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Evaluation of the Impact of Effective Project Management Techniques on the Success of Steel Development Projects in Nigeria.

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Abstract

Purpose: This research sought to bridge the existing gap and also shed light on the challenges of project management techniques and their role in influencing success metrics in the steel development projects especially among rolling mills companies.

Design/Methodology/Approach: The study adopted a systematic literature review approach. This involved a review of 25 articles sourced from various databases and repositories. The approved sources were then reviewed and thematic analysis used to identify the recurrent and meaningful themes.

Findings/Conclusion: This research finds two noteworthy discoveries that bring distinctive insights to the literature on the variable application of Project Management Techniques throughout various phases of the project life cycle in steel development projects. It first confirms the contextual dependence of the usage of these techniques on various stages of the project life cycle.

Recommendation: Steel development projects also involves numerous activities and there is need for project managers to integrate the useful techniques with project management software. The main aim of these software is to support project managers to handle various stages of a project.

Suggestion for further studies: Future research studies should therefore explore the potential correlations between the use of specific project management techniques, whether certain techniques tend to be employed in conjunction with others, and whether their combined usage would possibly influence project success.

Introduction

1.1 Background to the study

An effective project management technique refers to the methodical planning, organizing, and overseeing resources of a project to fulfill specific objectives within the set limitations. Akinmusuru, Oloruntoba and Yartey (2021) assert that it includes a range of tactics that are used for devising, overseeing, instigating, executing, and concluding projects with a lot of efficiency. Some of the most important consideration in these cases include establishing clear objectives, engaging stakeholders, evaluating risks, and allocating resources as well as effective communication which ensures that the team members grasp their roles and duties. The use of tools such as Gantt charts, Kanban boards, and project management software have gone a long way in helping to monitor the progress and adeptly managing schedules.

Ijaduola (2019) note that success of steel development project is typically assessed through three primary metrics namely quality, cost, and time which serve as both constraints and objectives for project managers. Maintaining a balance among these factors is very fundamental for project management and managers always need to prioritize one factor over the others relegating them to a lower priority during pivotal stages of the project lifecycle. The strategic focus of the project therefore in such instances revolves around determining which of the three factors should be given the utmost priority based on project conditions. Cleland and Ireland, (2006) identified three strategic focuses to include cost-driven, schedule-driven, and cost-quality-driven with each emphasizing the different priorities that depend on the circumstances of the project.

Most projects always have a set of activities that are carried out within a defined timeframe to achieve specific objectives. They often follow a life cycle with a distinct beginning and end and their execution often requires multiple resources, some of which could be limited and shared with other projects.

Project management is today considered to be one of the disciplines that facilitates project success since it enables managers to ensure that project activities are effectively implemented. Kerzner (2017) notes that its effective implementation includes the use of expertise, tools, abilities, and methodologies to attain particular project goals while adhering to specified limitations. The techniques involved such as Gantt Charts, critical path methods, Monte Carlo technique, work breakdown structure, and milestone charts offers an organized structure for the planning, coordination, and oversight of diverse project components such as resources, budgets, schedules, and risks Jowah, (2015). This demonstrates its necessity in many industries since it functions as a potent mechanism for promoting innovation, attaining strategic objectives, and adapting to the dynamic demands of the market.

Steel development projects in rolling mills companies just like any other also follows a life cycle that includes initiation, planning, execution, monitoring and control, commissioning and handing over, and closure of project activities as noted by Adekunle and Ogunsanwo (2021). The steel industries have experienced a technological revolution in the last 30 years since old technologies have nearly vanished to make way for the widespread adoption of state-of-the-art, cost-effective, and modern technologies. Implementing these technological replacements have however posed significant challenges at each of the aforementioned stages since every new project presents unique challenges that demand distinctive solutions that are aimed at introducing new products to markets.

Nigerian rolling mills companies have demonstrated remarkable performance over the years, and this has made it capable of developing high-quality materials that adhere to stringent international standards. This particularly applies for sophisticated applications in sectors such as engineering, construction, infrastructure, and automobiles. Abdulmalik and Olusegun (2017) observe that the key focus areas for the steel producers in recent times include increased production of value-added products, upgrading production processes, expanding capacity, and achieving cost-effective and environmentally friendly production. The growth of the industry is also closely tied to the demand for steel which is experiencing an upward trend due to the rapid expansion of the Nigerian economy. The country is the second most industrialized country in Africa Kerzner (2017) and it therefore serves as a notable example where companies involved in steel development employ efficient project management methods to ensure the success of their projects. The adoption of efficient project management techniques in the context of large-scale projects like steel development initiatives is very important as discussed above. There is therefore need for the companies to explore the impact of incorporating project management procedures specifically those that are tailored for steel development projects. This is because the projects are often challenging since they demand substantial investments of money, time, and resources, and also involve numerous stakeholders Ijaduola (2019). The implementation of effective project management is therefore indispensable since it ensures that the projects are successful in terms of adherence to estimated costs, timely completion, and compliance with the required standards and specifications.

Jos Steel Rolling Company is one of the three inland steel rolling mills in Nigeria that was established by the government of Nigeria to boost the development of the steel sub-sector. It was officially incorporated on January 23, 1981, and then it was then commissioned in 1983 Adekunle and Ogunsanwo (2021). Its primary mission has been to contribute to Nigeria's economic transformation and today it has an installed capacity of 210,000 metric tonnes per annum of finished steel products Ijaduola (2019). This has been achieved through significant avenues such as facilitating technological transfer, providing employment opportunities for Nigerians, stimulating commercial activities via material haulage and distribution of finished products, and promoting industrialization by promoting downstream industries like High Steel and Allied Products Ltd in Jos, Leman Industries Ltd in Kaduna, Kuda Nails Ltd in Bauchi, and Oscar Steel Ltd in Kabba Abdulmalik and Olusegun (2017).

The company distributes its products through government contractors, authorized distributors, and downstream industries such as nail manufacturers. It has significant growth prospects particularly in the middle belt region due to the ongoing construction activities in the Federal Capital City of Abuja where the market shows promise. Private steel companies are comparatively small and unable to meet local demand despite the absence of local competitors and therefore competition primarily revolves around the importation of billets and finished steel products. The company, however, faces challenges that are related to its location since it limits its distribution reach Abdulmalik and Olusegun (2017). The demand for its products is notably higher in the Eastern part of Nigeria even though transportation costs hinder the efforts of the company to import spare parts, machinery, and expand its customer base.

Several studies have overlooked the importance of evaluating the impact of effective project management techniques on the success of steel development projects in Nigeria especially in rolling mills companies despite the significant role it plays in achieving successful outcomes. This research therefore seeks to answer the question which project management techniques are used in the context of Nigerian steel development projects? It answers this question using systematic literature review of 25 articles and use the case study of Jos Steel Mills Company to bridge the existing gap and shed light on the challenges of project management techniques and their role in influencing success metrics in the steel development projects.

1.2 Research Rationale

Problem statement

Effectively project management in steel development requires a comprehensive grasp of the concepts and techniques that are necessary for overseeing projects of varying capacities and scopes. This includes Project Planning, Expedited Services, Progress Reporting, Contract Management, Follow-up, Procurement Management, Performance Monitoring, Commissioning Assistance, Materials Management, Risk Management, Project Evaluation, Schedule Management, and Budgetary Cost-Control Akinmusuru, Oloruntoba and Yartey (2021). These processes and techniques serve to coordinate resources and help in ensuring that the projected outcomes are achieved.

Steel industry in Nigeria

The growth of the steel industry in Nigeria is closely tied to the demand for steel which is experiencing an upward trend due to the rapid expansion of the Nigerian economy. The country serves as one of the notable countries where steel companies use efficient project management methods to ensure the success of their projects. Jos Steel Mill which is the case study is one of the prominent companies in the industry that have adopted efficient project management techniques in the context of large-scale projects like steel development initiatives that are tailored for steel development projects. This is because the projects are often challenging since they demand substantial investments of money, time, and resources, and also involve numerous stakeholders Ijaduola (2019). However, Cleland and Ireland (2006) note that the achievement of project objectives in the steel industry faces constraints such as quality, budget, schedule, scope, risks, resources, and customer satisfaction as will be discussed in the literature review. This implies that the duration and intensity of each of the phases in project management in the industry are subject to issues such as time allocated, techniques employed and other factors that are based on complexity, and magnitude.

Weakness of past studies

Most studies such as Cleland and Ireland (2006); Kirongo and Odoyo (2020); Aspers and Corte (2019) have also overlooked the importance of evaluating the impact of effective project management techniques on the success of steel development projects in Nigeria especially in rolling mills companies despite the significant role it plays in achieving successful outcomes. There is therefore a noticeable gap in the literature and the existing ones have limited exploration of its specific applicability to the dynamic context of rolling mills steel projects. This limits the available knowledge on this area of study which hinders further improvement.

Justification of the study

This research therefore seeks to bridge the existing gap and also shed light on the challenges of project management techniques and their role in influencing success metrics in the steel development projects especially among rolling mills companies. The researcher conducted a systematic literature review of 25 articles, and these were extensively searched in various online databases and academic journals that were published within the timeframe of 2014 to 2024 and they used targeted keywords such as “project management,” “steel development projects,” “Nigeria,” and “success on projects” to refine the search results and retrieve the most relevant materials.

Significance of the study

The findings of this study will be beneficial to both project managers and team members within project organizations in the steel development industry since it will provide detailed information on the factors that contribute to project success or failure as well as how some project management techniques are more effective than others. This understanding is very important since it allows them project managers and engineers to come up with strategies that fit best their specific projects and ensure that they attain their

desired objectives. It is also important to note that the findings will serve as a valuable resource for future scholars who would like to conduct studies that are related to this field.

1.3 Research Aims and Objectives

The primary aim of this study is to investigate the application of the techniques that are used in project management in executing and contributing to the success of steel development projects. The core objectives of the research therefore include:

1. To identify the project management techniques used by steel development companies in Nigeria by conducting secondary research of 25 studies that target engineers from different rolling mills companies within three months.
2. To assess the level of effectiveness of these techniques in terms of project performance indicators such as cost, time, quality, and stakeholder satisfaction by conducting a comparative analysis within four months.
3. To explore the challenges and opportunities for improving project management practices in steel development projects in Nigeria by conducting secondary research of 25 studies within five months.

Research Questions

This paper seeks to address the following questions based on the objectives.

1. What impact does project management techniques have on the success of projects?
2. What are the techniques used in project management, and how are they applied?
3. Which techniques are employed in the context of Nigerian steel development projects?

1.4 Limitations of the study

This study purely assessed and analyzed government reports, peer-reviewed articles and industrial publications that are related to the topic and Collingridge and Gantt (2019) note that these sources enable researchers and the readers to have a deeper understanding of the subject under study. However, this strategy made it difficult for the researcher to answer some of the specific research questions even though they could be answered in detail if primary data was collected. There is therefore a need for future researchers to consider combining both primary sources and secondary sources to come up with much more detailed information.

Bias in selecting the sources that were used was also another challenge since there were some articles which had critical information, yet they could not be considered because of the tie that they were published. The researcher however addressed this by using a comprehensive and objective search strategy that involved considering articles that were published not more than 10 years ago and it also included targeted keywords such as “project management,” “steel development projects,” “Nigeria,” and “success on projects” to refine the search results and retrieve the most relevant materials. This further helped in ensuring that the sources that were used were highly relevant, reliable, credible and were from reputable authors.

1.5 Structure of the study

The research study is made up of 4 chapters. The current chapter is an introduction, then states the research problem, objectives, and questions concisely and coherently. It also provides the background and context of the study and explains its significance and contribution to the field with examples and scenarios. Chapter 2 is methodology and literature review, and it describes and justifies the research strategy, design, and methods that are used in the study. It also provides a critical analysis of how the literature informs the research by clearly delineating the gaps and how the study addresses them. Moreover, it addresses the ethical issues, limitations, and the challenges that were encountered in the research process. The systematic literature review also critically analyses and synthesizes the relevant theoretical perspectives and empirical findings from previous studies. It also identifies the gaps and limitations in the existing literature and demonstrate how the chosen model or framework addresses them. Chapter 3 is analysis and discussion, and it interprets and explains the findings of the study and discusses their implications and relevance to the research problem and questions. It also compares and contrast the findings with the existing literature, and also acknowledges the limitations and uncertainties of the study. The last chapter is the conclusion, and it summarizes and integrates the key findings of the study to answer the research questions. It also highlights the practical implications and recommendations for policy, practice, and further research and then reflect on the strengths and weaknesses of the study.

Methodology

2.1 Introduction

This chapter outlines the selected research approach with the intention of achieving the goals and the objectives of the study. The primary aim of this section is to aid researchers in examining the impact of project management on steel development projects in Nigeria. It outlines the structure, the philosophy, gap analysis data collection and analysis approaches as well as the ethical considerations and the limitations of the study. The study seeks to answer the question of: In what ways do the techniques play a role in ensuring successful project delivery within the steel development industry in Nigeria? Its main objectives are therefore: To identify the project management techniques used by steel development companies in Nigeria by conducting secondary research of 25 studies that target engineers from different rolling mills companies within three months; to assess the level of effectiveness of these techniques in terms of project performance indicators such as cost, time, quality, and stakeholder satisfaction by conducting a comparative analysis within four months; and to explore the challenges and opportunities for improving project management practices in steel development projects in Nigeria by conducting secondary research of 25 studies within five months. The timeframes are reasonable for this kind of study since there is no need for physical movement to the companies.

The study adheres to a robust systematic literature review research methodology which involves thoroughly identifying and choosing reliable sources after evaluating their credibility and dependability. It is a type of literature review that follows a rigorous and transparent process of searching, selecting, appraising, and synthesizing relevant studies on a specific topic or question Bernd (2020). Its purpose is to provide a comprehensive and unbiased overview of the existing evidence and identify gaps and directions for future research. This study therefore used secondary qualitative research methods because it is an economical means of gathering information across various topics and it has consequently proven to be valuable in pinpointing the existing research gaps with regard to the research topic. It has also played a pivotal role in shaping the design of projects and the results obtained would be valuable for project managers in decision-making processes in project management and ultimately contribute to the achievement of successful projects. The collected data were then thematically analyzed to derive insightful conclusions.

2.2 Gap analysis

An examination of most of the existing literature concerning the effects of project management methods indicates that the contribution to achieving better project outcomes is unquestionable as noted by Kirongo and Odoyo (2020). Many studies have looked into this phenomenon even though there is a notable absence of studies that examine their impact within the Nigerian steel development sector and specifically within the rolling mills sector despite the recognized success that are linked with these techniques in project delivery with reference to Collingridge and Gantt (2019). Few investigations such as those by Collingridge and Gantt (2019) and Kirongo and Odoyo (2020) look into the matter and most of them point to the need for this study since there is therefore a noticeable gap in the literature and the existing ones have limited exploration of its specific applicability to the dynamic context of rolling mills steel projects. It is also worth noting that the existing studies just provide generalized insights into the significance of project management while neglecting the nuances of its implementation within the steel industry in Nigeria. This research therefore seeks to bridge the existing gap and also shed light on the challenges of project management techniques and their role in influencing success metrics in steel development projects especially among rolling mills companies.

More research was specifically required to ascertain the relationship in the rolling mills sector which is a sub-sector within the industry. The researchers conducted a thorough literature review in order to address the recognized deficiency in the current literature and various online databases and academic journals were extensively searched for relevant articles. It made good use of scholarly articles that discuss the topics and the articles delineated the particular elements of the techniques that exert the most significant influence on factors such as quality, cost and time. It also looked at the interrelationship between different techniques to demonstrate how they synergize to increase the success of steel development projects especially in rolling mills companies.

2.3 Research framework.

The researcher was guided by the research onion framework which outlines the sequential stages of research development. It essentially offers a comprehensive breakdown of the research process and facilitates the systematic design of research methodologies. It is highly versatile and therefore applicable across diverse research contexts Byrd (2020). This research progressed from the outer layers to the inner layers as shown below.

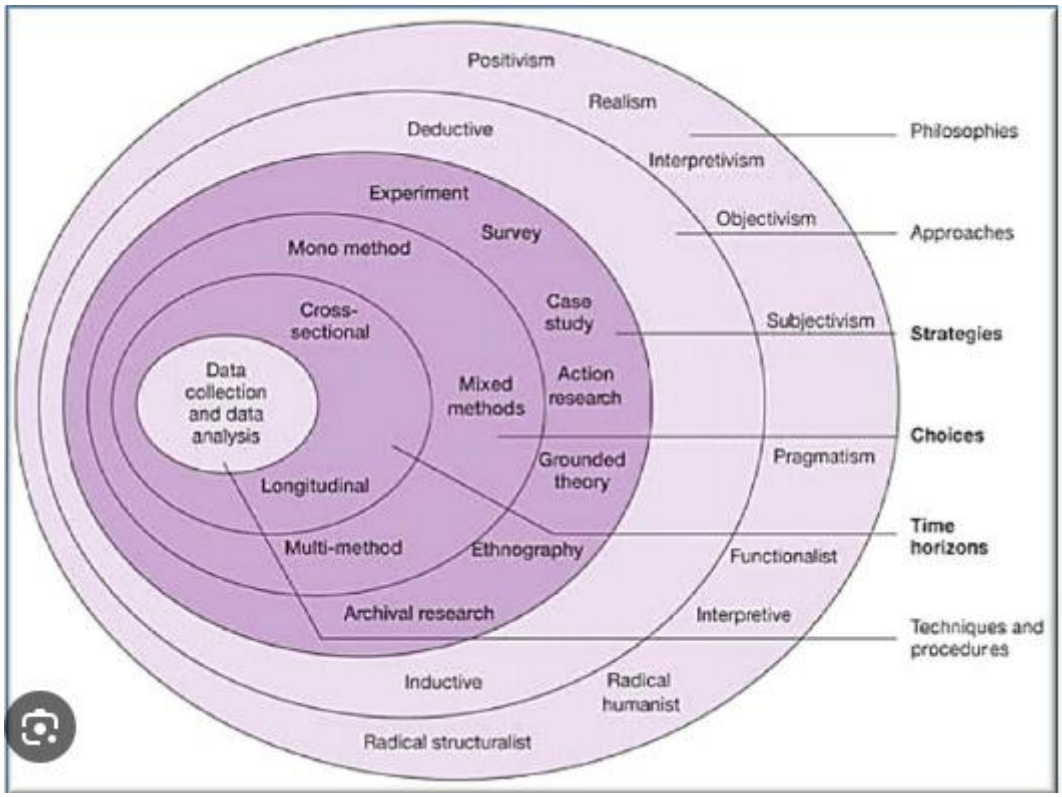

Figure 1: Research Onion Framework

Source: (Byrd, 2020)

2.3.1 Research Philosophy

Interpretivism is one of the philosophies that is widely used in studies, and it was highly relevant for this study because of its inclusion for the interpersonal interactions and broader societal contexts that surround the immediate setting of topics. Mishra and Alok (2022) and Kirongo and Odoyo (2020) note that it is applicable across both quantitative and qualitative research paradigms for exploring the underlying processes that propel events. The researcher opted for this philosophy since it gives precedence to varied perspectives and interpretations and enables a detailed analysis of diverse literature sources especially those that are suitable for uncovering underlying meanings, patterns, and themes that are in line with the objective of the study. The positivist is another philosophy that stresses on objectivity, causality, and generalizability which all do not fully capture the contextual richness and subjectivity that are present in the qualitative research and this makes interpretivism the most suitable for the extended exploration that is required in this qualitative systematic literature review.

2.3.2 Research approach.

The inductive approach was used in this study to answer the research questions which were derived from theoretical frameworks. Byrd (2020) highlight that the deductive method is commonly used in quantitative research while the inductive approach is more commonly associated with qualitative research. The deductive approach does not always lead to theory generation even though theories acted as a guiding framework in this qualitative inquiry Dougherty, Slevc and Grand (2019). Inductive methodologies were however used to investigate the research question, and this involved the exploration, comparison, analysis, and validation of the proposed theoretical premises. This inquiry delved into the rolling mills companies with regard to the

project management techniques that they use and they impact that they have on the overall organizational performance.

Qualitative studies often benefit from inductive research approach since it facilitates a flexible and exploratory method for data collection and analysis Turner III and Hagstrom-Schmidt (2022). This study had a qualitative research focus with the intention to gain deeper understanding of human behavior and experiences with the project management techniques and therefore the inductive approach was the most appropriate since it help it in capturing non-quantifiable data. Using inductive reasoning also proved to be appropriate in this case since secondary data was used to examining the topic. This approach supported a detailed and broad exploration of the related factors and in the process enabled adaptability in research design since new themes and patterns emerged from the data Mishra and Alok (2022).

2.3.3 Research strategy.

An action research strategy is embraced in this study to effectively fulfill the objectives since it enables the researcher to gain a thorough and broad understanding of how individuals think and behave in response to specific events or actions as well as the motivations that guide such behaviors Dougherty, Slevc and Grand (2019). The strategy stresses on collaborative, iterative problem-solving in real-world settings and this helps in complementing the dynamic nature of literature reviews Byrd (2020). The researchers used cycles of reflection and action to bring together the findings into practice and in the process improve the relevance and impact of the review outcomes.

There are some ethical considerations that are associated with this approach and some of them are associated with subjectivity, transparency, and respect of the researcher for the conclusions of the articles. Anwo et al. (2019) assert that acknowledgement of personal biases and reflexively by researchers and how these influence the interpretation of data I very important in any qualitative research study. Ensuring rigor in interpretation and understanding the diverse viewpoints are therefore some of the possible challenges. Subjectivity in the research process was also another challenge since most researchers often bring their own values, assumptions, and biases to the study which further affects the data collection, analysis, and interpretation processes. The researchers in this case however adopted a reflexive stance since they acknowledged their subjectivity and reflected on how it could impact the research process and outcomes Haven and Van Grootel (2019). The study involved an iterative and flexible process of data collection and analysis that enabled the emergence of the unforeseen themes and patterns and the researcher approached them with an open mindset since he recognized that simplistic approaches to data collection and analysis would fall short in capturing the richness of these experiences. Mishra and Alok (2022) also affirm that various qualitative data collection methods such as document analysis could help in gathering data that are analyzed through interpretive methods.

2.3.4 Methodological choice

The study used a mono method of qualitative research design where it used secondary data that targeted project managers, and project engineers since they are the ones who are always engaged in project management in rolling mills companies in Nigeria to determine the impact of project management techniques on the success of projects. This qualitative approach sought to increase the understanding of the challenges and issues that are associated with the techniques that are used in project management in projects and their impact on project completion time. The secondary data was developed with a structured method to maintain uniformity in data collection and also to enable the researchers to offer succinct choices from the provided options.

Berndt (2020) note that qualitative approach holds a significant importance in this kind of explorative research since it looks into the "how" and "why" aspects of research inquiries to facilitate a profound comprehension of the experiences, phenomena, and contexts. It enables exploration of questions that defy easy quantification and, in the process, offers insight into the human experience since it looks into the everyday realities of social phenomena and examines the pertinent questions as they manifest in practice. The limitations of this method such as ensuring secondary data is comprehensive and representative of the broader population was achieved by comparative analysis from various sources conducted on various population.

2.3.5 Time horizons

Secondary research often relies on the existing data and information to address research inquiries since they have high potential to yield valuable insights into the topics of interest Anwo et al. (2019). The researchers in this study used longitudinal approach to collect and analyze the pre-existing literature, academic journals pertaining to the subject matter, and reports with the main objective of assessing and amalgamating the available literature on the topic. The research was delineated to evaluate all the related existing literature.

2.3.6 Data collection and synthesis

Search strategy.

The primary aim of this study is to investigate the application of the techniques that are used in project management in executing and contributing to the success of steel development projects. The core objectives of the research therefore is to identify the project management techniques that are used by steel development companies in Nigeria by conducting secondary research of 25 studies that target engineers from different rolling mills companies within three months. Some of the databases and repositories that were used were Web of Science, ScienceDirect, ERIC, IEEE Xplore, Scopus, Directory of Open Access Journals (DOAJ), and JSTOR.

The process involved searching for information and data that has already been amassed and analyzed by other researchers. The articles were extensively searched in various online databases and academic journals that were published within the timeframe of 2014 to 2024 and they used targeted keywords and filters such as “project management,” “steel development projects,” “Nigeria,” and “success on projects” to refine the search results and retrieve the most relevant materials. Byrd (2020) asserts that this approach is always mainly used in qualitative studies and the data are always sourced from books, government reports, scholarly articles, and other published research studies. Haven and Van Grootel (2019) note that one of the main advantages of this approach to data collection is its time and resource-saving nature since the data has already undergone collection and analysis. The secondary data obtained also offers a wider and more diverse range of information that are unbound by the limitations of the own data collection abilities of the researcher.

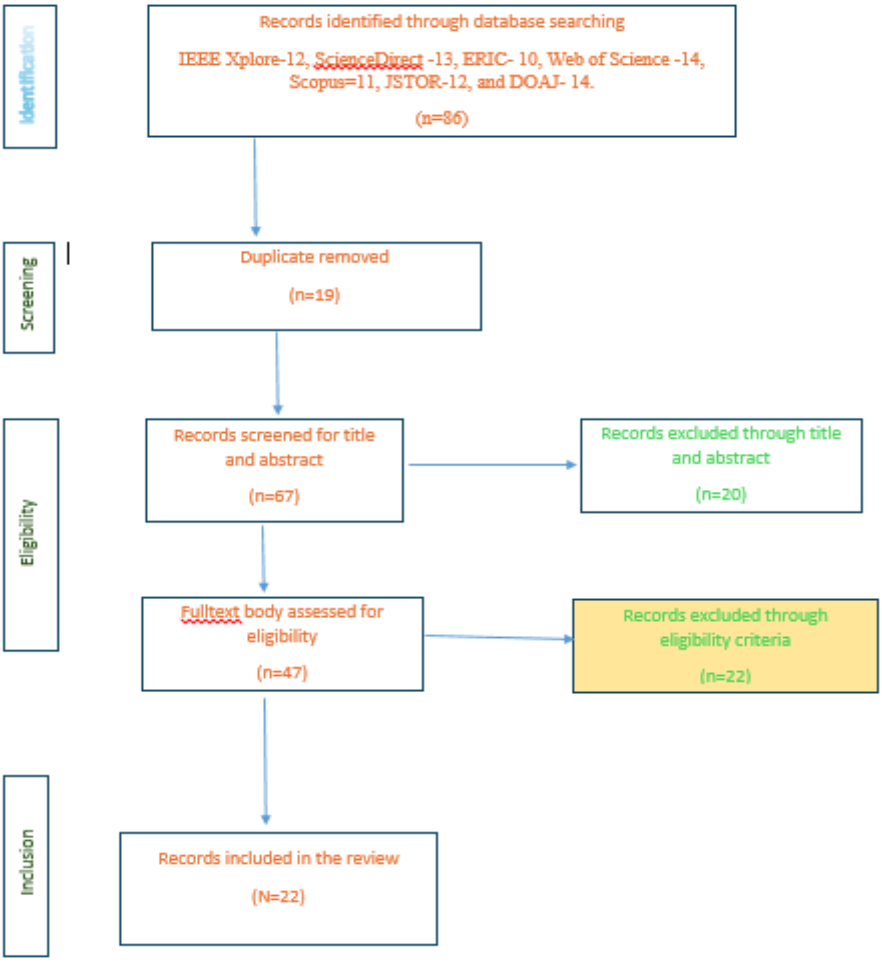

Figure 2: Screening for sources

Source: (Author)

Inclusion and exclusion criteria

The research considered various factors to form part of its inclusion criteria. Quality was one of the consideration and its assessment involved evaluating the predefined criteria such as subjectivity, credibility, and reliability, among others. The sources that were included had to be published between 2014 and 2024 and they also had to focus on topics that are related to project management, steel industry, and techniques of project management. It is also notable that only articles that are written in English and fully accessible were included because of their widespread usage and recognition. This does not limit the diversity of perspectives.

Several other factors were also considered to inform the exclusion criteria. This include the fact that the articles had to: address project management techniques and the how they are used among rolling mills companies. Studies that were written in languages other than English were also excluded to improve the understanding and analysis of the researcher and also ensure that the study is globally accepted. Duplicate and student theses were also removed to maintain the required data integrity and to uphold the required academic standards.

Criteria	Inclusion	Exclusion	Rationale
Publication focus	Inclusion and diversity, organizational performance, J&J	Any other that did not consider the related topics	They are papers that focus on the main area
Length	Articles that are fully accessible	Articles that are not fully accessible	For detailed analysis
Publication year	2014-2024	Those that do not fall within the timeline	Most relevant in this area of study
Quality	Books, peer-reviewed journals, company reports, and journals.	Unpublished materials, blogs, websites, dissertations	High-quality materials
Language	English	Languages apart from English	English is widely recognized and used in academic work

Figure 3: Inclusion and exclusion criteria

Source: (Author)

Selection strategy

There were several thresholds that were considered to be part of the inclusion criteria in this research. Some of these were; only studies that were published within the last ten years were considered as well as those that were written in English and focused on project management techniques. Research that were done outside the specified timeframe, those written in any other language apart from English, those that lacked empirical data, and those that were not directly related to project management were excluded. The screened sources were then assessed for their relevance to the research question as well as their objectives to ensure that they align with the research questions as well as the research objectives of the present study..

The remaining sources were then subjected to a lot of scrutiny as required by Byrd (2020) since it is always important for researchers to assess the sources that they use to determine whether or not they are relevant, align with the research objective, and answer the research question. All these were done to ensure that they met the threshold of integrity and reliability before they were thematically analyzed to identify the primary themes and concepts that are relevant to the study and to improve on the credibility, relevance, and reliability of the sources Hennink, Hutter and Bailey (2020).

Data extraction

The data that was collected in this study was purely qualitative in nature and they were therefore purely descriptive and not numerical since they were derived from observations and subjective information. Aspers and Corte (2019) assert that this kind of data is valuable since it helps in obtaining thorough understanding of the phenomena under investigation which allows researchers to delve into the challenging relationships and contextual factors. The data collection methods used included reviewing the existing literature on rolling mills companies. The review served as a foundation for understanding what the past studies had found on project management techniques and the success factors on such projects.

Data synthesis

Kirongo and Odoyo (2020) described analysis as a way of understanding the nature and operations of a subject. Busetto, Wick and Gumbinger (2020) also note that the methodologies for qualitative research are always insufficiently developed and this always present a fundamental challenge. The researchers in

response recommended that the approach to qualitative data analysis should be clarified and this requires dedicated commitment to a well-defined structure. The obtained data was from the systematic literature review from the research were then subjected to qualitative analysis techniques such as content analysis and thematic analysis. This was done using themes and patterns that showed similarities and differences in responses to provide a wealth of detailed information and also offer great insights into the influence of effective project management on the success of steel development projects in rolling mills companies.

The content analysis involved systematically categorizing and coding the textual data from reports on project management using software known as NVivo and the process helped in identifying the recurring themes such as risk management strategies, stakeholder engagement, and resource allocation. Thematic analysis was also used and it helped in identifying the recurrent patterns and interpretation of the underlying meanings of qualitative data from interviews with project managers. Codes were then applied to segments of the data to represent different project management practices, and this facilitated the identification of themes like communication breakdowns, budget overruns, and schedule delays. These were then compared with the existing literature on the success factors on project management to provide insights into their effectiveness in the context of steel development projects in Nigeria.

2.4 Ethical considerations

Several ethical challenges were eminent in this study even though they were properly addressed by the researchers. The anonymity of the participants who were engaged in the secondary research was at stake even though it was addressed by not disclosing any details that could potentially reveal their identities. The researchers ensured that information that could make them to be identified such as names and addresses were removed from the data to comply with this ethical requirement. The researchers also determined whether the participants in the original research studies consented to the research to determine whether or not that they were informed about the objectives of the study and the associated risks or benefits Liamputtong (2020). The researcher also ensured that the authors were properly acknowledged using the Havard citation style for the original studies.

Efficiency and access of the articles were also some of the considerations to the diverse datasets even though the researchers also ensured that they properly adhered to the ethical guidelines to prevent some of the risks such as misinterpretation of data and potential breaches of confidentiality or consent as required by Turner III and Hagstrom-Schmidt (2022). The identified risks were thoroughly assessed in terms of their quality, and this was achieved through obtaining the required permissions and by respecting the anonymity of the participants.

2.5 Literature review

An examination of most of the existing literature concerning the effects of project management methods indicates that the contribution to achieving better project outcomes is unquestionable as noted by Kirongo and Odoyo (2020). Many studies have looked into this phenomenon even though there is a notable absence of studies that examine their impact within the Nigerian steel development sector and specifically within the rolling mills sector despite the recognized success that are linked with these techniques in project delivery with reference to Collingridge and Gantt (2019). Few investigations such as those by Collingridge and Gantt (2019) and Kirongo and Odoyo (2020) look into the matter and most of them point to the need for this study since there is therefore a noticeable gap in the literature and the existing ones have limited exploration of its specific applicability to the dynamic context of rolling mills steel projects. It is also worth noting that the existing studies just provide generalized insights into the significance of project management while neglecting the nuances of its implementation within the steel industry in Nigeria. This research therefore seeks to bridge the existing gap and also shed light on the challenges of project management techniques and their role in influencing success metrics in steel development projects especially among rolling mills companies.

More research was specifically required to ascertain the relationship in the rolling mills sector which is a sub-sector within the industry. The researchers conducted a thorough literature review in order to address the recognized deficiency in the current literature and various online databases and academic journals were extensively searched for relevant articles. It made good use of scholarly articles that discuss the topics, and the articles delineated the particular elements of the techniques that exert the most significant influence on factors such as quality, cost and time. It also looked at the interrelationship between different

techniques to demonstrate how they synergize to increase the success of steel development projects especially in rolling mills companies.

2.5.1 Background and theoretical underpinnings

Project success definitions

Organizations today increasingly operate on a project-based model where their activities are organized into programs made up of many projects that are aimed at executing the strategies of the organization and improve its value. Effective management of these projects is therefore necessary for organizational success and ensuring that the right projects are selected is equally important for individual project success. Aarseth et al. (2017) liken defining success in a project context to achieving consensus among a diverse group on the definition of "good art." However, the understanding of project success has evolved over time from simplistic definitions that are confined to the implementation phase of the project life cycle to more comprehensive definitions that include success throughout both the project and product life cycles Ostermiller and Kynaston (2020).

Project management maturity matrix

Organizations also have varying degrees of proficiency in project management, and many recognize the need for an improved approach to ensure success. The Project Management Maturity Matrix is one of the frameworks that enable rolling mills companies to elevate the maturity of their project management processes as they transition from ad-hoc and disorganized methods to refined and disciplined practices Martens and Carvalho (2017). This matrix delineates four levels of maturity in project management and the first one is the fact that projects rely heavily on the heroic efforts of individual project managers and teams and this often succeed despite the organizational obstacles rather than with their support. The second level is success which is attainable by following an established methodology that enables replication of past successes through agreed-upon processes with training and courses that facilitates this progression. The third level involves not just project delivery but also the realization of the anticipated benefits that requires clear understanding of the expected benefits and their attainment upon project completion. The last level is the focus on shifts to ensure that the right projects are selected and used to advance the business strategy of the organization and add substantial value Martens and Carvalho (2017); El-Gohary, Aziz and Abdel-Khalek (2017); and Seymour, Tom, and Sara Hussein (2014).

Verzuh (2015) observed that effectively implementing projects involves the successful initiation and integration of projects within an organization and this remains a continuous challenge for managers and engineers in the steel development industry. De Marco and Thaheem (2014) further emphasized that the process of project implementation is challenging since it demands attention to a diverse array of financial, human, and technical factors and this makes organizational project managers confront a demanding role that is marked by overwhelming responsibilities, fragmentation, frantic activity, and superficiality. Jackson (2020) highlighted the common predicament wherein project managers often bear the responsibility for achieving successful project outcomes without possessing adequate funding, authority, or personnel to manage all the elements that are required for the success of the project.

A qualitative analysis by El-Gohary, Aziz and Abdel-Khalek (2017) found that projects in the rolling mills companies often start within an environment that is characterized by unpredictability, turbulence, and constant change. This means that having more detailed information about the specific factors that are important for project success greatly benefits engineers and project managers in the steel development industry. Project members should also be equipped with the necessary tools to enable them to effectively prioritize among various project elements and appropriately allocate attention. This would enable them to allocate their efforts more efficiently towards successful executing the project.

Stakeholder theory

Aarseth et al. (2017) observe that project management extends to frameworks that include both nature and people and identify the stakeholder theory to be one of them that help project managers in making decisions that consider the interests of all stakeholders who are involved in a project. Ahmed (2018) highlights them to include financial stakeholders, customers, employees, regulatory authorities and communities. This theory challenges the assumption that the interests of shareholders alone should dictate decision-making processes and advocate instead for a holistic management approach that takes into account the interests of all

stakeholders. It emphasizes that project values are inherently embedded within a project which shows the importance for project managers to articulate the shared sense of value they create to effectively engage key stakeholders. Martens and Carvalho (2017) also note that a sense of ownership and belonging is created when the needs of all the stakeholders are met.

The sustainability of steel rolling mills companies hinges on maintaining strong relationships with its stakeholders and therefore these organization have to prioritize engaging not only employees, investors, and customers but also include all the relevant groups such as the communities. Stakeholder relationships is therefore a guiding principle in managerial decision-making processes and the entirety of stakeholder relations is important for the long-term success and survival of an organization Meredith, Shafer and Mantel Jr. (2017). It is however worth noting that the proponents of this theory refrain from dictating how to navigate the inherent tradeoffs among conflicting interests and in the process leave managers with a framework that renders deliberate decision-making impossible. El-Gohary, Aziz and Abdel-Khalek, (2017) argue that maximizing value must be complemented by effective management practices that are guided by a cohesive strategy, vision, and policies that engage program participants toward achieving competitiveness. It is also important to note that neglecting stakeholder interests in the long term undermines the ability of a project to generate maximum value. All these imply that failure to implement a clear and effective strategy for assessing, managing, and reporting performance has the potential to lead to confusion and lack of clarity among the stakeholders of the organization and further hinder their ability to evaluate and appreciate sustainability efforts.

El-Gohary, Aziz and Abdel-Khalek, (2017) found that the longevity of an organization hinges on its ability to establish and maintain enduring relationships with all members of its stakeholder networks and these relationships constitute very important assets that management should effectively oversee since they serve as the ultimate source of wealth for the firm. This research is therefore guided by this theory and it posits that enhancing project performance requires an organization to consider and fulfil the expectations of its influential stakeholders and that it is important to strike a balance that ensures that there is an alignment between the expectations of the stakeholder and the goals, mission, and vision of the company.

Contingency theory

The organizational design of the study is primarily informed by the contingency theory of organizational structure as outlined by Jackson (2020). It is widely regarded as the dominant conceptual framework within organizational theory research particularly at the structural level since its structural model is recognized to be effective in navigating the complexities that are in organizational systems. They always need managers to adopt multiple management approaches and project management techniques in emergency situations further shows the importance of integrating conventional management theories and modeling processes El-Gohary, Aziz and Abdel-Khalek (2017). Steel companies often use this theory to manage and evaluate their setup since it helps managers to have the ability to monitor and react through both top-down and bottom-up feedback mechanisms. Martens and Carvalho (2017) assert that these companies employ a range of project management techniques to track and evaluate processes throughout the different phases of the project life cycle.

Applying this theory across diverse industries however poses challenges because of the variations in organizational structures, cultures, and environmental factors that complicate the identification of universal contingencies. Factors that influence project management effectiveness are also complex and dynamic thus making it difficult to accurately predict project outcomes. An empirical study by Martens and Carvalho (2017) also found that cultural differences and industry-specific norms sometimes require tailored approaches and that implies that the application of this theory requires careful consideration of specific situational variables when applied in various contexts.

Prospect theory.

This theory was proposed by Tversky and Kahneman in 1979 and it helps in decision-making in situations of uncertainty Meredith, Shafer and Mantel Jr. (2017). These includes choices that involve conflicting values with a purpose is to enhance narration, understanding, and forecasting for both organizations and people who grapple with uncertainty. It therefore delineates the development and evaluation of options within the decision-making process and is characterized by its descriptive and empirical nature Chen, Chen and Lin (2016). It specifically focuses on two aspects which are the framing process that illustrates how a

decision is influenced by the presentation of the decision-maker, and the evaluation phase which involves the values and weighing functions. The values function specifically describes how decisions are assessed in terms of gains and losses that are relative to a reference point.

This theory is therefore applied in decision-making processes in projects especially in Gant Charts where decision-makers assign a value to each outcome and are weighted by the likelihood of the occurrence of that outcome Amoatey et al. (2015). Risk in this case involves the transition from uncertainty about taking a specific action to the potential for financial or economic gain, loss or delay. It is important to provide relevant data when assessing project risks to facilitate statistical analysis or else decision-makers rely on their expertise and understanding to gauge the likelihood of adverse events. Risks significantly impact projects since they affect the job quality, planned investments, and expected program outcomes Marcelino-Sádaba, González-Jaen and Pérez-Ezcurdia (2015) and therefore effective risk management is important for handling projects that are exposed to risks.

2.5.2 Project management

Project management processes

A project according to Jackson (2020) is a temporary activity that is aimed at producing a unique product, outcome, or service and it is carried out within a specified time frame with defined start and end dates. The project management process on the other hand involves creating a plan and executing it to achieve the project objectives and Martens and Carvalho (2017) further suggests that it includes nine knowledge areas which are important for coordinating processes and activities across the domains. Some of these include scope, human resources, scope, cost, time, risk, quality, and procurement management. Effective project execution necessitates a systems thinking approach from leadership at both organizational and project levels, as these areas are interrelated and require holistic understanding for successful implementation.

Project management involves the application of tools, skills, knowledge, and techniques to project tasks to fulfil project requirements and Chawla et al. (2018) state that it enables the assembly of manpower with the appropriate skills to address issues at the right time. The important consideration therefore is the adequacy of qualified personnel within organizations when selecting team members and project managers for a project. Meredith, Shafer and Mantel Jr (2017) argued in their review that it is important to recognize that the process of appointing suitable individuals is determined by leadership that is guided by the employment targets. Project management therefore unfolds through various processes namely initiating, planning, execution, controlling, and closing and each task is thoroughly overseen according to these five processes.

Critical success factors

A qualitative research by Zhu and Mostafavi (2017) outline seven critical success factors that characterize a successful project from a global perspective and these are; staying within the allocated budget, adherence to planned timelines, minimizing or mutually agreeing upon scope changes, gaining client approval, meeting expected performance and specification levels, minimizing impact on corporate culture, and minimizing disruption to the workflow of the host organization. Martens and Carvalho, 2017) acknowledges that it is rare in modern project management to see a project completed without any scope alterations and this affects morale or even entirely halts the progress. It is therefore recommended that project managers should minimize scope changes and only consider necessary alterations with full agreement between the project manager and client. Disruptions to the workflow of the organization due to the project should be carefully managed since projects are integrated within the policies, guidelines, directives and procedures of the organization Amoatey et al. (2015). This implies that achieving successful project outcomes and excellence in project management requires a continuous series of well-managed projects and requires the company to commit starting from the corporate leadership.

Criteria such as adhering to the planned budget and meeting user requirements from the perspective of project users are recognized as indicators of both success and failure whereas they specifically identify achieving the project purpose as a sign of failure and happiness as a measure of success (Jackson, 2020). These findings objectively lead to two main conclusions that it is first important for all the stakeholders to agree on the criteria for project success well before the project commences and to continuously reassess them as the project progresses given that many success criteria are subjective and prone to change. The

second one is the fact that there is a need to clearly define good quality from the outset of the project as this will help ensure that all key stakeholders have a shared understanding of what constitutes quality.

The success of any project is therefore often perceived as meeting the expectations within the constraints of cost, time, and quality. This perspective is however overly simplistic and fails to capture the complexities of innovative and modern projects. Ahmed (2018) in his meta-analysis argued that defining success solely as a point on the cost, time, and quality/performance spectrum is unrealistic given the frequent need for companies to compromise and change their scope during project execution. The author argued that success instead should be envisioned as a multidimensional "cube" that includes various aspects of cost, time, and quality, and clients and project sponsors should set performance goals that are reasonably high and achieving 80 to 90 percent of these goals is considered successful.

2.5.3 Project management tools and techniques

Techniques include the systems, equipment, methods, or approaches that are used to carry out a task. A spade analogous to tools in project execution serves as a fitting example Ostermiller and Kynaston (2020). El-Gohary, Aziz and Abdel-Khalek, (2017) also note that the effectiveness of a technique relies on its suitability for the task and the proficiency of the user, and they therefore serve as instruments for executing work, and their variety is extensive. A spade for example excel in gardening tasks yet its relevance depends on soil conditions. The effectiveness of the tool is also determined by the methods or techniques that are employed by the gardener. Tools alone therefore do not yield significant benefits. Various techniques and tools are used in project management and Amoatey et al. (2015) assert that some of them include the predefined performance criteria, project plan, meeting and reporting frameworks, supplementary project plans, progress report templates, computers, project schedules and milestones, and software programs that are tailored for efficient delivery of the project.

Research studies have shown that project managers recognize the determinant of project success not only as the accurate sequencing of critical activities but also as the effective allocation of resources across a portfolio of multiple programs Marcelino-Sádaba, González-Jaen and Pérez-Ezcurdia (2015). This implies that prioritizing resources is very challenging especially in the case of large projects in steel development projects with varying sizes and urgencies. Brewer and Dittman (2018) also observe that there is always need for project management techniques that adeptly accommodate both the project-driven and resource-based perspectives. They are very important for facilitating the correct prioritization of important activities to ensure proper project implementation and this study focuses particularly on project management techniques that are almost exclusively used in the steel development projects such as work breakdown structures, Gantt charts, critical path methods, resource smoothing, and milestone charts.

Gant charts

This is a technique that uses visual representation of project execution activities that are presented as a bar line and are scaled against time. Gudienė et al. (2014) define it as a scheduling instrument where the duration of every activity is depicted as a horizontal bar whose length corresponds to the time required for completion. It originated from Henry Gantt in the early 1900s and it was first used as a specialized project management technique. It however underwent further development during the aerospace projects in the 1950s and 1960s and it is today widely believed that many project management tools and techniques such as PERT (Program Evaluation and Review Technique) and EV (Earned Value) emerged during the expansion of the defense-aerospace industry of the USA Chen, Chen and Lin (2016).

The Gantt technique is a simple yet powerful program that enables comprehensive analysis of resources, time, and costs within a single spreadsheet and this allows users to monitor up to eight tasks in a single row and facilitate the creation of resource and cost analyses through various summaries Chawla et al. (2018). It is today integrated into modern software like Microsoft Excel and therefore proves to be highly accessible and useful for project planners in the steel development industry. It has several advantages and Marcelino-Sádaba, González-Jaen and Pérez-Ezcurdia, (2015) highlight that some of them include the ability to display project task start and end dates, timelines, activities, milestones, progress tracking, clearly defined resource needs, and task interdependencies.

This technique however faces unique challenges in the steel industry due to the complexity of projects and their inherent uncertainties. Steel projects processes are often challenging because of the resource-intensive tasks, and dependencies that are susceptible to disruptions. Delays in material

procurement, equipment maintenance, or regulatory approvals for instance significantly impact timelines of these projects. These projects also frequently encounter unforeseen technical issues or changes in market demand, and they therefore require constant adjustments to schedules as acknowledged by Gudienė et al. (2014). It is therefore worth noting that project managers in this industry needs to ensure the accuracy of the technique amidst these variables.

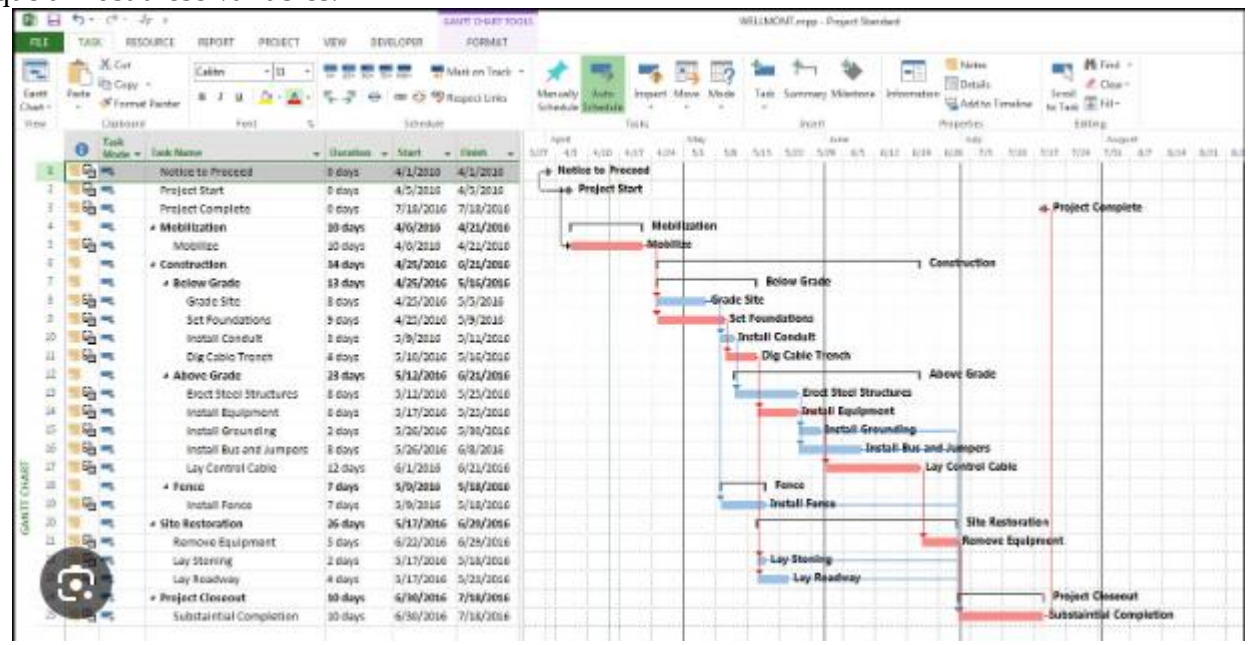

Figure 4: Simple Gantt Chart

Source: (Ahmed, 2018)

Work-breakdown structure.

Gudienė et al. (2014) assert that this technique is a hierarchical approach that progressively breaks down the project work into finer levels of detail by organizing the work into manageable work packages and checklists that facilitates easier planning, management, control, and allocation to specific persons. Its aim is to group similar tasks together to enhance productivity and optimize usage of resource. Jackson (2020) also describes the WBS as the foundation of the project and it includes key elements such as subdivision methods, structure, and numbering or coding systems. Its primary objective is to divide the scope of work into manageable units although this is sometimes challenging for inexperienced project managers to undertake. The technique essentially serves as a roadmap for the project and it ensures that all the elements of the work are identified and integrated into the overall framework of the organization to establish a basis for control. Meredith, Shafer and Mantel Jr (2017) also shows that it shows deliverables that start from the project level and cascades down into work packages which are further subdivided based on showing cost centers, progress, work type, and responsibilities. The project therefore consists of a series of work breakdown structures with each representing a summation of work packages which are hierarchically represented to highlight the process and structure of work decomposition.

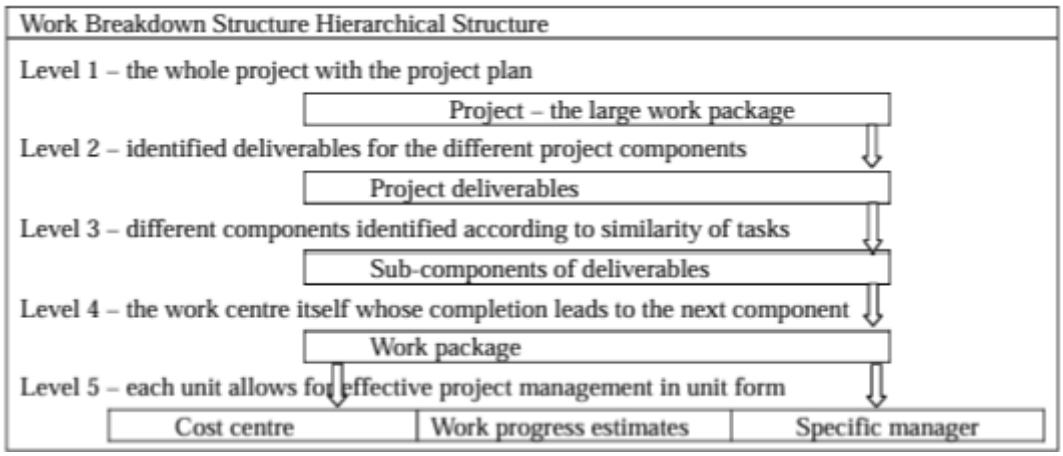

Figure 5: WBS

Source: De Marco and Thaheem (2014)

Work packages represent the smallest tasks or elements of a project that have defined start and end times to ensure that there is accurate skill allocation, cost estimation, and progress monitoring. Assigned work package managers therefore ensure that there is timely and budget-compliant completion in line with technical requirements and customer expectations De Marco and Thaheem (2014). It is therefore important to distinguish between work packages and work breakdown sub-deliverables since the latter includes various work packages and departments and they lack its own duration. Work packages on the hand serve as the fundamental unit for project scheduling, planning, and control. Brewer and Dittman (2018) also assert that an ideal work package within a WBS is characterized by clearly start and end times, defined tasks, assigned individual oversight, required resources, budget allocation, and measurable performance standards.

The effectiveness and efficiency of a breakdown structure hinge on the implementation of an efficient coding system and Jackson (2020) asserts that these codes aid in the definition, identification, and allocation of elements, work packages, levels, and cost information within the WBS. They enable the consolidation of reports at various levels within the structure. This implies that WBS is particularly well-suited for design and steel development projects since it has tangible and quantifiable outcomes that are broken down into work packages, major deliverables, and sub-deliverables. Certain projects are always not conducive to the effective use of the WBS and coding particularly those that are less tangible and more process-oriented. Meredith, Shafer and Mantel Jr (2017) note that such projects involve a series of phases, steps, and plans that lead to a final product without clearly measurable end results or deliverables such as the development of an extranet website or organizing a wedding.

Critical path method

The critical path of a project is the route that dictates the longest duration through the project network that is required to complete the project from start to finish. Chawla et al. (2017) note that it represents the estimated project duration that is equivalent to the longest path traversed by the project network. All multiple paths of equal length are considered to be the critical paths for the project in cases where they are many. Many project managers use this technique to determine the duration of the project as outlined by the critical path method (CPM). Conforto et al. (2016) explain that the method involves one of the pathways through a project network that start from the START node and ending at the FINISH node. The networks consist of activities sequenced in a specific order and are illustrated by arrows that point to the nodes that represent the activities to be completed as shown in the diagram below.

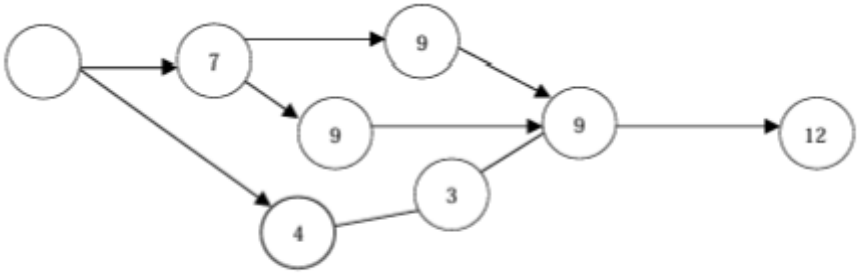

Figure 6: Example of critical path

Source: Larson and Gray (2014)

The technique illustrates the activities or nodes to be completed and some of them sometimes occur simultaneously while others depend on the completion of preceding tasks. Conforto et al. (2016) assert that the duration sometimes span months, weeks, days, hours, or longer depending on the type of project. The project duration however do not exceed the length of the longest path which is known as the critical path which ideally comprises tasks that are sequentially performed without interruption. The completion of the project aligns with the length of this critical path and activities along this critical path serve as bottlenecks or constraints to project speed Bamidele et al. (2015). This technique therefore plays an important role in effective project management since it serves various critical functions such as estimating timeframes and determining project costs. Aarseth et al. (2017) observe that efforts to expedite project completion depend on the ability of the project manager to identify tasks that are reducible to shorten the project timeline. This

involves a trade-off between the eventual cost and the reduction in project duration. Chawla et al. (2018) therefore identify methods for crashing activities to include requesting overtime from employees or hiring additional temporary staff to accelerate work. These activities at any level result in a combination of time and cost somewhere along the project timeline.

The critical aspect of this analysis lies in its ability to evaluate challenges that are encountered during project plan implementation. Zhu and Mostafavi (2017) observe that there are essentially three categories of activities namely dependent, interdependent, and independent where dependent or sequential activities are carried out in a specific order with their initiation or completion being contingent upon certain preceding tasks. Parallel activities on the other hand are executed independently of one another as standalone processes and this technique aids in identifying these activity sets by showing their interdependence and duration Ahmed (2018). This consequently facilitates accurate estimation of time and budget requirements and it is therefore worth noting that project managers have additional tools and techniques at their disposal to expedite activities and potentially reduce costs. They have to select the most cost-effective method for expediting activities and use tools such as linear programming or marginal cost analysis. The decision to expedite activities should therefore be carefully balanced against potential negative impacts on stakeholder cost-benefit considerations, quality, and product usage timelines should any constraints or pressures exist in that regard.

Efficiency in project management involves optimizing resources to achieve maximum desired outcomes Conforto et al. (2016) and the above project management tools serve as guides that support the process to deliver in alignment with the profitability goals and competitive strategy of the company. These techniques also help in determining how to achieve these objectives. Effective implementation of workable business practices and procedures is also very important and Larson and Gray (2014) assert that it requires facilitators to act as both managers and individual contributors across various projects. These tools play an important role in time management for project managers. Meredith, Shafer and Mantel Jr (2017) suggest that effective project management techniques involve using procedures, methodologies, and standards to define the roles and responsibilities of the project team and this is different from operations management which focuses on the operation, design, and enhancement of systems to deliver the primary products and services of the company Ahmed (2018); Layton, Ostermiller and Kynaston (2020); Brewer and Dittman (2018). These collectively shows that project development has distinct practices and requires specific tools for effective project execution and this requires an understanding of the differences and appropriate selection of the technique.

2.5.4 Project management in the steel industry

The cornerstone of success lies in effective project management in challenging and demanding sectors such as steel plant construction and heavy industries and Conforto et al. (2016) note that these industries require a harmonious blend of thorough planning, precision, and flawless execution to ensure that the initiated projects are not only completed within the set timelines but are also well within the budget constraints. A project just like is discussed above is a temporary activity that is distinct from routine operations and it includes a series of tasks that are undertaken within a specified timeframe to achieve specific objectives. Larson and Gray (2014) assert that every project follows a lifecycle that starts with initiation and concludes with closure and other stages include execution, planning, monitoring, and commissioning. Tasks within a project are also delineated and they often require budgetary constraints and the allocation of diverse resources some of which are scarce and shared among multiple projects. Steel project just like any other also undergoes a similar lifecycle as shown in the figure below.

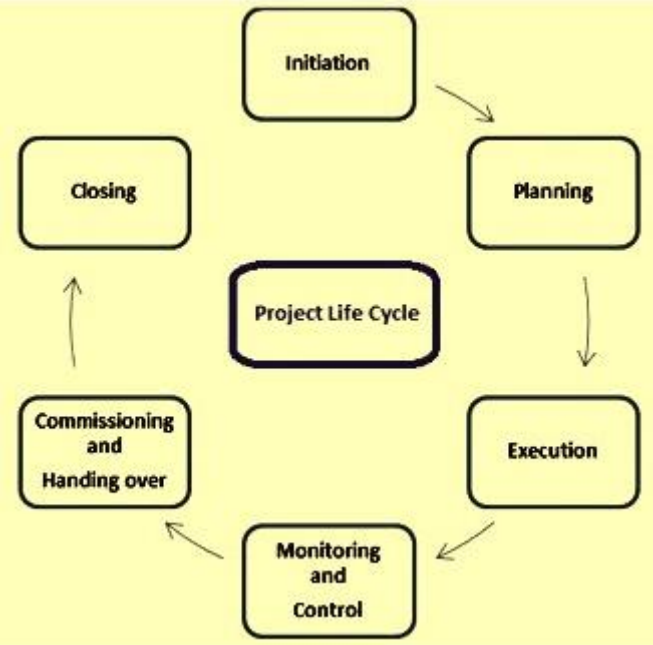

Figure 7: Project life cycle.

Source: Kaiser, El Arbi and Ahlemann (2015)

Larson and Gray (2014) note that the steel project is made of four main components that are cost, performance, scope, and time and all of them are interconnected and reliant on each other. Time in this case refers to the schedule that is required successfully completing the scope and work. It also shows the extent of the tasks to be accomplished. Performance on the other hand refers to the quality of the work that is carried out while cost in this case refers to the expenses that are incurred when executing the project and they are often directly tied to the human and physical resources use Kaiser, El Arbi and Ahlemann (2015); and Chen, Chen and Lin, (2016). An important aspect of successful project management in a steel project therefore involves employing the right persons and effectively overseeing their contributions. These aspects include selecting suitable personnel and managing them appropriately to ensure that the project is successful however these conditions in practice are often disregarded.

A steel project also includes various activity groups that require effective management and Brewer and Dittman (2018) identify them to include tasks such as planning, conducting feasibility studies, executing construction work, designing, handling materials, managing contracts and procurement, obtaining approvals, monitoring activities, overseeing budgets and expenditures, finalizing concepts and site selection, and project closure. Zhu and Mostafavi (2017) note that these activities involve developing and tracking schedules, cost and resources, and defining work parameters. Controlling resource expenses is an important factor due to the substantial financial and labor investments required prior to project completion. This implies that ensuring the highest quality standards for the deliverables of steel projects is very important.

Analysis And Discussion

3.1 Introduction

This chapter seeks to present the analysis and discussion from the above systematic literature review. It discusses the findings from the studies to answer the research questions which are:

RQ 1: What impact does project management techniques have on the success of projects?

RQ 2: What are the techniques used in project management, and how are they applied?

RQ 3: Which techniques are employed in the context of Nigerian steel development projects?

The chapter also presents the analysis that was conducted using constant comparison techniques to iteratively refine the data until discernible themes surfaced. It has tables and visual aids that help depict the code and theme data and emphasizes on the significant themes and the resulting understanding.

3.2 Project management techniques used by rolling mills companies in Nigeria.

Work-breakdown structure

This technique takes on the role of the foundational blueprint for project planning in steel development projects Chawla et al. (2018) and it begins by breaking down the entire project into distinct components and offers a platform for detailed assignment, definition, and tracking of tasks. The WBS in the steel industry stands out as the guiding beacon since it brings teams together, outlines a logical sequence of operations, and clarifies roles. There are three main types of WBS that are used in rolling mills companies and one of them is the deliverable-based WBS. This type uses a hierarchical decomposition method to break down the scope of the project and Larson and Gray (2014) highlight that this approach involves dividing the large project into smaller and more manageable segments as well as establishing a hierarchy. Each level of the hierarchy represents a progressively detailed breakdown of the deliverables of the project. Zhu and Mostafavi (2017) observes that the top level include the overall goal or objective and this is followed by smaller components or phases at the next level down which are further subdivided into tasks and deliverables at subsequent levels. This technique enable the project managers in rolling companies to create work packages and organize them into control accounts. This makes it particularly suitable since most of the steel projects have specific tasks and quick turnarounds Chawla et al. (2018).

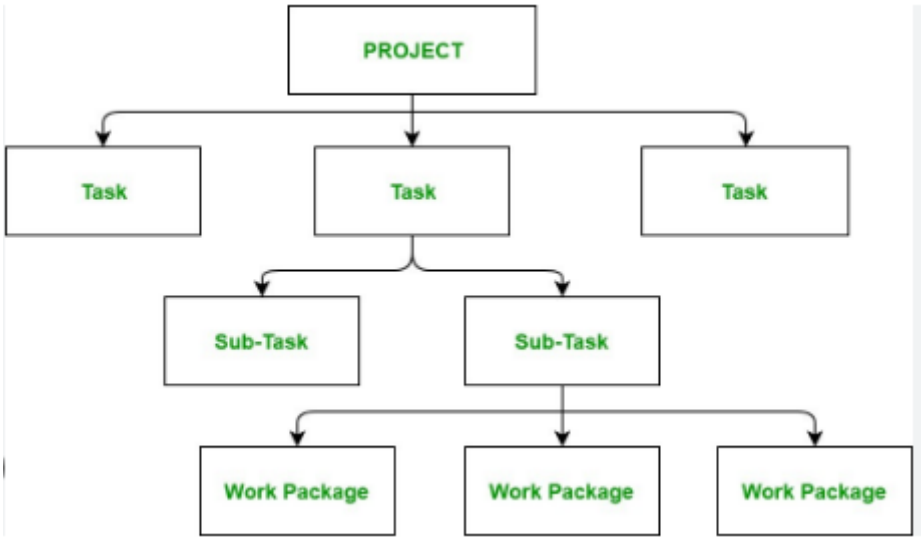

Figure 8: Deliverable oriented WBS

Source: (Larson and Gray, 2014)

The phase-based WBS is another commonly used WBS in the steel industry and Ahmed, (2018) asserts that work packages are established here by using the phases of the project consisting of tasks. Ostermiller and Kynaston (2020) also list Procurement, Design, Inspection, Construction, and Turnover to be the five standard phases in projects of rolling mills companies and they are usually customized to suit specific requirements. Below the second level are the deliverables for each phase and they are referred to as control accounts which are further decomposed into work packages. Agbo and Ayegba (2014) note that the lower levels consistently represent deliverables regardless of the type of WBS that is selected.

Figure 9: Phase-based WBS

Source: Agbo and Ayegba (2014)

The third type is the responsibility-based Work Breakdown Structure which Bamidele et al. (2015) note that is developed based on the organizational chart of the participants of the project and shows the teams and task owners. Its second level always outline the ownership structure while the subsequent lower levels usually specify the project deliverables.

Rolling mills projects are known for their complexity, high costs, and lengthy durations Agbo and Ayegba (2014) which all inherently involve elevated risks which magnifies the daunting prospect of failure. WBS has however emerged as a reassuring ally in such projects and its benefits are many. Aghimien and Oke (2015) assert that it aids in dissecting the challenging projects especially those that span in multiple phases of development. It therefore helps managing work packages as well as facilitating progress tracking and cost management. Ajayi, Adegbite and Iyanda (2014) also note that the WBS provides a clear roadmap to project success since it help the project managers to draft a project plan. Solely drafting these plans from a broad project scope is always overwhelming for managers Ede et al. (2014) but visual representation of the work allows for strategic optimization with a comprehensive overview.

The WBS also adheres strictly to the project scope to ensure that each work package only include tasks that are directly related to its parent task (Gudienė et al., 2014) and it therefore prevents scope creep and also guarantees that only compensated work is undertaken with additional work accounted for and remunerated by referring back to the technique. The techniques follows the 100% rule and includes all project deliverables across procurement, engineering, and construction to facilitate the progress tracking and adherence to the project plan (Ajayi, Adegbite and Iyanda, 2014). It therefore acts as a comprehensive checklist that ensures that every aspect of the project is covered and ensures that there are no major work oversights. The technique therefore compared to a Gantt chart aids in visualizing project progress and monitoring costs against various deliverables, phases, and elements with various online formats that are available for easy creation and sharing of reports (Zhu and Mostafavi, 2017). It is also worth noting that WBS software or tools creates streamlined communication among stakeholders which further enables identification of potential delays, real-time updates, and synchronized actions. This in the process minimizes communication discrepancies. The techniques also serves as a framework for continuous improvement Bamidele et al. (2015) since it helps in simplifying the drafting of project management documents and allows for adjustments to project milestones, deliverables, and quality control based on status updates and this ultimately optimizes on-site execution processes.

Gantt Chart

Scheduling, keen observation and precision are very important in steel development projects and Verzuh (2015) asserts that numerous variables operate concurrently in these projects. Committing to supervise the entirety of a project sometimes pose significant challenges since there are diverse crews, many tasks, varying timelines as well as the involvement of general contractors and subcontractors. Various

phases and milestones within the steel development project process should be thoroughly accounted for and closely monitored when scheduling. Aghimien and Oke (2015) note that this demonstrate the value of Gantt charts with their illustrative features which offer a comprehensive view of progress across multiple tasks and the overall timeline. Meredith, Shafer and Mantel Jr. (2017) note that it is this visual representation that significantly facilitates planning and scheduling efforts and these have demonstrated their remarkable utility by offering several advantages such as understanding task dependencies, identifying required resources and materials, assessing project duration, and planning the sequence of execution.

3.3 Effectiveness of these techniques in terms of project performance indicators such as cost, time, quality, and stakeholder satisfaction

Cost

Determining the price of a rolling mill is a complex task because of the challenging processes that are involved in manufacturing. Project managers in rolling mills companies in Nigeria rely on a cost breakdown structure which is part of WBS to navigate this complexity by breaking down the various factors that influences the costs Chen, Chen and Lin (2016). They develop a robust cost breakdown analysis to ensure that the project delivery is profitable. This is possible because work breakdown structure delineates project deliverables and breaks down the tasks to be accomplished by the project team. The project manager in this case is able to estimate the associated expenses after defining the project activities. These costs in rolling mill projects are usually classified into materials, labor or direct costs, overhead, equipment, and other relevant factors Zhu and Mostafavi (2017). This implies that this technique involves various cost estimation techniques to achieve the most precise estimate. The final cost for the project is then determined once the costs of the components are accurately estimated.

Gantt chart is very impactful in cost estimation since it assists in estimating the duration and resources that are required for each task. Chen, Chen and Lin (2016) assert that various methods such as expert insights, historical data analysis, or alternative approaches are used by project managers in steel industry to determine the time and the cost that are associated with individual tasks. The technique also helps in identifying the critical path and thus represent the sequential tasks that dictate the shortest feasible project completion time. Understanding this critical path enables more efficient resource prioritization and allocation and thus facilitates the avoidance of extra cost.

Time

A study by Aghimien and Oke (2015) found that specifically 84.2% of respondents in rolling mills companies in Nigeria acknowledged the importance of Work Breakdown Structure (WBS) in ensuring timely project delivery. They also confirmed that WBS has enhanced stakeholder satisfaction, contributed to reducing project costs, facilitates efficient resource usage and have positive impact on communication flow within project teams. This descriptive statistics is shown below.

	Level of Agreement					Average	
Work breakdown structure:	**SA**	**A**	**I**	**D**	**SD**	**Mean**	**Standard Deviation**
Are necessary in achieving timely delivery of project.	7.9%	76.3%	7.9%	7.9%	-	3.84	0.679
Has improve stakeholder satisfaction.	39.5%	60.5%	-	-	-	4.39	0.495
Has reduce project cost.	-	31.6%	52.6%	15.8%	-	3.16	0.679
Help in efficient utilization of resources.	7.9%	76.3%	15.8%	-	-	3.92	0.487
Improve the flow of communication among project team.	23.7%	39.5%	28.9%	7.9%	-	3.79	0.905
Grand Average						3.82	0.649

Figure 10:WBS agreement

Source: Aghimien and Oke (2015)

The testing results above show that the WBS holds statistical significance and is a reliable predictor of timely project delivery. This finding aligns with the study by Zhu and Mostafavi (2017) wherein he concluded that the technique serves as an important tool in project management since it acts as the cornerstone for effective project scheduling, monitoring, implementation, and reporting. The outcome of the study also supports the contingency theory which advocates for breaking down the entire project transformation hierarchically into smaller tasks and reduce costs in the process. This therefore suggests that applying this principle in managing rolling mills projects has the potential to alleviate challenges such as poor quality, project delays, and project failure which are frequently encountered in the Nigerian steel industry.

Gantt charts also serve as valuable tools for scheduling tasks and managing resources. The visibility of task start and end dates arguably enable project managers to allocate resources and time with greater efficiency Jowah (2015). This consequently minimizes conflicts and overlaps in scheduling which further helps in preventing delays and maintaining the progress of the project according to the established plan. Aghimien and Oke (2015) also assert that Gantt charts are used in steel industry projects in project planning and scheduling because of their capacity to pinpoint the critical paths and potential delays. This helps in discerning task dependencies which further enable project managers to recognize tasks that are important in maintaining the schedule integrity of the project. They also identify tasks that possess flexibility in their completion timeframe without adversely affecting the overall project timeline.

Quality

A comprehensive WBS in the rolling mills projects guarantees that all team members understand the precise definition and all project tasks. This in the process minimizes miscommunication and subpar development. Larson and Gray (2014) also confirm that the technique reduces project alterations and budgetary oversights, facilitates efficient scope management, and improve cost projections and risk mitigation strategies. This consequently helps in the identification and assessment of the potential hazards and risks thereby playing a role in preventing construction accidents during project execution and improving quality. It is also worth noting that integrating safety protocols into the WBS also effectively reduces workplace accidents and enhances the overall safety standards within the construction sector which are all ways of improving quality.

Gantt charts also serve as a valuable framework that helps in overseeing progress and monitoring milestones. It requires the integration of continuous progress tracking against the timeline to enable project managers to promptly detect delays or issues Jowah (2015). This in the process enables timely corrective measures to prevent escalation and improves on the overall quality.

Stakeholder satisfaction

A study by Chen, Chen and Lin (2016) found that WBS enables a systematic organization of project work and serves as a methodical approach to hierarchically breaking down project scope and providing a structured roadmap for project planning phases. It is this hierarchical breakdown that facilitates clear distinction between tasks, simplifies the assignment of responsibilities, roles, and accountabilities within the project. This technique therefore enhances clarity and productivity by dividing the project into discrete jobs while also aiding in identifying interfaces and relationships for prioritizing work. Martens and Carvalho (2017) also examined sustainability-related projects in the Nigerian steel industry and emphasized that stakeholder participation expedite project progress and help in achieving sustainability in the sector. This implies that stakeholder engagement and analysis techniques are effective and this highlights the important role of stakeholders in the success of development projects.

Gantt chart just like WBS simplifies complex projects by dividing them into smaller and more digestible tasks. This consequently facilitates the assignment of tasks to team members and ensures clarity on the responsibilities of every stakeholder Niu et al. (2018). It is arguable therefore that visualizing the entire project timeline enables project managers to recognize task dependencies and guarantee their sequential completion which in the process helps in improving project efficiency and organization.

3.4 Challenges and opportunities for improving project management.

Gantt charts serve as effective project management tools even though their use is susceptible to common errors in the steel industry that jeopardize project success. Seymour, Tom, and Sara Hussein (2015) observe that one prevalent mistake is neglecting regular updates of the Gantt chart since its accuracy is important for

guiding project activities. It is arguable that failure to make the update has the potential to result in team members working on obsolete tasks or missing new deadlines. This consequently leads to confusion and setbacks. Disregarding task dependencies is another challenge according to Aghimien and Oke (2015). It plays an important role since it helps in maintaining project flow. It does this through early identification and address of the dependencies and this helps in preventing delays and incomplete tasks. It is also worth noting that overcomplicating the technique also hinders understanding of the project team members Larson and Gray (2014). This calls for the need to strike a balance between detail and clarity as well as involving all the team in creating the chart. This consequently ensures that they understand and commit to the timeline.

The two identified techniques should be paired with other tools and methodologies like project management softwares. Kerzner (2017) asserts that some of these software offers centralized platform to oversee the deliverables of the project such as deadlines, task allocations, and progress monitoring. This integration would make the techniques to be interfaced with other additional tools such as email, and calendars which further helps in streamlining communication among team members and stakeholders.

Most stakeholders are also always not engaged during the creation of WBS which presents a lot of challenges. Lack of their input makes the technique to risks overlooking some of the most important components of the project and this further makes the projects to fail to align to the organizational goals. Kerzner (2022) also note that the perspectives of all the team members are important since they help to accurately define the scope of the project and also ensure that they meet all the needs of the stakeholders. Lack of their input otherwise lead to miscommunication, conflicting priorities, and ultimately project failure. This implies that actively involving stakeholders from the outset is very important since it helps in developing a comprehensive and effective WBS that garners support, improves decision-making processes, and drives the project toward success.

Conclusion And Recommendation

4.1 Conclusion

This research study intended to achieve three main objectives which are: identify the project management techniques used by steel development companies in Nigeria; assess the level of effectiveness of these techniques in terms of project performance indicators such as cost, time, quality, and stakeholder satisfaction; and explore the challenges and opportunities for improving project management practices in steel development projects in Nigeria. This was achieved by conducting systematic literature review of 25 sources that target engineers from different rolling mills companies.

This research finds two noteworthy discoveries that bring distinctive insights to the literature on the variable application of Project Management Techniques throughout various phases of the project life cycle in steel development projects. It first confirms the contextual dependence of the usage of these techniques on various stages of the project life cycle. The unique characteristics and deliverables that are required in each phase influence the necessary activities and this consequently determines the applicability of the technique.

The literature highlights a strong correlation between project management technologies and project performance. The examined studies explore the use of various PM techniques and methodologies, and they note significant differences in their application in the steel development projects. Effective project leadership therefore requires that project managers should be proficient in overseeing the project activities. Numerous studies have also suggested that the success of a project is influenced by the proper use of project management tools and techniques. Other researchers have also asserted that project failure in the rolling mills sector sometimes stem from the improper application of the identified project management tools and techniques.

This study therefore enriches the existing literature since it identifies and presents the prevalence of the technique used in each project life cycle phase. It draws these from an empirical analysis of a diverse sample across the steel development industry and project types. It secondly highlights the specific techniques that are commonly used in the steel development industry to contribute to measures of project success in each life cycle phase. Project managers are often advised to select the best technique that align with the characteristics of the project phase and those identified as significant contributors to success measures within each phase of the project life cycle.

It is important to acknowledge the potential limitations of this study despite the strengths that are exhibited through rigorous systematic literature review of 25 articles. There are several project management techniques but it was found that only the WBS and the Gantt Chart are commonly used in the steel

development projects. This research however did not examine the entirety of those available to project managers. Certain techniques like the decision tree analysis and critical chain scheduling were omitted from the list. Other project management techniques such as the critical path method which were initially included were subsequently excluded when the list. This is because they were found not to be highly relevant in the rolling mills sector but they are equally relevant in other sectors of the industry. The measurement of the usage of the techniques in terms of frequency does not necessarily indicate the proficiency with which project managers use these tools. It is also noted that the study does not fully represent the entire population of project managers as it is restricted to companies in Nigeria. The sources that were examined do not include the full spectrum of steel project types or ranges and this limits the generalizability of the research findings to projects with similar demographics as those included in the study.

4.2 Recommendations

Scope creep is one of the prevalent risk in project management in the steel industry and it occurs when the requirements or tasks of a project undergo extensive alterations. One good example is when a project to build a steel mill for automotive applications expands to include additional features like upgrading equipment or implementing stricter safety measures which consequently lead to increased costs and delays. This scenario usually jeopardizes timely completion and budget adherence. Rolling mills projects typically commence with well-defined boundaries and these boundaries often become fluid during the execution phase which lead to an expansion of the scope of the project. Project managers should therefore manage the scope creep by effectively using techniques such as Gantt Chart View to offer a Gantt-style overview of projects and enable the visualization of milestones on the project timeline. This technique provides a visual representation of project timelines, milestones, and dependencies which enables managers to better track the progress of the project and also identify some of the potential scope changes to promptly and effectively address them.

Steel development projects also involves numerous activities and there is need for project managers to integrate the useful techniques with project management software. The main aim of these software is to support project managers to handle various stages of a project. Project management software like Asana helps project managers to track task and also comes with collaboration features that are suitable for coordinating steel development tasks. Other specialized software like Procore integrate document management and communication systems which are ideal for overseeing steel projects. Integrating them in resource management, project planning, time tracking, financial management, team collaboration, and reporting for example would enable the managers to oversee projects from the initial quote to the final invoice. Steel companies always aim for long-term success in their projects and it is very important for them to effectively monitor work progress. Project management software solutions would therefore streamline the decision-making process through consolidating all the pertinent details in one centralized location.

Recommendations for further studies

Future research studies should therefore explore the potential correlations between the use of specific project management techniques, whether certain techniques tend to be employed in conjunction with others, and whether their combined usage would possibly influence project success. This kind of examination should be conducted throughout the project life cycle. Further studies should also consider examining the use of the techniques in relation to various situational factors such as type, duration, project size, and strategic focus. They should analyse the usage of the techniques within the context of these situational factors and explore their impact on project success rather than solely focusing on the phases of the project life cycle. The outcomes of such future studies would improve the understanding of contingency theory in the use of the techniques and offer practical insights to practitioners on the appropriate application of the technique in specific situations. It is also worth noting that future studies could benefit from a broader demographic to improve the applicability of the findings.

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