption. This finding aligns with previous research by Song et al. (2009) where knowledge influenced the development of plans.

Table 5. Correlation between the level of knowledge and the practice of milestone management.

Level of Knowledge/Adoption of Milestone management	N	R -V	P - V	Decision
Level of knowledge of planning & Scheduling				
Level of adoption of planning & Scheduling	119	0.582	0.000	Accept
Level of knowledge in identification of critical path				
Level of adoption in identification of critical path	119	0.544	0.000	Accept
Level of knowledge of resource allocation				
Level of adoption of resource allocation	119	0.655	0.000	Accept
Level of knowledge of regular monitoring & reporting				
Level of adoption of regular monitoring & reporting	119	0.544	0.000	Accept
Level of knowledge of communication & collaboration				
Level of adoption of communication & collaboration	119	0.429	0.000	Accept
Level of knowledge of control measure				
Level of adoption of control measure	119	0.485	0.000	Accept
Level of knowledge of stakeholder involvement				
Level of adoption of stakeholder involvement	119	0.500	0.000	Accept

The study aimed to investigate the relationship between the level of adoption of milestone management and time performance, with a significance level of α=0.05. Hypotheses were formulated: H0 (no relationship) and H1 (a relationship). Results from Table 6 indicate a significant relationship between the level of adoption of milestones and time predictability. The correlation coefficients ranged between 0.382 and 0.480, with a p-value of 0.000, which is less than 0.05, indicating statistical significance. This finding is consistent with previous research by Idoro (2009), which highlighted the significant influence of planning level on delivery time.

Table 6. Level of adoption of milestone management and time performance.

Correlation of milestone management and time performance	N	R -V	P- V	Decision
Level of adoption of planning & Scheduling				
Predictability of time	119	0.383	0.000	Accept
Quick start	119	0.358	0.000	Accept
Slow start	119	0.268	0.000	Accept
Quick progression	119	0.390	0.000	Accept
Slow progression	119	0.175	0.057	Reject
Quick finish	119	0.321	0.000	Accept
Slow finish	119	0.268	0.003	Accept
Level in identification of critical path				

Predictability of time	119	0.484	0.000	Accept
Quick start	119	0.285	0.002	Accept
Slow start	119	0.257	0.005	Accept
Quick progression	119	0.387	0.000	Accept
Slow progression	119	0.283	0.002	Accept
Quick finish	119	0.375	0.000	Accept
Slow finish	119	0.265	0.004	Accept
Level of resource allocation				
Predictability of time	119	0.409	0.000	Accept
Quick start	119	0.350	0.000	Accept
Slow start	119	0.288	0.001	Accept
Quick progression	119	0.342	0.000	Accept
Slow progression	119	0.199	0.030	Accept
Quick finish	119	0.224	0.014	Accept
Slow finish	119	0.220	0.016	Accept
Level of regular monitoring & reporting				
Predictability of time	119	0.386	0.000	Accept
Quick start	119	0.316	0.000	Accept
Slow start	119	0.230	0.012	Accept
Quick progression	119	0.429	0.000	Accept
Slow progression	119	0.200	0.029	Accept
Quick finish	119	0.312	0.001	Accept
Slow finish	119	0.234	0.011	Accept
Level of communication & collaboration				
Predictability of time	119	0.424	0.000	Accept
Quick start	119	0.211	0.021	Accept
Slow start	119	0.281	0.002	Accept
Quick progression	119	0.397	0.000	Accept
Slow progression	119	0.239	0.009	Accept
Quick finish	119	0.290	0.001	Accept
Slow finish	119	0.265	0.004	Accept
Level of control measure				
Predictability of time	119	0.430	0.000	Accept
Quick start	119	0.375	0.000	Accept
Slow start	119	0.208	0.023	Accept
Quick progression	119	0.400	0.000	Accept
Slow progression	119	0.186	0.043	Accept
Quick finish	119	0.370	0.001	Accept
Slow finish	119	0.163	0.077	Reject
Level of stakeholder involvement				
Predictability of time	119	0.407	0.000	Accept
Quick start	119	0.282	0.002	Accept
Slow start	119	0.373	0.000	Accept
Quick progression	119	0.281	0.002	Accept
Slow progression	119	0.252	0.006	Accept
Quick finish	119	0.202	0.028	Accept
Slow finish	119	0.345	0.000	Accept

The analysis revealed a positive correlation between the level of adoption of milestone management practices and project time predictability. Significant relationships were observed

between adoption levels and quick project starts, suggesting that higher adoption leads to improved time performance during project initiation (Gledson et al., 2018). Increased adoption levels across various aspects of milestone management, including project planning, critical path identification, resource allocation, monitoring and reporting, communication, collaboration, control measures, and stakeholder involvement, were associated with quicker project progression, as indicated by significant p-values below 0.05. However, while project planning and scheduling had an insignificant relationship with slow progression, other factors like critical path identification, resource allocation, monitoring and reporting, communication, collaboration, and stakeholder involvement showed significant positive relationships with slow progression. Similarly, control measures exhibited an insignificant relationship with slow finishes, whereas project planning, critical path identification, resource allocation, monitoring and reporting, communication, collaboration, and stakeholder involvement all had significant positive relationships, suggesting that higher adoption levels of these practices increase the likelihood of experiencing slow project finishes.

Conclusion

The aim of this study was to examine the dynamic relationship involved in managing ambiguity in selecting and achieving set milestones in construction projects in Minna, Nigeria. The study argues that selecting and managing milestones is widely known practice that enables professionals to represent and manage work activities to achieve set expectations of time regardless of project disruptions.

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