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Effect of Agile Project Management Practices on the Successful Implementation of Projects: A Case of Gigawatt Solar Power Project in Rwamagana District, Rwanda

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Abstract: *This study examined the effect of agile project management practices on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. Specifically, the study examined the effect of agile planning, assessed the influence of stakeholder collaboration, and evaluated the effect of iterative methods on successful project implementation. The study was guided by Agile Project Management Theory, Stakeholder Theory, and Dynamic Capabilities Theory. A descriptive and correlational research design using quantitative and qualitative approaches was adopted. The study targeted 230 respondents. Quantitative data were analyzed using SPSS version 25 through descriptive statistics, Pearson correlation, and multiple regression analysis, while qualitative data were analyzed thematically. The findings revealed that agile planning, stakeholder collaboration, and iterative methods had positive and statistically significant effects on successful project implementation. The three agile project management practices jointly explained 68.9% of the variation in successful project implementation ($R^2 = 0.689$). Stakeholder collaboration was the strongest predictor ($\beta = 0.408$, $p < 0.001$), followed by agile planning ($\beta = 0.380$, $p < 0.001$) and iterative methods ($\beta = 0.219$, $p < 0.001$). The study concluded that strengthening agile planning, stakeholder collaboration, and iterative methods improves timely completion, budget compliance, and quality achievement. The study recommends strengthening stakeholder engagement mechanisms, institutionalizing agile planning practices, and promoting continuous review and improvement throughout the project lifecycle.*

Keywords: *Agile Project Management; Agile Planning; Stakeholder Collaboration; Iterative Methods; Successful Project Implementation; Solar Power Projects; Rwanda*

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1. Introduction

The successful implementation of projects is widely recognized as a critical factor in achieving organizational objectives and sustainable development outcomes (Baccarini, 2023). Project implementation involves the execution of planned activities to achieve project goals within the specified scope, budget, time, and quality requirements. Effective implementation enhances resource utilization, stakeholder satisfaction, and realization of intended project benefits. However, many projects continue to face challenges such as delays, cost overruns, inadequate communication, and stakeholder conflicts, which negatively affect project outcomes and overall project success (Too & Weaver, 2024).

Globally, renewable energy projects have become increasingly important in addressing climate change,

energy security concerns, and sustainable development objectives (IRENA, 2025). Governments and private investors have significantly increased investments in solar, wind, hydroelectric, and other renewable energy technologies to meet growing energy demands while reducing carbon emissions. The implementation of renewable energy projects requires effective coordination of resources, stakeholders, and technical processes to achieve desired outcomes. Consequently, successful project implementation has become a key determinant of the sustainability and performance of renewable energy initiatives worldwide (IEA, 2025).

In developed countries, agile project management practices have gained widespread recognition as effective approaches for improving project implementation and performance in complex project environments (Conforto et al., 2023). Agile methodologies emphasize adaptive planning, continuous stakeholder engagement, iterative execution, and flexibility in responding to changing project requirements. These practices have been increasingly applied beyond software development to infrastructure and renewable energy projects where uncertainty and dynamic conditions are common. Organizations that adopt agile approaches often achieve improved project efficiency, enhanced quality outcomes, and greater stakeholder satisfaction (Augustine, 2024).

In Sub-Saharan Africa, renewable energy projects have become essential for expanding electricity access, promoting industrial development, and supporting economic growth (African Development Bank, 2024). Countries across the region have invested heavily in solar and wind energy infrastructure to address persistent energy deficits and increase access to reliable electricity. Despite these investments, project implementation often faces challenges related to financial constraints, technical capacity limitations, environmental uncertainties, and stakeholder coordination. The adoption of agile project management practices has therefore emerged as an important strategy for enhancing project adaptability and implementation effectiveness in the region (Musyoka & Wanjohi, 2023).

In East Africa, governments have prioritized renewable energy development as part of broader efforts to achieve sustainable economic transformation and universal access to electricity (East African Community, 2024). Countries such as Kenya, Tanzania, and Uganda have implemented major solar and wind energy projects aimed at increasing energy generation capacity and reducing dependence on conventional energy sources. Effective implementation of these projects requires flexible management approaches capable of responding to changing stakeholder needs and operational challenges. Agile project management practices have increasingly supported project teams in improving coordination, communication, and implementation performance within the region's energy sector (Mwangi, 2024).

In Rwanda, renewable energy development remains a strategic priority in supporting national development goals and increasing electricity access across the country (Ministry of Infrastructure, 2024). The Government of Rwanda has invested in various renewable energy initiatives, including solar power projects, to diversify energy sources and enhance energy security. These projects are expected to contribute to economic growth, environmental sustainability, and improved living standards for the population. Effective project implementation is therefore essential to ensure that renewable energy investments deliver the intended benefits and contribute to national development objectives (Rwanda Energy Group, 2024).

One of Rwanda's most significant renewable energy initiatives is the Gigawatt Solar Power Project located in Rwamagana District, which contributes substantially to the country's clean energy production capacity (Gigawatt Global, 2024). The successful implementation of this project requires effective planning, stakeholder collaboration, and the ability to adapt to changing project conditions throughout the project lifecycle. Agile project management practices provide mechanisms for enhancing flexibility, communication, and continuous improvement, which are critical for achieving successful project outcomes. Examining the effect of agile project management practices on the successful implementation of the Gigawatt Solar Power Project is therefore important for improving project performance and generating valuable lessons for future renewable energy projects in Rwanda (Uwizeyimana & Niyonsaba, 2025).

1.3 Statement of the Problem

Successful implementation of renewable energy projects requires effective planning, efficient resource utilization, active stakeholder engagement, and continuous monitoring to ensure projects are completed on time, within budget, and according to the required quality standards (Shenhar & Dvir, 2024). Renewable energy projects are expected to contribute to sustainable energy production, environmental conservation, and economic development while delivering value to investors, governments, and local communities. Achieving these outcomes depends on the adoption of effective project management approaches capable of addressing the complexities and uncertainties associated with large-scale infrastructure projects. Consequently, project managers are increasingly encouraged to adopt

flexible and adaptive management practices to improve project implementation success (Müller & Turner, 2024).

Despite the growing investment in renewable energy projects, implementation challenges continue to affect project performance in many developing countries, including Rwanda (African Development Bank, 2024). Large-scale solar energy projects often experience delays, budget overruns, communication breakdowns, stakeholder conflicts, and difficulties in adapting to changing project requirements. These challenges can negatively affect project schedules, resource utilization, quality standards, and stakeholder satisfaction. In the case of the Gigawatt Solar Power Project in Rwamagana District, the successful implementation of project activities requires effective coordination among project managers, technical teams, government institutions, investors, contractors, and local communities. Failure to effectively manage these factors may compromise project performance and limit the achievement of intended project objectives (Rwanda Energy Group, 2024).

Previous studies have demonstrated that agile project management practices can significantly improve project implementation and performance across different sectors and project environments (Conforto et al., 2023). Studies conducted by Augustine (2024) found that agile planning enhances project flexibility and responsiveness to change, while Serrador and Pinto (2024) established that stakeholder collaboration contributes to improved project outcomes and stakeholder satisfaction. Similarly, Leach (2024) reported that iterative methods facilitate continuous improvement, risk reduction, and effective project control. These studies suggest that agile project management practices play a critical role in enhancing project implementation success under dynamic and uncertain conditions (Highsmith, 2024).

Despite the growing body of literature on agile project management, limited empirical evidence exists regarding the effect of agile project management practices on the successful implementation of renewable energy projects in Rwanda (Uwizeyimana & Niyonsaba, 2025). In particular, little is known about how agile planning, stakeholder collaboration, and iterative methods influence the successful implementation of the Gigawatt Solar Power Project in Rwamagana District. This knowledge gap limits the ability of project stakeholders to make informed decisions regarding the adoption of agile practices in renewable energy projects. Therefore, this study seeks to examine the effect of agile project management practices on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda.

1.4 Research Objectives

This study was guided by the general and specific objectives presented below.

1.4.1 General Objective

The general objective of this study was to examine the effect of Agile Project Management Practices on the Successful Implementation of Projects: A case of Gigawatt Solar Power Projects in Rwamagana District, Rwanda"

1.4.2 Specific Objectives

The following were the specific objectives of the study

i. To examine the effect of agile planning on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda.

2. Literature Review

This section presents a review of literature related to agile project management practices and successful project implementation. The chapter discusses the key concepts underpinning the study, including agile planning. It also presents the conceptual framework illustrating the relationship between the study variables and identifies the research gap that necessitates the current study.

2.1.1 Agile Project Management

Agile project management refers to a set of project management approaches that emphasize flexibility, collaboration, continuous improvement, and responsiveness to change throughout the project lifecycle (Rigby, Sutherland & Noble, 2023). Agile practices encourage project teams to break down complex activities into manageable tasks, continuously monitor progress, incorporate stakeholder feedback, and make adjustments where necessary. Originally developed within software development environments, agile approaches have increasingly been adopted in infrastructure, construction, and renewable energy projects due to their ability to address uncertainty and complexity effectively (Denning, 2024).

The importance of agile project management lies in their ability to improve project adaptability and enhance decision-making in dynamic project environments. Through iterative execution, stakeholder engagement, and continuous learning, project teams can identify challenges early, reduce implementation risks, and improve project outcomes. Agile practices also strengthen communication and collaboration among stakeholders, enabling organizations to deliver projects more efficiently while

maintaining quality standards and customer satisfaction. Consequently, agile approaches have become important tools for improving project implementation success across various sectors (Boehm & Turner, 2023).

In the context of this study, agile project management practices provide a useful framework for enhancing the successful implementation of the Gigawatt Solar Power Project in Rwamagana District. The application of agile planning, stakeholder collaboration, and iterative methods is expected to improve project coordination, responsiveness, and adaptability throughout the implementation process. These practices can contribute to timely completion, budget compliance, and achievement of quality standards, which are critical indicators of project implementation success.

2.1.2 Agile Planning

Agile planning refers to a flexible and iterative approach to project planning that allows project teams to continuously review, adjust, and refine project activities based on changing requirements and emerging project conditions (Cervone, 2023). Unlike traditional planning approaches that rely on fixed plans established at the beginning of a project, agile planning encourages continuous forecasting, prioritization of activities, and adaptive scheduling throughout the project lifecycle. This approach enables project teams to remain responsive to uncertainty while ensuring that project objectives remain aligned with stakeholder expectations and organizational goals (Cooper & Sommer, 2024).

The importance of agile planning lies in its ability to improve project flexibility, responsiveness, and decision-making. Through techniques such as sprint planning, backlog prioritization, and adaptive scheduling, project teams can identify potential challenges early and implement corrective actions before they escalate into major project issues. Agile planning also enhances resource allocation, promotes effective risk management, and facilitates timely communication among project stakeholders. As a result, organizations are able to improve project efficiency and increase the likelihood of achieving project objectives within the planned schedule and budget (Wysocki, 2023).

In the context of this study, agile planning is relevant because the implementation of the Gigawatt Solar Power Project requires continuous coordination of activities, effective resource management, and timely responses to changing project conditions. The use of agile planning practices can help project managers adapt to operational challenges, improve workflow management, and ensure that project activities remain aligned with implementation goals. Consequently, agile planning is expected to contribute significantly to the successful implementation of the Gigawatt Solar Power Project through timely completion, budget compliance, and quality achievement.

2.1.3 Successful Project Implementation

Successful project implementation refers to the effective execution of project activities in a manner that enables the achievement of project objectives within the planned scope, schedule, budget, and quality standards (Shenhar & Dvir, 2023). It involves coordinating resources, managing stakeholders, monitoring project activities, and ensuring that project deliverables meet the expectations of sponsors, beneficiaries, and other stakeholders. Successful implementation is often viewed as a critical phase in the project lifecycle because it determines whether the intended project outcomes and benefits are realized (Turner, 2024).

The importance of successful project implementation lies in its contribution to organizational performance, stakeholder satisfaction, and sustainable project outcomes. Projects that are successfully implemented are more likely to achieve their intended objectives, optimize resource utilization, and generate long-term value for stakeholders. Effective project implementation also minimizes delays, cost overruns, quality defects, and operational inefficiencies that may negatively affect project performance. As a result, successful implementation has become a key measure of project success across different sectors, including infrastructure, construction, energy, and development projects (Jugdev & Müller, 2023).

In this study, successful project implementation constitutes the dependent variable and was measured using three key indicators: timely completion, budget compliance, and quality achievement. Timely completion refers to the extent to which project activities are completed according to the planned schedule. Budget compliance focuses on the ability of the project to operate within approved financial resources without significant cost overruns. Quality achievement refers to the extent to which project outputs meet the required technical specifications, performance standards, and stakeholder expectations. In the context of the Gigawatt Solar Power Project in Rwamagana District, successful implementation is essential for ensuring efficient energy generation, stakeholder satisfaction, and the realization of the project's intended economic and environmental benefits (Meredith & Mantel, 2024).

2.2 Theoretical Review

2.3.1 Agile Project Management Theory

Agile Project Management Theory emerged from the Agile Manifesto developed by a group of software development

experts in 2001 to address the limitations of traditional project management approaches in dynamic and rapidly changing environments (Cockburn, 2023). The theory was developed to promote flexibility, collaboration, adaptability, and continuous improvement throughout project implementation. It emphasizes responding to change rather than rigidly following predetermined plans and encourages continuous stakeholder involvement in project activities. Over time, the theory has evolved beyond software development and has been applied in construction, infrastructure, manufacturing, and renewable energy projects where uncertainty and complexity are common (Moe, Dingsøyr & Dybå, 2024).

The meaning of Agile Project Management Theory lies in its emphasis on adaptive planning, iterative execution, continuous feedback, and stakeholder collaboration as mechanisms for improving project outcomes (VersionOne, 2023). The theory argues that projects operate in environments characterized by changing requirements, emerging risks, and evolving stakeholder expectations. Consequently, project teams should continuously assess progress, learn from experience, and make adjustments to ensure project objectives are achieved. Key principles of the theory include flexibility, incremental delivery, customer involvement, and continuous learning, all of which contribute to improved project performance and implementation success (Ambler, 2024).

In the context of this study, Agile Project Management Theory underpins the first specific objective, which seeks to examine the effect of agile planning on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District. The theory supports the idea that effective planning should be adaptive and responsive to changing project requirements rather than fixed throughout the project lifecycle. Through agile planning practices such as sprint planning, backlog prioritization, and adaptive scheduling, project teams can respond effectively to implementation challenges, optimize resource utilization, and improve project performance. Therefore, the theory provides a foundation for understanding how agile planning contributes to timely completion, budget compliance, and quality achievement.

2.3. Empirical Review

The empirical review presents findings from previous studies related to agile project management practices and successful project implementation. The review focuses on studies conducted in different geographical contexts to establish the relationship between agile planning and project implementation success. The review further identifies methodological, contextual, and conceptual gaps that justify the need for the current study.

2.3.1 Agile Planning and Successful Project Implementation

Globally, agile planning has been widely recognized as an effective approach for improving project implementation in dynamic and uncertain environments. Hartman and Delgado (2022) conducted a comparative study involving 120 infrastructure projects across North America, Europe, and Asia using a mixed-method research design. The results indicated that projects utilizing agile planning achieved a 28% reduction in implementation delays and a 22% improvement in schedule adherence compared to projects using traditional planning approaches. The findings revealed that adaptive scheduling and continuous planning enabled project teams to respond effectively to emerging challenges and changing stakeholder requirements. The study concluded that agile planning significantly enhances project implementation success. The researchers recommended that project managers adopt agile planning techniques to improve project adaptability and efficiency. However, the study focused mainly on developed economies and did not examine renewable energy projects in developing countries.

In Europe, Richardson and Keller (2021) investigated the influence of agile planning on the implementation of renewable energy infrastructure projects in Germany, France, and Denmark. The study employed a descriptive survey design involving 85 project managers and planners. The results showed that projects that adopted agile planning practices experienced higher levels of schedule compliance and improved coordination among project teams. The findings suggested that adaptive planning allowed project managers to respond effectively to technological and regulatory changes affecting project implementation. The study concluded that agile planning contributes positively to project implementation performance. The researchers recommended the integration of agile planning practices into renewable energy project management frameworks. The identified gap was that the study did not explore the applicability of agile planning in African renewable energy projects.

In Sub-Saharan Africa, Ndlovu and Maseko (2023) conducted a case study of infrastructure projects in South Africa and Botswana to examine the influence of agile planning on project performance. Using interviews and project performance reports, the study found that agile planning improved resource allocation, risk management, and project coordination. The results indicated that projects utilizing adaptive scheduling experienced fewer implementation disruptions and better project outcomes. The study concluded that agile planning enhances implementation effectiveness in complex project environments. The researchers recommended increased adoption of agile planning practices across infrastructure

projects in developing countries. However, the study did not specifically address renewable energy projects.

In East Africa, Kihara and Mutiso (2022) examined agile planning practices in large-scale infrastructure projects in Kenya and Tanzania using a correlational research design. The findings showed a significant positive relationship between agile planning and project implementation success. Projects that continuously reviewed schedules and priorities reported improved efficiency and reduced implementation delays. The study concluded that agile planning plays an important role in enhancing project implementation outcomes in dynamic environments. The recommendation was for project organizations to institutionalize agile planning practices within project management systems. The study, however, did not focus on renewable energy projects or the Rwandan context.

In Rwanda, Mugisha and Nshuti (2024) conducted a study on project planning practices and implementation performance among selected infrastructure projects in Kigali City. The study adopted a mixed-method approach involving questionnaires and interviews. The results revealed that adaptive planning significantly improved project coordination, implementation efficiency, and timely completion of project activities. The findings suggested that projects that continuously updated implementation plans were better able to achieve their objectives despite changing conditions. The study concluded that agile planning contributes significantly to successful project implementation. The researchers recommended the adoption of agile planning techniques in major infrastructure projects. However, the study did not specifically examine renewable energy projects such as the Gigawatt Solar Power Project in Rwamagana District.

3. Methodology

The study adopted a descriptive and correlational research design to examine the effect of agile project management practices on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. The descriptive design was used to describe agile planning, stakeholder collaboration, iterative methods, and the level of successful project implementation. The correlational design was used to examine the relationships between the independent variables and successful project implementation. This design enabled the researcher to assess the study variables and determine the extent to which agile project management practices influenced project implementation.

The study population comprised personnel directly involved in the planning, coordination, implementation, monitoring, and regulation of the Gigawatt Solar Power Project. The target population consisted of 230 respondents, including one project manager, 18 engineers, 142 technical staff, 15 supervisors, 25 contractors, 12 government representatives, seven monitoring and evaluation officers, and 10 procurement officers. These categories were selected because they possessed relevant knowledge and practical experience concerning project management activities, agile practices, and project implementation outcomes.

Because the target population consisted of only 230 respondents and was considered manageable, the study employed a census approach. All 230 members of the population were therefore included in the study rather than selecting a smaller sample. Census sampling enabled the researcher to obtain information from all relevant stakeholders involved in the project and minimized sampling error. The approach also provided comprehensive representation of respondents' views and experiences concerning agile planning, stakeholder collaboration, iterative methods, and successful project implementation.

The study utilized primary data collected directly from respondents involved in the implementation of the Gigawatt Solar Power Project. Questionnaires and interviews were used to obtain information from the project manager, engineers, technical staff, supervisors, contractors, government representatives, monitoring and evaluation officers, and procurement officers. The questionnaires used a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Interview guides were administered to the project manager to obtain detailed qualitative information concerning agile planning, stakeholder collaboration, iterative methods, and project implementation outcomes.

The research instruments were subjected to piloting, validity assessment, and reliability testing before the actual data collection. A pilot study involving approximately 23 respondents, representing 10% of the target population, was conducted among respondents with characteristics similar to the target population but outside the actual study. Content validity was assessed through expert review and the Content Validity Index (CVI), with a value of 0.70 or above considered acceptable. Reliability was assessed using Cronbach's Alpha through SPSS version 25, with a coefficient of 0.70 or higher considered acceptable for demonstrating internal consistency of the questionnaire items.

The collected data were processed through editing, coding, classification, data entry, cleaning, and presentation. Quantitative data from the questionnaires were analyzed using SPSS version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' characteristics and the study variables. Pearson correlation analysis was used

to determine the strength and direction of relationships between agile project management practices and successful project implementation, while multiple regression analysis was used to determine the effects of agile planning, stakeholder collaboration, and iterative methods on successful project implementation. Qualitative information obtained through interviews was analyzed thematically and integrated with the quantitative findings. The study recognized possible limitations related to respondents' demanding work schedules, confidentiality concerns, and financial and time constraints. These challenges were addressed through advance scheduling of appointments, flexible data collection arrangements, assurance of confidentiality, appropriate budgeting, and effective use of available resources. Ethical principles were also observed throughout the research process. The researcher obtained authorization from relevant authorities, informed respondents about the purpose of the study, obtained informed consent, maintained confidentiality and anonymity, and respected participants' right to withdraw. The researcher also committed to accurate reporting, proper acknowledgment of sources, and avoidance of fabrication, falsification, misrepresentation, and plagiarism

4. Results and Discussion

This section presents, analyzes, and interprets the findings of the study on the effect of agile project management practices on the successful implementation of projects at the Gigawatt Solar Power Project in Rwamagana District, Rwanda. The findings are presented according to the study objectives, namely agile planning, stakeholder collaboration, and iterative methods and their effect on successful project implementation. It further presents the response rate, descriptive statistics, correlation analysis, regression analysis, and discussion of findings.

4.1 Findings

4.1.1. Response Rate

The study targeted a total sample size of 230 respondents, comprising 229 respondents who were administered questionnaires and one (1) Project Manager who participated in an interview. The questionnaires were administered to employees involved in the implementation of the Gigawatt Solar Power Project in Rwamagana District. Out of the 229 questionnaires distributed, 219 were successfully completed and returned, representing a response rate of 95.6%, while 10 questionnaires were not returned, representing 4.4% of the distributed questionnaires. In addition, one (1) Project Manager was interviewed, representing a 100% interview response rate. The Project Manager was purposively selected because of his direct involvement in the planning, implementation, coordination, monitoring, and evaluation of the Gigawatt Solar Power Project.

Table 1: Response Rate of Respondents

Response Rate	Frequency	Percentage (%)
Questionnaires Returned	219	95.6
Questionnaires Not Returned	10	4.4
Project Manager Interviewed	1	100.0
Total	**230**	**100.0**

Source: Field Data (2026)

The high questionnaire response rate of 95.6% indicates a strong level of participation among respondents and provided sufficient data for reliable statistical analysis and interpretation. According to Mugenda and Mugenda (2003), a response rate of 70% and above is considered very good for analysis. Therefore, the response rate achieved in this study was excellent and adequate for drawing valid conclusions regarding the effect of agile project management practices on the successful implementation of projects at the Gigawatt Solar Power Project in Rwamagana District, Rwanda. Furthermore, the 100% interview response rate ensured that qualitative information was obtained from the Project Manager, whose practical experience and managerial responsibilities provided valuable insights that complemented the quantitative findings presented in this chapter.

4.1.2 Descriptive Statistics of Agile Planning

The first objective of this study was to examine the effect of agile planning on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. Agile planning is one of the fundamental principles of agile project management because it enables project teams to develop flexible plans, continuously review project activities, respond promptly to changing requirements, and allocate resources efficiently. Respondents were requested to indicate their level of agreement with statements relating to agile planning using

a five-point Likert scale where 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D), and 1 = Strongly Disagree (SD).

Table 2: Agreement on Agile Planning and Successful Project Implementation

Views of Respondents	N	Mean	SD
Project plans are reviewed and updated regularly during project implementation.	219	4.39	0.71
Project activities are prioritized according to changing project needs.	219	4.27	0.76
The project team quickly adjusts plans whenever changes occur.	219	4.18	0.82
Agile planning enables efficient utilization of project resources.	219	4.31	0.74
Agile planning has contributed to the successful implementation of the Gigawatt Solar Power Project.	219	4.42	0.68
Overall Mean		**4.31**	**0.74**

Source: Field Data (2026)

Table 2 presents respondents' perceptions regarding agile planning and its contribution to the successful implementation of the Gigawatt Solar Power Project. The overall findings indicate that respondents strongly agreed that agile planning positively contributes to project implementation, as reflected by an overall mean score of 4.31 and a standard deviation of 0.74. The high overall mean indicates that agile planning practices were widely implemented within the project, while the relatively low standard deviation suggests consistency in respondents' opinions regarding the importance of agile planning during project implementation.

The findings reveal that respondents strongly agreed that agile planning has contributed to the successful implementation of the Gigawatt Solar Power Project with the highest mean score of 4.42 and a standard deviation of 0.68. This finding implies that respondents perceived agile planning as a major contributor to achieving project objectives within the expected time, cost, and quality requirements. The high level of agreement suggests that continuous planning enabled project managers to coordinate project activities effectively, respond to implementation challenges, and improve overall project performance. In large infrastructure projects such as solar power development projects, implementation conditions frequently change due to technical, environmental, financial, and stakeholder-related factors. Therefore, flexible planning enables project managers to adapt quickly without disrupting project progress.

The study further established that respondents strongly agreed that project plans are reviewed and updated regularly during project implementation with a mean score of 4.39 and a standard deviation of 0.71. This indicates that planning within the Gigawatt Solar Power Project was viewed as a continuous process rather than a one-time activity conducted only at project initiation. Regular review of implementation plans enabled project managers to assess project progress, identify emerging risks, revise implementation schedules, and introduce corrective actions whenever necessary. Such continuous planning reduced uncertainties, improved coordination among project teams, and enhanced project responsiveness to changing implementation conditions.

Respondents also strongly agreed that agile planning enables efficient utilization of project resources, recording a mean score of 4.31 and a standard deviation of 0.74. This finding demonstrates that agile planning improved the allocation and utilization of financial resources, human resources, equipment, and construction materials throughout project implementation. Efficient resource utilization minimizes wastage, reduces unnecessary project costs, improves productivity, and ensures that available resources are directed toward priority activities. Consequently, the project team was able to maximize available resources while maintaining project quality and implementation efficiency.

The findings further reveal that respondents strongly agreed that project activities are prioritized according to changing project needs, with a mean score of 4.27 and a standard deviation of 0.76. This implies that project managers continuously evaluated implementation priorities and adjusted work schedules based on current project requirements. Prioritizing project activities according to changing needs enabled the project team to focus on critical tasks, improve workflow coordination, reduce delays, and ensure that essential project milestones were achieved within the planned implementation period. Such flexibility is particularly important in infrastructure

projects where external conditions and stakeholder requirements frequently evolve throughout the project lifecycle.

The statement that the project team quickly adjusts plans whenever changes occur recorded a mean score of 4.18 and a standard deviation of 0.82. Although this was the lowest mean among the agile planning indicators, respondents still agreed that the project team responded effectively to changing implementation conditions. This finding suggests that the project management team possessed adequate flexibility to revise implementation plans whenever unforeseen challenges emerged. The ability to adjust project plans promptly reduces implementation risks, minimizes delays, and improves project resilience. It also demonstrates that decision-making processes within the project supported adaptability rather than rigid adherence to initial implementation plans.

The interview conducted with the Project Manager further supported the quantitative findings regarding agile planning. The Project Manager explained that planning was treated as a continuous management activity throughout the implementation of the Gigawatt Solar Power Project rather than a document prepared only at project initiation. According to the respondent, project implementation plans were reviewed regularly to accommodate changes in technical requirements, stakeholder expectations, environmental conditions, and resource availability

The Project Manager stated:

> *"Our implementation plans were continuously reviewed throughout the project. Whenever technical requirements, environmental conditions, or stakeholder expectations changed, we immediately updated our work plans to ensure that project activities remained on schedule and project objectives were achieved."*

The respondent further explained that regular planning meetings enabled project teams to identify implementation challenges early and develop practical solutions before those challenges affected project performance. According to the Project Manager:

> *"Regular planning meetings helped us identify potential implementation challenges early enough. This allowed the project team to allocate resources efficiently, adjust priorities where necessary, and maintain the quality and timeliness of project activities."*

The Project Manager also emphasized that flexible planning improved communication among engineers, contractors, consultants, suppliers, and other project stakeholders. Continuous planning enabled project teams to coordinate implementation activities effectively, minimize delays, and maintain alignment with overall project objectives.

Overall, the interview findings complement the quantitative results by demonstrating that agile planning enhanced adaptability, strengthened coordination, improved resource utilization, facilitated timely decision-making, and significantly contributed to the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. These qualitative findings reinforce the conclusion that agile planning is an essential project management practice for improving implementation success in large infrastructure projects.

The findings of this study are consistent with those of Hartman and Delgado (2022), who conducted a comparative study involving infrastructure projects across North America, Europe, and Asia and found that agile planning significantly reduced implementation delays and improved schedule adherence through adaptive planning and continuous review of project activities. They concluded that organizations adopting agile planning techniques were better able to respond to emerging implementation challenges and changing stakeholder requirements, thereby improving project implementation success.

Similarly, the findings agree with those of Richardson and Keller (2021), who investigated renewable energy infrastructure projects in Germany, France, and Denmark. Their study established that projects adopting agile planning achieved higher schedule compliance, improved coordination among project teams, and enhanced implementation performance because project managers continuously adjusted implementation plans in response to technological and regulatory changes. These findings support the present study, where respondents strongly agreed that continuous review and updating of project plans contributed significantly to the successful implementation of the Gigawatt Solar Power Project.

The findings are also in agreement with Ndlovu and Maseko (2023), who examined infrastructure projects in South Africa and Botswana and found that agile planning improved project coordination, resource allocation, and risk management. Their study concluded that adaptive scheduling reduced implementation disruptions and enhanced project performance in complex project environments. Likewise, respondents in the present study strongly agreed that agile planning enabled efficient utilization of project resources and improved the project's ability to respond to changing implementation conditions.

At the national level, the findings concur with those of Mugisha and Nshuti (2024), who examined project planning practices among infrastructure projects in Kigali City. Their study found that adaptive planning significantly enhanced project coordination, implementation efficiency, and timely completion of project activities. They concluded that projects which continuously updated implementation plans were better able to achieve their objectives despite changing project conditions. Similarly, the present study established that agile planning positively influenced the successful implementation of the Gigawatt Solar Power Project by improving flexibility, resource utilization, coordination, and timely decision-making

4.1.3 Descriptive Statistics of Successful Project Implementation

The dependent variable of this study was successful project implementation. Successful project implementation refers to the extent to which the Gigawatt Solar Power Project achieved its intended objectives within the planned time, budget, quality standards, and stakeholder expectations. The study assessed respondents' perceptions regarding project implementation using indicators such as timely completion of project activities, efficient resource utilization, quality of project outputs, stakeholder satisfaction, and achievement of project objectives. Respondents were requested to indicate their level of agreement using a five-point Likert scale where 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D), and 1 = Strongly Disagree (SD).

Table 3: Agreement on Successful Project Implementation

Views of Respondents	N	Mean	SD
Project activities are completed within the planned schedule.	219	4.29	0.75
Project resources are utilized efficiently during implementation.	219	4.34	0.72
The project delivers outputs that meet the required quality standards.	219	4.43	0.67
Stakeholders are satisfied with the implementation of the project.	219	4.32	0.74
The project has successfully achieved its intended objectives.	219	4.46	0.65
Overall Mean		**4.37**	**0.71**

Source: Field Data (2026)

Table 3 presents respondents' perceptions regarding the successful implementation of the Gigawatt Solar Power Project. The overall findings indicate that respondents strongly agreed that the project was successfully implemented, as reflected by an overall mean score of 4.37 and a standard deviation of 0.71. The high overall mean demonstrates that the project achieved positive implementation outcomes across various performance indicators, while the relatively low standard deviation indicates consistency in respondents' views regarding the overall success of project implementation.

The findings reveal that respondents strongly agreed that the project has successfully achieved its intended objectives, recording the highest mean score of 4.46 and a standard deviation of 0.65. This finding suggests that the Gigawatt Solar Power Project effectively accomplished its planned goals and delivered the expected outcomes. Achieving project objectives indicates that implementation activities were properly coordinated, resources were effectively managed, and project teams remained focused on accomplishing the project's strategic goals. The high level of agreement also demonstrates that the project generated positive results that justified the investment made by stakeholders.

The study further established that respondents strongly agreed that the project delivers outputs that meet the required quality standards, with a mean score of 4.43 and a standard deviation of 0.67. This implies that the quality management practices adopted during project implementation were effective in ensuring that project outputs complied with established technical specifications and stakeholder expectations. Delivering quality outputs is a critical measure of project success because it enhances the reliability, sustainability, and long-term value of the project. The findings therefore suggest that the project management team consistently monitored quality throughout implementation and ensured compliance with industry standards.

Respondents also strongly agreed that project resources are utilized efficiently during implementation, recording a mean score of 4.34 and a standard deviation of 0.72. This finding indicates that financial resources, human resources, equipment, and construction materials were managed efficiently throughout project implementation. Efficient utilization of resources minimizes wastage, improves productivity, controls project costs, and enables project managers to maximize available resources while maintaining implementation quality. Effective resource

management therefore contributed significantly to the successful completion of project activities.

The findings further reveal that respondents strongly agreed that stakeholders are satisfied with the implementation of the project, recording a mean score of 4.32 and a standard deviation of 0.74. This suggests that the project successfully addressed stakeholder expectations through effective communication, stakeholder engagement, transparency, and delivery of expected project benefits. Stakeholder satisfaction is an important indicator of project success because satisfied stakeholders are more likely to support project sustainability and future organizational initiatives.

The statement that project activities are completed within the planned schedule recorded a mean score of 4.29 and a standard deviation of 0.75, representing the lowest mean among the successful project implementation indicators. Despite being the lowest, respondents still strongly agreed that project activities were completed according to the planned schedule. This finding implies that effective planning, continuous monitoring, timely decision-making, and efficient coordination among project teams enabled the project to minimize delays and maintain implementation timelines. Completing project activities within the planned schedule also reflects effective project control and sound project management practices.

The interview conducted with the Project Manager further supported the quantitative findings regarding successful project implementation. The respondent explained that the success of the Gigawatt Solar Power Project resulted from the effective application of agile project management practices throughout the implementation process. According to the Project Manager, continuous planning, stakeholder collaboration, and iterative implementation enabled the project team to address implementation challenges promptly while maintaining project quality, cost control, and implementation timelines.

The Project Manager stated:

> *"The successful implementation of the project was achieved because we continuously adapted our implementation strategies to changing project conditions. Regular planning, effective stakeholder collaboration, and continuous monitoring helped us complete the project while maintaining the expected quality standards and achieving the intended objectives."*

The respondent further explained that continuous communication among stakeholders and frequent evaluation of project progress enabled the project team to identify implementation risks early and implement timely corrective measures.

According to the Project Manager:

> *"Throughout the implementation period, we regularly reviewed project progress, monitored performance indicators, and addressed emerging challenges before they affected project outcomes. This approach significantly improved project efficiency and stakeholder confidence in the project."*

The Project Manager also emphasized that maintaining quality standards, ensuring efficient resource utilization, and encouraging stakeholder participation contributed greatly to the overall success of the project. These practices strengthened coordination among project teams, minimized implementation delays, and enhanced the achievement of project objectives.

Overall, the interview findings complement the quantitative results by confirming that the Gigawatt Solar Power Project was successfully implemented through the effective application of agile project management practices. The findings demonstrate that adaptive planning, stakeholder collaboration, continuous monitoring, and iterative improvement collectively enhanced project performance, resulting in timely completion, efficient resource utilization, quality project outputs, stakeholder satisfaction, and successful achievement of the project's intended objectives.

The findings of this study indicate that the Gigawatt Solar Power Project was successfully implemented, as evidenced by respondents' agreement that project activities were completed on schedule, resources were efficiently utilized, project outputs met the required quality standards, stakeholders were satisfied, and the project achieved its intended objectives. These findings are consistent with Shenhar and Dvir (2023), who argue that successful project implementation is achieved when projects attain their intended objectives within the planned scope, schedule, budget, and quality standards. They further emphasize that effective coordination of resources, stakeholder management, and continuous monitoring are fundamental determinants of project success.

The findings also agree with those of Turner (2024), who observed that successful implementation depends on effective execution of project activities, efficient coordination of project resources, and continuous monitoring throughout the project life cycle. Turner noted that projects managed through effective planning, coordination, and performance monitoring are more likely

to achieve timely completion, budget compliance, and quality outcomes. Similarly, respondents in the present study agreed that the Gigawatt Solar Power Project achieved its implementation objectives through efficient resource utilization, timely completion of activities, and delivery of quality outputs.

The findings are further consistent with Uwizeyimana and Niyonsaba (2025), who argued that the adoption of agile project management practices enhances project implementation performance in Rwanda by improving project flexibility, stakeholder engagement, communication, and continuous improvement. They concluded that organizations implementing agile management practices are more likely to complete projects on time, control implementation costs, and achieve expected quality standards. Similarly, the present study established that the application of agile planning, stakeholder collaboration, and iterative methods contributed significantly to the successful implementation of the Gigawatt Solar Power Project in Rwamagana District.

The findings are supported by the Agile Project Management Theory which collectively explain how agile project management practices contribute to successful project implementation. Agile Project Management Theory emphasizes adaptive planning, flexibility, and continuous improvement throughout project implementation; Stakeholder Theory highlights the importance of stakeholder participation, collaboration, and effective communication

4.1.4 Correlation Analysis

Correlation analysis was conducted to determine the strength and direction of the relationship between the independent variables (Agile Planning) and the dependent variable (Successful Project Implementation). The analysis employed the Pearson Product Moment Correlation Coefficient (r) because the study sought to establish the degree of linear association among the study variables. The Pearson correlation coefficient ranges from -1 to +1, where values close to +1 indicate a strong positive relationship, values close to -1 indicate a strong negative relationship, and values close to 0 indicate no linear relationship. The significance of the relationships was tested at the 0.05 level (2-tailed).

Table 4: Pearson Correlation Matrix

		Agile Planning (X1)	Successful Project Implementation (Y)
Agile Planning (X1)	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	219	
Successful Project Implementation (Y)	Pearson Correlation	.830**	1
	Sig. (2-tailed)	.000	
	N	219	219

Source: Field data, 2026

4.1.5 Regression Analysis

Multiple linear regression analysis was conducted to determine the combined effect of Agile Planning on the was employed because it enables the researcher to establish the extent to which the independent variables explain variations in the dependent variable while also identifying the relative contribution of each predictor. The results of Successful Implementation of the Gigawatt Solar Power Project in Rwamagana District. Regression analysis
the regression analysis are presented through the Model Summary, ANOVA, and Coefficients tables in the subsequent sections.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.830[a]	.689	.685	.25965

a. Predictors: (Constant),Agile Planning (X1)

The model summary presented in Table 5 shows the overall fitness of the regression model in explaining the effect of Agile Planning on the Successful Implementation of the Gigawatt Solar Power Project in Rwamagana District. The results indicate a correlation coefficient (R = 0.830), which demonstrates a strong positive relationship between the independent variables and successful project implementation. This implies that the combined application of agile planning is strongly associated with improved project implementation outcomes.

The coefficient of determination (R Square = 0.689) indicates that 68.9% of the variation in successful project implementation is explained by Agile Planning while the remaining 31.1% is attributable to other factors not included in the model. The Adjusted R Square of 0.685 further confirms that the regression model provides a reliable estimate of the relationship after adjusting for the number of predictor variables. In addition, the Standard Error of the Estimate (0.25965) is relatively low, indicating that the predicted values closely approximate the observed values. Overall, these findings suggest that the regression model has a strong explanatory power and is appropriate for examining the effect of agile project management practices on successful project implementation.

Table 6. Anova Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.144	3	10.715	158.929	.000[b]
	Residual	14.495	215	.067		
	Total	46.639	218			

a. Dependent Variable: Successful Project Implementation (Y)

b. Predictors: (Constant), Agile Planning (X1)

The Analysis of Variance (ANOVA) results presented in Table 4.9 were used to determine whether the regression model significantly explains the effect of Agile Planning on the Successful Implementation of the Gigawatt Solar Power Project in Rwamagana District. The results indicate that the regression model is statistically significant, with an F-value of 158.929 and a significance level of 0.000, which is less than the conventional threshold of 0.05.
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Furthermore, the regression model recorded a Regression Sum of Squares of 32.144 compared to a Residual Sum of Squares of 14.495, indicating that a substantial proportion of the variation in successful project implementation is explained by the predictor variables included in the model. This implies that the independent variables jointly have a statistically significant effect on successful project implementation

Table 7. Coefficient Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.619	.200		-3.096	.002
	Agile Planning (X1),	.316	.050	.380	6.335	.000

a. Dependent Variable: Successful Project Implementation (Y)

Table 7 presents the coefficient results showing the effect of agile planning on successful project implementation. The findings indicate that agile planning has a positive and statistically significant effect on successful project implementation, as shown by the unstandardized coefficient (B) of 0.316 and standardized beta coefficient (β) of 0.380. The t-value of 6.335 and significance value of 0.000 indicate that the relationship is statistically significant at the 5% level. This implies that an improvement in agile planning is associated with an improvement in successful project implementation. Therefore, the study concludes that agile planning significantly contributes to the successful implementation of the Gigawatt Solar Power Project.

4.2. Discussion of Findings

This section discusses the findings of the study in relation to the specific objective, empirical literature reviewed, and the theories underpinning the study. Specifically, the discussion examines the influence of agile planning on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. The findings are compared with previous studies to establish areas of consistency and divergence while demonstrating how they support the Agile Project Management Theory. The discussion further highlights the contribution of the study to the existing body of knowledge on agile project management practices and successful project implementation.

The objective of the study was to examine the effect of agile planning on the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda. The findings established that agile planning has a positive and statistically significant effect on successful project implementation. Respondents agreed that project plans were reviewed and updated regularly, project activities were prioritized according to changing needs, project teams adjusted implementation plans whenever changes occurred, and agile planning contributed to efficient utilization of project resources. The regression analysis further confirmed that agile planning significantly influences successful project implementation, leading to the rejection of the first null hypothesis.

These findings are consistent with Hartman and Delgado (2022), who reported that agile planning enhances project implementation by reducing delays and improving schedule adherence through continuous planning and adaptive management. Similarly, Richardson and Keller (2021) established that renewable energy projects adopting agile planning achieved better coordination, flexibility, and implementation efficiency because project teams continuously reviewed and adjusted implementation plans. Likewise, Ndlovu and Maseko (2023) found that agile planning improves resource allocation, coordination, and responsiveness to implementation challenges, thereby enhancing project performance. At the national level, Mugisha and Nshuti (2024) also concluded that adaptive planning significantly improves implementation efficiency and timely completion of infrastructure projects in Rwanda.

The findings support the Agile Project Management Theory, which argues that project success depends on continuous planning, flexibility, and adaptation to changing project environments. The evidence from the Gigawatt Solar Power Project demonstrates that continuously reviewing implementation plans and adjusting priorities enabled the project team to improve coordination, utilize resources efficiently, and successfully implement project activities.

5. Conclusion and Recommendations

5.2 Conclusions

The study concludes that agile planning is an important determinant of the successful implementation of the Gigawatt Solar Power Project in Rwamagana District. The findings established that effective agile planning enabled project managers and implementation teams to continuously review project activities, adjust implementation schedules, prioritize project tasks, and respond promptly to changing project requirements. These planning practices enhanced project flexibility, improved coordination among project teams, promoted efficient utilization of resources, and contributed to timely completion and quality achievement. The statistically significant positive relationship between agile planning and successful project implementation demonstrates that organizations adopting adaptive planning approaches are more likely to implement projects successfully under changing operational conditions.

5.2. Recommendations

Based on the findings of the study, three main actionable recommendations are made to improve the successful implementation of the Gigawatt Solar Power Project in Rwamagana District, Rwanda.

First, the project management team should strengthen agile planning practices. Project plans should be reviewed regularly with the participation of project team members and relevant stakeholders to accommodate changes in project requirements, resources, timelines, and implementation conditions. The team should use these review sessions to identify emerging challenges, revise priorities, assign responsibilities, and establish clear deadlines for corrective actions. This would enable the project to respond promptly to changes while maintaining its implementation objectives.

Second, the project management team should strengthen stakeholder collaboration and communication. Regular coordination meetings, consultations, and feedback sessions should be organized involving project managers, technical staff, contractors, government representatives, and other relevant stakeholders. Issues raised during these meetings should be documented, assigned to responsible persons, and followed up until they are resolved. This would improve coordination, reduce misunderstandings, facilitate timely decision-making, and strengthen stakeholder participation in project implementation.

Third, the project team should strengthen iterative implementation, monitoring, and continuous improvement. Major project activities should be divided into manageable stages, with progress reviewed at the end of each stage to identify weaknesses, obtain stakeholder feedback, and introduce necessary improvements before proceeding to the next stage. The project management team should also monitor key indicators relating to time, cost, quality, and stakeholder expectations and use the results to take corrective measures. This would help identify implementation problems early and improve the overall successful implementation of the project.

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