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THE IMPACT OF SOIL AND LAND ASSESSMENT DATA ON SUSTAINABLE DEVELOPMENT PROJECT OUTCOMES: A COMPARATIVE CASE STUDY IN NAKURU COUNTY, KENYA

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Abstract: *The purpose of this research was to evaluate how soil and land assessment data affected the results of sustainable development initiatives in Kenya's Nakuru County. In particular, it examined how soil fertility, texture, and drainage affected project success; compared the performance results of projects carried out with and without soil and land assessment data; identified important soil and land factors influencing sustainability and suggested methods for incorporating soil and land evaluation into upcoming projects. The study was motivated by the fact that effective environmental assessments, especially soil and land evaluation, are essential for successful and sustainable development projects (SDPs) because they provide information about land suitability, fertility, drainage, and erosion risk. Project planning, resource allocation and community satisfaction are all improved by using soil and land assessment data. Using a comparative case study design, the study examined through projects in Nakuru County, one of which made use of excessive soil and land assessment data and the other of which did not. Data was gathered by reviewing project documents and conducting interviews with community members and project managers.. To identify connections between soil and land evaluation and project success, data analysts used descriptive techniques. In terms of productivity, sustainability, and efficiency, the results indicated that projects using soil and land evaluation data performed noticeably better. Soil fertility, texture, drainage, slope, and land use adaptation were important elements that affected project success. Based on these findings, the study suggests that all development projects require soil and land assessment data. It also suggests that project staff be trained in land evaluation; soil conditions be continuously monitored; and policy support provided to guarantee that environmental assessments are incorporated into project planning and execution.*

Keywords: Soil Analysis, Environmental Assessments, Sustainable Development, Soil Fertility.

• Introduction

Sustainable development initiatives are essential for boosting economic growth, enhancing livelihoods, and encouraging resource efficiency. However, accurate environmental and site assessments are frequently necessary for their effectiveness, with soil and land data being crucial to identifying drainage, fertility, land suitability, and erosion hazards (FAO, 2017). The purpose of this study was to evaluate how soil and land assessment data affected the accomplishment of sustainable development initiatives in Kenya's Nakuru County. It assessed how much soil and land data was incorporated into project planning, compared the performance results of projects with and without such data, identified important soil and land factors influencing sustainability, and offered practical suggestions for upcoming projects (Pretty, 2008). Two projects were examined using a comparative case study methodology; one included data from soil and land assessments (SLAs) while the other did not. Interviews and project documents reviews were used to gather data. To ascertain the connection between soil/land evaluation and project results, statistical correlations and performance scores were used (Yin, 2018). According to the results, initiatives that incorporated data from soil and land assessments (SLAs) outperformed those that did not in terms of efficiency, sustainability, and community satisfaction. Soil fertility, drainage, slope, texture, and land use adaptability were important success factors. Based on these results, the study recommends SLAs be required for all projects; all project managers be trained in GIS and land evaluation; ongoing monitoring be conducted; and that policies be supported to guarantee that environmental evaluations are incorporated into project design (Pretty, 2008). It is anticipated that putting these suggestions into practice will improve project sustainability, efficiency, and long-term community effect.

The research was carried out in Kenya's Nakuru County. The Rift Valley region's Nakuru County is distinguished by a variety of soil types, land-use patterns and agro-ecological zones. The county was a good place to look at how soil and land assessment data affect the results of sustainable development projects since it has a lot of sustainable development initiatives, especially in the areas of agriculture, water resource management and land conservation.

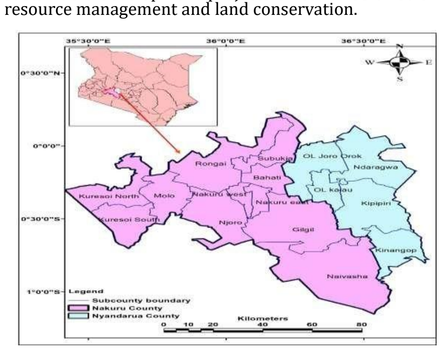

Fig 1: The map of Kenya illustrating the research study location (Nakuru County) (Otieno, 2020).

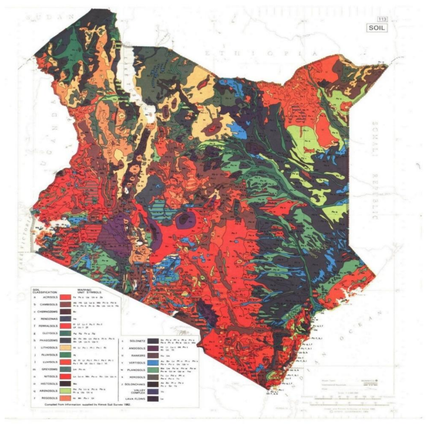

Figure 2: The map of Kenya illustrating soil patterns in Kenya (Kiogoro, 2026).

Statement of Purpose

Although soil and land evaluation is acknowledged to be important, limited research has been done on how it affects project success in Nakuru County. Delays, costs, low productivity and low community satisfaction are common outcomes of projects carried out without adequate assessment. By comparing projects that use soil and land assessment data with those that do not, this study aims to bridge the gap.

Research Objectives

1.To identify the effect of soil characteristics (fertility, texture, drainage) on the success of sustainable development projects.
2.To examine project performance results with and without data from soil and land assessments (SLAs).
3.To determine the important land and soil elements that have a major impact on the sustainability of the project.
4. To recommend strategies for incorporating land and soil assessment into upcoming initiatives.

• Material and method

Two sustainable development initiatives carried out in Nakuru County, Kenya, as well as the important parties engaged in their conception and execution, made up the target population for this study. Thirty (30) project managers and technical officers, thirty 30 county agricultural and land extension officers, and ninety 90 community leaders and beneficiaries recruited from the two (2) chosen programs made up the study's target sample of about one hundred and fifty (150) respondents. These groups were deemed suitable since they had firsthand experience with soil and land evaluation procedures, project planning procedures, and project performance results. Because of its varied soil types and land-use patterns, Nakuru County was chosen.

Judgemental sampling, was used in this study to choose participants who were thought to be informed and actively participating in sustainable development initiatives in Nakuru County. Because the researcher wanted detailed information about the use of soil and land assessment data and its impact on project outcomes which is information that could only be obtained from people with firsthand experience in project planning, implementation, and utilization, hence purposeful sampling was judged appropriate. Respondents were chosen using the researcher's discretion, considering factors including their position within the project, djudgmentalegree of technical proficiency, duration of participation, and knowledge with soil and land assessment procedures.

Category	Number
Project managers and technical officers	30
County agricultural, environmental and land extension officers	30
Community members and project beneficiaries	90
Total	150

Table 1: **Targeted population**

• Results and discussions

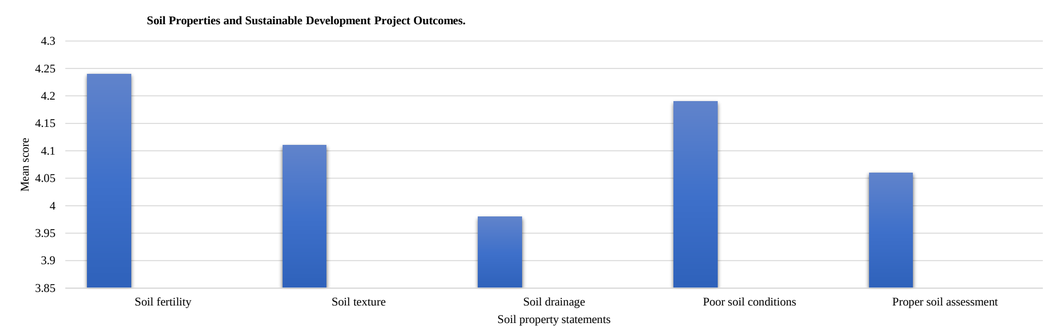

Chart 1: Soil Properties and Sustainable Development Project Outcomes (n = 76).

Effects of soil characteristics on the success of sustainable development projects

Soil fertility substantially impacts the productivity of sustainable development initiatives. Thus, projects created on nutrient-poor soils, which frequently need additional inputs to remain alive had lower productivity levels than those implemented on fertile soils. Soil texture was also found to impact crop performance and land use sustainability, whereby sandy and clay soils presented management issues and loamy soils offered superior agriculture and forestry outcomes because of their balanced water retention and nutrient-holding capabilities. Soil drainage was also found to affect project sustainability per the scores in Table 1, whereby well-drained soils improved long-term project outcomes by lowering the risks of erosion, waterlogging, and infrastructure failure. Poor soil conditions raised project operating costs, meaning that poor drainage or soil fertility led to increased costs for irrigation, fertilizers, soil amendments, and upkeep, which decreased their overall cost-effectiveness. Respondents also agreed that appropriate soil evaluation increased project success rates.

Project performance results with and without data from SLAs

Statement	N	Mean	SD
Projects that used soil and land assessment data achieved better overall performance	76	4.24	0.72
Use of soil data reduced projects maintenance and operational costs	76	4.11	0.79
Projects without soil assessment data experienced more implementation challenges	76	3.98	0.86
Soil and land assessment improved long-term project sustainability	76	4.19	0.75
Availability of soil data enhanced stakeholder satisfaction and confidence.	76	4.06	0.82
Overall	76	4.12	0.79

Table 2: **Mean scores of project performance with and without soil and land assessment**

The data from the respondents suggested they felt that projects with soil and land assessment data performed better overall. This is because soil-based planning increased the alignment of project design with site conditions, decreased uncertainty, and improved technical decision-making. The results also demonstrated that including soil data decreased project maintenance and operational expenses, suggesting that early detection of soil-related hazards including erosion, instability, or inadequate drainage reduced expensive repairs and implementation delays. The table further shows projects were believed to have higher implementation issues if they were carried out without soil evaluation data, meaning the lack of soil information frequently results in unanticipated issues like crop failure, infrastructure damage, or waterlogging, which had a detrimental impact on project deadlines and results. SLAs were also found to enhance long-term project sustainability, implying that projects based on precise soil data were more durable over time and needed fewer remedial actions. Having access to SLAs also was linked to improved stakeholder satisfaction and trust in project outcomes, suggesting that effective project execution increased community and implemented agency trust, encouraging ongoing involvement and ownership.

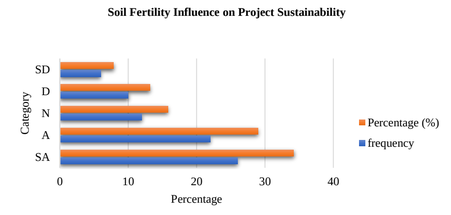

Chart 2: Soil Fertility influence on Project Sustainability

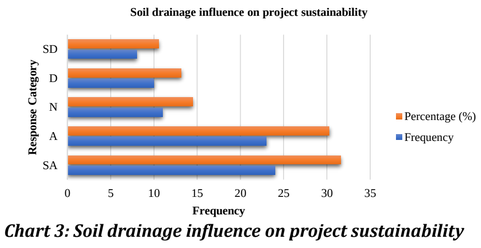

Chart 3: Soil drainage influence on project sustainability

Soil fertility was found to have a substantial impact on project sustainability per chart 2. Appropriate soil drainage improved project sustainability (chart 3). Additional data and results showed the respondents (32.89%) agreed that terrain and slope affected development projects' sustainability. SLAs integration at the project design stage was also agreed by 42.11% of respondents. The majority of respondents (34.21`%) also agreed that GIS and land appraisal frameworks enhance project planning. Data further showed that training project teams on soil and land assessment enhances sustainability as strongly agreed by 44.74% of respondents. Finally, most respondents (35.53%) agreed that embedding soil and land assessment into county and national policy frameworks improves project outcomes.

Delimitations of the study

The success of sustainable development initiatives was influenced by a variety of factors. The specific focus of the study, however, was to investigate how SLA data affect project performance in Nakuru County. It looked at the fertility, texture, and drainage of the soil. It exclusively looked at two specific projects in Nakuru County, one of which employed thorough SLA data and the other which did not. Other environmental, economic, or social aspects that could impact project success were not investigated in depth.

• Conclusions

The study's goal was to examine how soil and land assessments affect development projects' sustainability and success. The study carefully evaluated the impact of important land qualities, soil characteristics, and the availability of soil and land assessment data on project performance. It also suggested ways to enhance the integration of soil and land assessments in future projects. The results are especially pertinent to development planning in Nakuru County, where land-based initiatives often encounter sustainability issues associated with insufficient environmental assessment. The results showed that a key factor influencing project productivity and cost-effectiveness was soil fertility. While programs on nutrient=poor soils required larger investments in fertilizers and soil amendments, raising operating costs, initiatives on fertile soils reported increased agricultural yields, decreased reliance on outside inputs, and improved lives. Project outcomes were also found to be influenced by soil texture. For the second goal to examine how programs that included soil and land assessment data performed differently from those that did not, results indicated that projects guided by them consistently performed better, with fewer implementation delays, lower maintenance costs, and lower failure rates when soil stability maps, fertility data, and erosion risk assessments were used. For the third goal, results suggested that soil fertility and organic matter help maintain biological productivity and lower long-term reliance on outside inputs.

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