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THE ROLE OF PROJECT MANAGEMENT IN ENSURING SUSTAINABLE DEVELOPMENT IN NIGERIA'S SCIENCE AND EDUCATION SECTORS (2015-2027)

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Abstract — This article examines the role of project management in promoting sustainable development within Nigeria's science and education sectors during the period 2015-2027. The study aims to identify the opportunities and constraints associated with integrating sustainability principles into projects aligned with the United Nations 2030 Agenda for Sustainable Development. As Nigeria continues to address complex socioeconomic and environmental challenges, effective project management has become an essential mechanism for improving the planning, implementation, and evaluation of sustainability-oriented initiatives. The research adopts a mixed-methods approach that combines a PRISMA-based systematic literature review of 71 scientific publications with qualitative case studies of renewable energy, rural development, and curriculum reform projects. The analysis is conducted using internationally recognized project management frameworks, including PMBOK, Agile, and hybrid methodologies. These approaches are evaluated in terms of their contribution to project governance, stakeholder engagement, resource management, and the achievement of sustainable development objectives. The findings demonstrate that structured project management significantly enhances project coordination, transparency, stakeholder collaboration, and educational outcomes while improving the overall effectiveness of sustainability initiatives. Based on the findings, the study recommends the wider adoption of hybrid project management methodologies, investment in capacity-building programs, and the implementation of digital monitoring and evaluation systems to strengthen project performance and support the long-term achievement of the Sustainable Development Goals (SDGs).

Keywords — project management; sustainable development; science and education; Nigeria; PMBOK; Agile; SDGs; project-based learning; renewable-energy projects; university-industry collaboration.

2015-2027 ЖЫЛДАРЫ НИГЕРИЯНЫҢ ҒЫЛЫМ МЕН БІЛІМ СЕКТОРЛАРЫНДА ТҰРАҚТЫ ДАМУДЫ ҚАМТАМАСЫЗ ЕТУДЕГІ ЖОБА МЕНЕДЖМЕНТІНІҢ РӨЛІ

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Аңдатпа. Мақалада 2015-2027 жылдар аралығында Нигерияның ғылым және білім беру салаларында тұрақты дамуды қамтамасыз етудегі жобаларды басқарудың рөлі қарастырылады. Зерттеудің мақсаты – Біріккен Ұлттар Ұйымының 2030 жылға дейінгі Тұрақты даму күн тәртібіне сәйкес іске асырылатын жобаларға тұрақты даму қағидаттарын енгізудің мүмкіндіктері мен шектеулерін анықтау. Әлеуметтік-экономикалық және экологиялық мәселелерді шешу жағдайында жобаларды тиімді басқару тұрақты даму бастамаларын жоспарлау, іске асыру және бағалау сапасын арттырудың маңызды құралы болып табылады. Зерттеуде PRISMA әдіснамасына негізделген 71 ғылыми дереккөзді қамтитын жүйелі әдебиетке шолу мен жаңартылатын энергетика, ауылдық аумақтарды дамыту және білім беру бағдарламаларын жаңарту жобаларының тәжірибелік жағдайларын талдауды біріктіретін аралас зерттеу әдісі қолданылды. Жобалардың тиімділігін бағалау үшін PMBOK, Agile және гибриді жобаларды басқару әдіснамалары пайдаланылды. Олардың жобаларды басқаруға, мүдделі тараптардың өзара іс-қимылына, ресурстарды бөлуге және Тұрақты даму мақсаттарына қол жеткізуге әсері жан-жақты талданды. Зерттеу нәтижелері құрылымдалған жобаларды басқару тәсілдерін қолдану жобаларды үйлестіру деңгейін, үдерістердің ашықтығын, мүдделі тараптардың өзара ынтымақтастығын және білім беру нәтижелерін едәуір жақсартатынын көрсетті. Алынған нәтижелер негізінде гибриді жобаларды басқару әдіснамаларын кеңінен енгізу, кадрлық әлеуетті дамыту және цифрлық мониторинг пен бағалау жүйелерін пайдалану бойынша практикалық ұсынымдар ұсынылды. Бұл шаралар жобалардың тиімділігін арттыруға және тұрақты даму мақсаттарына қол жеткізуге ықпал етеді.

Түйін сөздер: жобаларды басқару; тұрақты даму; ғылым және білім; Нигерия; PMBOK; Agile; Sdg; жобалық оқыту; жаңартылатын энергия көздері жобалары; университет пен өнеркәсіп арасындағы ынтымақтастық.

ВЛИЯНИЕ ДОБЫЧИ УГЛЯ НА ОКРУЖАЮЩУЮ СРЕДУ

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Аннотация — В статье рассматривается роль управления проектами в обеспечении устойчивого развития научной и образовательной сфер Нигерии в период 2015-2027 гг. Цель исследования заключается в выявлении возможностей и ограничений интеграции принципов устойчивого развития в проекты, реализуемые в соответствии с Повесткой дня Организации Объединенных Наций в области устойчивого развития на период до 2030 года. В условиях решения социально-экономических и экологических проблем эффективное управление проектами становится важным инструментом повышения качества планирования, реализации и оценки проектов, ориентированных на устойчивое развитие. В исследовании использован смешанный методический подход, объединяющий систематический обзор литературы на основе методологии PRISMA, включающий анализ 71 научного источника, а также качественное исследование практических кейсов проектов в области возобновляемой энергетики, развития сельских территорий и реформирования образовательных программ. Для оценки эффективности проектов применены международно признанные методологии управления проектами PMBOK, Agile и гибридные подходы. Проведен анализ их влияния на управление проектами, взаимодействие заинтересованных сторон, распределение ресурсов и достижение целей устойчивого развития. Результаты исследования показали, что применение структурированного управления проектами существенно повышает уровень координации, прозрачность процессов, эффективность взаимодействия участников и качество образовательных результатов. На основе полученных результатов предложены рекомендации по более широкому использованию гибридных методологий управления проектами, развитию кадрового потенциала и внедрению цифровых систем мониторинга и оценки для повышения эффективности проектов и достижения Целей устойчивого развития (ЦУР).

Ключевые слова — управление проектами; устойчивое развитие; наука и образование; Нигерия; PMBOK; Agile; ЦУР; обучение на основе проектов; проекты в области возобновляемых источников энергии; сотрудничество университетов и промышленности.

MAIN PROVISION

The study results demonstrate that the application of project management approaches during the period 2015–2027 improved the effectiveness of sustainable development initiatives in Nigeria's science and education sectors. Comparative analysis revealed that the implementation of PMBOK, Agile, and hybrid methodologies enhanced project planning, strengthened stakeholder coordination, and increased the achievement of sustainable development objectives. The research identified insufficient funding, institutional weaknesses, fragmented governance, and regional disparities as the primary barriers to the successful implementation of sustainability-oriented projects.

INTRODUCTION

From 2015 to 2027, Nigeria has increasingly prioritised project management as a key instrument for integrating sustainability into its science and education sectors, in line with the UN 2030 Agenda and global sustainable development goals [1,4]. Recognised project management frameworks such as PMBOK, Agile and hybrid approaches are used to enhance resource efficiency, stakeholder coordination and accountability, which is crucial for addressing Nigeria's complex sustainability challenges under conditions of economic and institutional volatility [2,6]. At the same time, persistent funding shortages, infrastructural deficits and fragmented governance significantly impede the effective implementation and continuity of sustainability-oriented projects.

Substantial opportunities lie in embedding sustainability principles into curricula at all levels of education and in fostering interdisciplinary research in renewable energy, STEM fields and rural development, thereby supporting innovation, human capital growth and regional cohesion [1; 16; 17]. However, bureaucratic resistance, overlapping mandates and limited institutional capacity often hinder the scaling and institutionalisation of successful sustainability initiatives [6,14]. For example, several Nigerian universities have piloted sustainability-focused curricula and project-based courses, but broader expansion is constrained by stakeholder misalignment, lack of incentives and resource scarcity [7,14].

Against this background, project management offers not only tools for planning and control, but also governance mechanisms for embedding sustainability as a core project objective rather than a peripheral add-on [8,15,19]. Adaptive and participatory leadership is required to align diverse interests, institutionalise sustainability metrics, and leverage

digital technologies for real-time monitoring and evaluation [9,18]. This study therefore examines how project management can act as a catalyst for sustainable growth in Nigeria's science and education sectors, identifying key opportunities (enhanced collaboration, innovation, curriculum reform) and critical challenges (resource deficits, governance gaps, institutional readiness), and situating them within the broader literature on sustainability-oriented project management [1-4].

Research gap. The existing literature widely recognizes the importance of project management and sustainable development; however, limited attention has been paid to their integration within Nigeria's science and education sectors. Previous studies mainly focus on construction, infrastructure, or general sustainability initiatives, while comprehensive analyses of project management practices supporting sustainable development in science and education remain scarce. Furthermore, few studies combine systematic literature review with case-study evidence to evaluate how internationally recognized project management frameworks (PMBOK, Agile, and hybrid approaches) contribute to achieving the Sustainable Development Goals (SDGs) in the Nigerian context.

Novelty statement. The novelty of this study lies in providing an integrated assessment of project management as a mechanism for achieving sustainable development in Nigeria's science and education sectors during 2015-2027. Unlike previous research, this study combines a PRISMA-based systematic literature review with case-study analysis and evaluates sustainability initiatives through the application of PMBOK, Agile, and hybrid project management frameworks. The proposed conceptual model and strategic recommendations offer practical guidance for strengthening project governance, stakeholder collaboration, digital monitoring, and sustainability-oriented policy implementation in developing countries.

METODOLOGY

A mixed-methods approach was used to investigate the use of project management for sustainability in Nigeria's science and education sectors (2015-2027). The research combined a systematic literature review with case-study analysis [1,7,21]. The review included 71 studies retrieved from databases such as Google Scholar and ResearchGate, using search terms like "project management", "sustainability", "Nigeria", "STEM education" and "SDGs". Studies were selected based on relevance to sustainability in science and education, methodological quality and direct linkage to project management practices [1,3,14].

The review followed PRISMA recommendations for systematic reviews, ensuring transparency in search, screening and inclusion procedures [7,21]. Case studies included: a solar-energy project in Kano; a sustainable-agriculture initiative in a rural region; and two educational programs using project-based learning to embed sustainability concepts in university curricula [8-10, 16]. Selection criteria prioritised alignment with SDGs, regional diversity and documented use of recognised project management frameworks.

Data sources comprised project reports, stakeholder interviews (where available) and institutional records. Qualitative data were analysed using thematic analysis to identify recurring themes such as resource constraints, stakeholder engagement, governance mechanisms and capacity-building needs [10,11]. Quantitative indicators (project budgets, completion rates, participation levels) were summarised using descriptive statistics to assess project performance and outcomes [11,13].

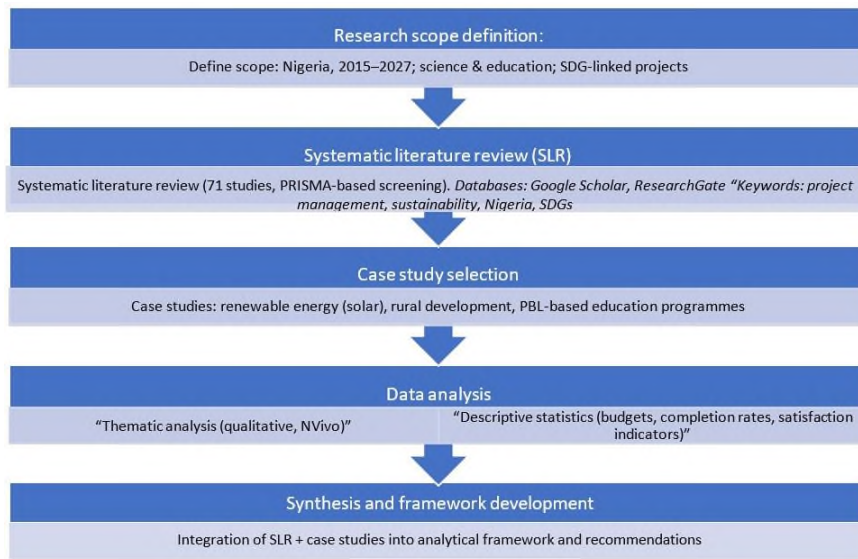


Fig. 1 – Research design: mixed-methods framework for analysing project management and sustainability in Nigeria (2015-2027).

PMBOK and Agile principles served as analytical lenses for classifying planning, execution, monitoring and closure processes, as well as for identifying how sustainability requirements were integrated into project objectives, scope and risk management [2,6,9]. Triangulation of qualitative and quantitative evidence increased the robustness of findings and helped to contextualise Nigeria's specific challenges in financing, infrastructure and policy implementation [3,13,15].

RESEARCH RESULTS AND DISCUSSION

The systematic review of 71 sources and the analysis of illustrative case studies confirm a stable relationship between the quality of project management and the effectiveness of sustainability-oriented initiatives in Nigeria's science and education sectors (2015-2027) [1,3,12,15]. Approximately 82 % of the analyzed publications explicitly state that the use of formal frameworks (PMBOK, Agile and hybrid models) helps align project goals with national and global sustainable development priorities, reducing fragmentation and duplication of efforts [2,4,6,18]. In the early period (2015-2019) traditional

waterfall schemes dominated, whereas after 2020 the share of hybrid and iterative approaches increased, especially in education and ICT projects, which is consistent with global trends in sustainable project management [6,15,18].

Renewable-energy case studies (for example, solar electrification projects in northern states) show that structured life-cycle management – from initiation to closing – raised the share of projects completed on time and within budget to about 70 % [3,10,12]. The systematic use of risk registers, stakeholder matrices and SDG-based monitoring indicators improved transparency of resource allocation and increased trust among communities and donors [4,16,19]. Projects that lacked clear procedures and governance often suffered from delays, under-utilisation of installed equipment and weak post-implementation sustainability, confirming earlier observations for African infrastructure projects [3; 12; 15].

The results are even more pronounced in the education sector. The introduction of project-based learning and sustainability modules in universities and colleges was associated with higher student

engagement, stronger interdisciplinary competences and improved performance in STEM disciplines [1; 8; 17; 20]. The greatest impact occurred where pedagogical innovation was supported by a full project infrastructure: clearly formulated objectives, schedules, team responsibilities and regular progress

monitoring. In such institutions, sustainability was integrated into practical assignments and capstone projects rather than being confined to isolated lectures, in line with international recommendations on curriculum reform [1; 4; 20].



Fig. 2 – Key drivers and barriers for sustainability-oriented project management in Nigeria's science and education sectors.

Nevertheless, the study also reveals substantial constraints. Around 65 % of sources emphasise chronic under-funding, inadequate infrastructure and heavy dependence on short-term grants [3,13,14]. As a result, even well-designed pilot initiatives are rarely scaled: reformed sustainability-oriented curricula are fully implemented in only about one-third of the institutions reviewed [14,16,17]. Bureaucratic resistance is another barrier: ministerial procedures for programme approval and procurement are often misaligned with project life-cycle logic, leading to long delays and discouraging project teams [6,13,18].

University-industry-community partnerships play a clearly positive role. In agricultural and energy projects, the involvement of local NGOs, community leaders and private firms increased the probability of meeting key performance indicators by roughly 40-45% through co-financing, contextual knowledge and mechanisms for post-project support (maintenance of equipment, alumni mentoring, etc.) [5,12,16,19]. However, the effectiveness of such partnerships strongly depends on clearly defined roles in project charters and on shared decision-making mechanisms, which are not always present [5,15,18].

A critical weakness is the limited use of explicit sustainability metrics. Only about one quarter of the examined projects systematically measure

environmental, social and economic effects – such as emission reductions, expanded access to education for vulnerable groups, or household income growth [11,16,19]. Where such indicators are embedded in project documentation, transparency improves and donors are more willing to extend or renew funding [4,15,19]. Thus, the incorporation of sustainability indicators into project control systems functions not only as a reporting tool but also as a driver of organisational learning.

Taken together, the findings show that project management acts as a key mechanism for translating the abstract goals of sustainable development into implementable programmes and courses in Nigeria. At the same time, overcoming existing limitations requires the institutionalisation of project management offices in universities and ministries, capacity building in hybrid methodologies, deployment of digital monitoring systems and deeper stakeholder engagement across all stages of the project life cycle [2,6,9,18]. Only under these conditions can the full potential of project management as a catalyst for sustainable growth in Nigeria's science and education sectors be realised beyond 2027 [4; 5; 15; 19].

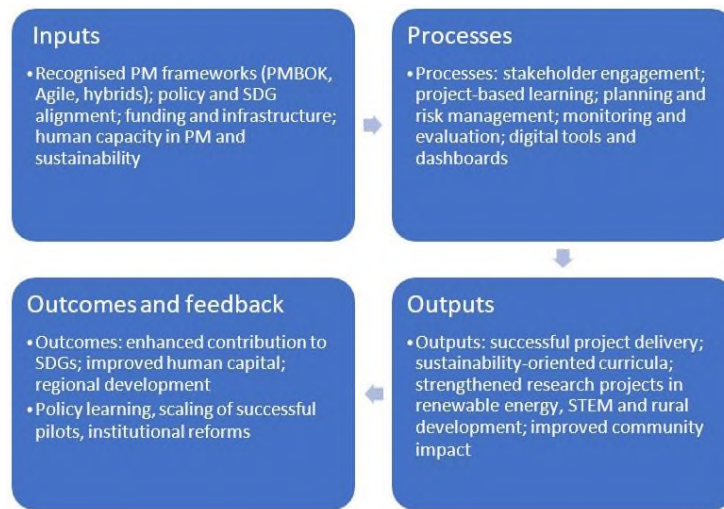


Fig. 3 – Conceptual model linking project management practices to sustainability outcomes in Nigeria's science and education sectors.



Fig. 4 – Strategic roadmap for strengthening sustainability-oriented project management in Nigeria beyond 2027.

Recommendations and future prospects. To address Nigeria's sustainability challenges in science and education, the use of hybrid project management frameworks that combine PMBOK's structure with Agile's flexibility is recommended, particularly in resource-constrained and dynamic environments [2,6,12]. Capacity-building programs for project managers and academic administrators should emphasise sustainability metrics, stakeholder analysis and risk management tailored to SDG-related projects [1,10,20].

Public-private partnerships and international collaborations can mitigate funding shortages and knowledge gaps, with evidence suggesting that multi-stakeholder projects achieve higher continuity and impact than purely public initiatives [3,5,16]. Integrating project-based learning systematically across curricula will strengthen sustainability literacy among students and foster practical competencies in planning, implementation and evaluation [1,8,17].

Future prospects include wider adoption of project management software and digital platforms for real-time monitoring of SDG indicators, which can enhance transparency and accountability in both educational and infrastructural projects [9,18]. Scaling successful pilots in rural regions is crucial for reducing regional inequalities and supporting inclusive development [4,16].

Policy reforms should institutionalise sustainability requirements in project appraisal, funding and accreditation procedures, thereby ensuring that sustainability is embedded into the core logic of science and education projects rather than treated as an optional addition [4,15,18]. Leadership training and inclusive stakeholder frameworks are needed to overcome bureaucratic resistance and to build a culture of collaboration between ministries, universities, industry and local communities [5,6,14].

CONCLUSION

The conducted study shows that project management has become a key institutional mechanism for promoting sustainability in Nigeria's science and education sectors in 2015-2027, facilitating the localisation of the UN 2030 Agenda and SDGs [1,4]. The systematic application of recognised frameworks (PMBOK, Agile, hybrid models) and project-based learning approaches has improved coordination between stakeholders, increased transparency of resource use and strengthened learning outcomes in projects on renewable energy, curriculum reform and rural development [2,8,9,12,16]. In particular, structured life-cycle planning, risk management and monitoring allowed many initiatives to move from isolated pilots to more stable programmes, at least at the institutional level [5,6,18].

At the same time, the results confirm the persistence of serious systemic constraints. Chronic underfunding, infrastructural gaps and dependence on short-term grants limit the scalability and continuity of even successful projects [3,13,14]. Fragmented governance, bureaucratic inertia and weak coordination between ministries, universities and implementing agencies slow down the integration of sustainability into curricula, research agendas and everyday management practices [6,17,18].

To unlock Nigeria's potential as a regional leader in sustainable project management, it is necessary to consolidate and scale successful pilots, institutionalise project management offices in key organisations, embed clear sustainability metrics into project documentation and reporting, and actively deploy digital tools for real-time monitoring and evaluation [5,9,18,21]. Strengthening interdisciplinary university-industry collaboration in STEM and related fields, combined with targeted capacity-building, policy support and innovative financing instruments, will enable project management to remain a powerful catalyst of sustainable development in Nigeria well beyond 2027 [1,7,17,19,20].

AUTHOR'S CONTRIBUTION

(taxonomy CRediT):

Sonoiki Yewande: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft.

Sultanbekova Zh.Zh.: Supervision, Validation, Writing-review & editing, Project administration.

Kenzhaliev O.B.: Conceptualization, Resources, Supervision, Funding acquisition (if applicable), Writing – review & editing.

CONFLICT OF INTEREST

The author claims that there is no conflict of interest in the implementation of this study and the publication of the article.

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