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Edited By
Anthony MW | Karen Afandi

EDITORIAL NOTE

Welcome to Volume 9, Issue 2 of the *African Research Journal of Education and Social Sciences (ARJESS)*. This issue brings together a diverse collection of research studies that reflect current trends, challenges, and innovations in education and social sciences across Africa. Our goal continues to be the dissemination of high-quality, impactful research that informs policy, practice, and further scholarly inquiry.

In this issue, readers will find studies addressing critical areas such as youth development, pedagogical innovations, school management, social welfare, and the intersection of education with sustainable development goals. The research presented demonstrates rigorous methodology, analytical depth, and practical relevance, offering insights that can support educators, policymakers, and researchers in shaping effective interventions in diverse educational and social contexts.

We hope that this issue will stimulate dialogue, inspire further research, and contribute to the advancement of knowledge that promotes educational excellence and social development across the continent. We thank our contributing authors, reviewers, and editorial team for their continued commitment to scholarly excellence and look forward to engaging with our readers on the ideas and findings shared in this edition.

Sincerely,
Anthony, M.W
Editor-in-Chief, ARJESS Journal

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INDIGENOUS FOOD MANAGEMENT PRACTICES AND CLIMATE CHANGE ADAPTATION IN SERERE DISTRICT UGANDA

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ABSTRACT

Climate change continues to be the single greatest threat to humanity with its blunt effects, affecting mostly the indigenous and local communities whose livelihoods are hinged on climate friendliness and dependent activities, thus the need for their involvement in shaping climate change adaptation and consequently its mitigation. For a very long time, indigenous communities have interacted with their environment and as a result, acquired immense information about it. Thus, the need for their involvement in climate change adaptation and mitigation discourse. This study, therefore, sought to examine the influence of Indigenous Food Management Practices on climate change adaptation among the Iteso community in the Serere district in Uganda. The study adopted a cross-sectional survey research design, and its sample was selected randomly. The sample size of 704 was arrived at using the Yamane formula. This included subsistence farmers, pastoralists, fishing communities, and small-scale traders. Data was collected using questionnaires and focus group discussions with the community stakeholders. For data analysis, SPSS and thematic analysis were used for quantitative and qualitative data analysis respectively, the study found that a significant portion of the population was vulnerable to food insecurity. This is mainly a preserve of both social, political, and economic factors and climate change, poor harvests from previous seasons had exacerbated their vulnerability to food insecurity. Also, over-dependence on produce to offset most households' expenses was a driver of food insecurity among the local communities, and poor agricultural and farming practices greatly affected the environment and led to climate change and food insecurity. Generally, the brunt effect of climate change among the community was manifested through food insecurity and poor agricultural production with 49.1% of the respondents indicating to be vulnerable to food insecurity and 15.1 specifying to be very vulnerable. Additionally, 84.1% of the respondents indicated that climate change was the major driver of food insecurity in the Serere district. The study also concluded that there should be a social-economic service to help offset some household expenses to prevent over-dependence on the sale of household food production. Also, there should be deliberate efforts to enhance the preservation and protection of indigenous foods and species to enhance sustainability and adoption by local communities. There should be efforts to provide food storage facilities for local communities, which will prevent wastage and post-harvest losses. Also, high-quality seeds should be provided, those which mature in short periods and have a lengthy shelf life. This will protect communities from food insecurity and famine in the face of climate change. The study further made recommendations for policies, action, and future studies.

Keywords: *Indigenous Food management practices, Climate change adaptation, Food insecurity, Food processing*

INTRODUCTION

Defined as a change or variability in weather conditions and surface temperatures over a long period, especially decades or longer (IPCC, 2011), climate change is the single greatest complex challenge that affects societies in many ways and has an impact on societal development (O'Brien 2008). The 1906-2005 century saw global average surface temperatures increase by 0.74 ± 0.18 °C (IPCC, 2007). Following an observation of global air, ocean temperatures, and changes in (among others) snow/ice extent and sea level, the Intergovernmental Panel on Climate Change (IPCC) concluded that the climate system has warmed, and thus climate change is a reality that humanity ought to grapple with. As a result, the parley on climate change has been at the epicenter of contemporary discussions in all spheres of development mainly arising from the sole fear that, unlike the medieval times, the rate, and extremes at which the climate is changing, poses not only an existential threat to humanity but also threatens the future of the coming generations.

Many factors have been hailed for the phenomenon. For example, in Africa and South Asia, the rise in population size has stressed the available resources, especially land and water leading to an alteration in land use with, for example, forests and permanent wetlands turned into farmland, to feed the growing population. This has destroyed the ecosystem further exacerbating climate change. Also, the increase in greenhouse gas emissions stemming from industrialization and increased human activity on the earth's surface has led to increased global warming and consequently climate change (Sustainability, 2021). Absolute temperatures have been observed globally case in point, in 2016, every month was hotter than the previous and saw the biggest jump in atmospheric CO2 concentrations. As a result, millions of people have been suffering across the globe from the impacts of climate change. For example, the El Niño-driven drought, made worse by climate change, is exacerbating food insecurity, which strongly indicates the severe climate adaptation and disaster preparedness gap, especially in developing countries. Globally, the number of people who are displaced from their homes due to extreme weather events is unprecedented. This situation is regarded as the biggest humanitarian crisis since the Second World War (UN, 2017).

However, the irony is that climate change is affecting the people who are the least responsible for its occurrence. The 2022 IPCC report titled impacts adaptation and vulnerability pointed out that climate change despite being a global phenomenon affected people in varying ways. People living in poverty and rural areas, who are barely responsible for greenhouse gas emissions, bear the wrath of climate change impacts. Despite governments and intergovernmental efforts to mitigate its occurrence, the trend seems to only progress. With a surge in food insecurity, increased internally displaced Persons, loss of lives due to climate-related occurrences, and environmental degradation due to human activities, measures to curtail and mitigate climate change should be intensified and the fight against climate change should take a multidimensional approach (UN 2019). In essence, the complexity of climate change requires developing and implementing a sufficiently complex response at all scales, from the international to the national, to the community, and down to the

household and individual levels. One which explores the social, political, cultural, and economic spheres of climate change. While also allowing for the integration of indigenous knowledge and practices into mainstream scientific undertakings to adapt to and consequently mitigate climate change.

Climate change cannot be eliminated thus the need for adaptation. The IPCC 2022, in all its six sessions, emphasized the need for adaptation to accompany mitigation efforts. However, proposed adaptation strategies have remained prohibitive to many vulnerable communities for example the farming communities in Africa, which derive their livelihood from rain-fed agriculture because of their inability to afford smart farming practices. This leaves production to a few farmers with access to funds, education, and generally buffers to combat climate change impacts. As a result of short rain seasons and long drought periods, farmers are often faced with low productivity and reduced yield, creating food hunger, and malnutrition leaving local communities' food insecure. Several social dimensions have been proposed to promote equity in climate change adaptations. Among these is gender, which takes into consideration the roles of men and women, targeting them differently to tailor climate change interventions. Additionally, migration and government policy have also been cited as coping mechanisms for the effects of climate change. Policy actions targeted at sustainable agriculture and rural development can help tackle the challenges posed by climate change. However, such interventions have fallen short of their goal due to the alienation of indigenous knowledge and practices (Awuah-Nyamekye, 2014). Thus, the need for incorporation of indigenous knowledge practices in the climate of climate change mitigation and adaptation.

Multiple studies have found that indigenous knowledge has not been taken into consideration when dealing with climate change in recent decades, the knowledge has been disregarded and perceived as primitive and not viable (Hobbs, N. T. 2013) & (IPCC 2022). To a larger extent, the exclusion of indigenous knowledge and practices regarding climate change mitigation and adaptation strategies among local communities could not only explain why the challenge of climate change continues to increase despite all government and international efforts but also, denies stakeholders the achievement of sustainable climate change mitigation, and adaptation strategies while also alienating local communities from the process of shaping their future regarding climate change. Given the above, to effectively curtail the progression of climate change, policymakers and stakeholders should explore how local communities without modern science have adapted and mitigated climate change. To allow for the integration of indigenous knowledge into mainstream practices and efforts to mitigate and adapt to climate change. Therefore, this study sought to examine the influence of Indigenous Food Management Practices on climate change adaptation among the Iteso community in the Serere District in Uganda.

METHODOLOGY

Research Design

To achieve the research objectives and to address the research problem, this study adopted a descriptive survey research design. A research design is the plan for obtaining answers to the questions being studied and for handling some of the difficulties encountered during the research process (Polit &Beck 2004). Research designs are developed to meet the unique requirements of a study. According to De Vos (1998) a research design is a blueprint or a detailed plan for how a research study is conducted. The term survey can be used to designate any research activity in which the investigator gathers data from a portion of a population for the purpose of examining the characteristics, opinions, or intentions of that population (Couchman & Dawson 1995).

A descriptive design was adopted because of its high degree of representativeness and the ease with which a researcher could obtain the participant's opinion (polit & beck 2004). This involved the use of both qualitative and quantitative data. The design provided answers to questions of who, what, when, where, and how, associated with the research problem. It also provided information about natural occurrences, health status behavior, attitudes, and characteristics of the group. Therefore, the descriptive study enhanced an in-depth understanding of climate change mitigation among agro-pastoralists, drought areas, fishing communities, and metropolitan areas respectively. In this doing the study's findings were context-specific and provided a robust understanding of indigenous practices and climate change adaptation among the Iteso people of Serere district.

Target Population

A population refers to an entire group of individuals, events, or objects having a common observable characteristic. In most cases, a researcher first defines the population to which she or he wants to generalize the result. Also, researchers would like to generalize results to the absolute population or target population (Mugenda &Mugenda 2007). Polit and Beck (2004) defined a population as the entire aggregation of cases that meet a set of criteria. The target population is the aggregate of cases about which the researcher would like to generalize the findings. This study targeted 704 respondents using the Yamane formula. This was composed of the fishing communities, subsistence farmers, pastoralists, and the business community in the urban centers. This allowed for the attainment of a robust understanding of climate change mitigation and adaptation among the diverse groups in the Iteso community.

Sample Size and Selection

From a population of 1,188,665 according to the 2014 national population and housing census, the sample size was derived using the Yamane formula and will be selected randomly from the areas of Kasilo (Apapai and Ongoto), Bugondo, Pingire and Serere Township. The sample areas were purposely sampled due to their unique economic activities. This was meant to capture climate change adaptation and mitigation strategies among wetland, pastoralists and relatively droughtridden areas respectively in Uganda and, among densely and sparsely populated areas. In this way, the study arrived at robust findings explaining climate change adaptation practices among

the Iteso community. However, the participants were selected through stratified random sampling. This was meant to ensure that everyone had the same chance of being selected or not selected.

Table 1
Sampling Frame

Category	Population	Sample Size	Sampling Technique
Business	109,238	104	Purposive Sampling
Fishing Communities	210,115	200	Purposive Sampling
Subsistence Farmers	457,303	200	Random Sampling
Pastoralist	412,009	200	Purposive Sampling
Total	1,188,665	704	

The sample size (n) will be:

$$n = N \div 1 + (e^2)$$

n = 4,188,665/ 1+

4,188,665 (0.0025) n =

704 n = 704

Instruments of Data Collection

The researcher employed questionnaires and Focus group discussions for data collection. Polit and Beck (2004) defined a questionnaire as an instrument for gathering information from respondents through the self-administration of questions on paper and pencil. The utilization of structured questionnaires enhanced objectivity and supports statistical analysis. The questionnaires were distributed to households. There were two types of questions in the questionnaire, and this included closed-ended questions and open-ended questions. This allowed the researcher to collect both qualitative and quantitative data.

Focus group discussions were conducted in groups of 5-8 people with relevant stakeholders and community members respectively to collect data relevant to the objectives. These groups were mobilized with the help of area chiefs and clan elders. Also, the conversations were held in both English and Ateso languages to allow for a robust engagement regarding climate change mitigation and adaptation. Finally, all questionnaires were collected by the researchers from different locations and kept safe while the recordings from the interviews were transcribed and prepared for analysis.

Data Analysis

The data analysis process involved several activities i.e., data editing for correctness and completeness, data coding, entry, and modification. The study employed both qualitative and quantitative methods both of which require different processes. In this case for quantitative data, cleaning of generated information through coding was undertaken to identify errors, omissions, and inconsistencies which was then be followed by a data entry and analysis process using the Statistical Package for Social Scientists (SPSS) and Microsoft Excel Package through Regression and Correlation analysis to establish the relationship between the variables of the study. The researcher then presented the findings in the form of graphs, charts, and written accounts.

For the qualitative data, the researcher undertook a descriptive statistical analysis of the information gathered from the open-ended questionnaires and the focus group discussion with respondents. Descriptive analysis allowed the researcher to be able to detect patterns and themes from data collected for inference which was achieved through thematic analysis. In this case, the researcher identified the most predominant themes in the responses. The results were presented in charts, graphs, and reports. The findings from the analysis were reported in chapter four and presented verbally before a panel.

Ethical Considerations

Despite the high value of knowledge gained through research, knowledge cannot be pursued at the expense of human dignity thus the need for ethical precepts in research Osoo and Onen, (2005).

In social research, confidentiality and anonymity of information provided by respondents are of utmost importance. If a researcher satisfies the respondents regarding the anonymity and confidentiality of the information they provide, the validity of responses is guaranteed as they provide actual information. Therefore, the researcher ensured anonymity and confidentiality by not asking respondents to write their names and personal details.

The researcher ensured informed consent by the participants. Informed consent was established by providing information to the respondents as to the nature and purpose of the study and the objectives of the study were communicated to the respondents. This information helped the respondents make informed decisions on whether to participate in the study or not.

Also, participation was voluntary. The researcher did not in any way both directly and indirectly through incentives coerces the respondents into participation in the study against their will. The decision of whether to participate or not was left for the respondents to make and on that basis, the researcher proceeded.

Finally, the researcher also obtained a letter of approval and introduction from the University and will obtain a pass from Serere seeking permission to collect data. To ensure that all the laws of the land are observed, and that the researcher's presence and activities are not illegal.

RESULTS

This section presents key findings regarding food management practices as a coping mechanism in the context of climate change.

Food Processing

From the responses, 96.3% of the respondents indicated that Sun drying was their preferred food processing mechanism while 2.5% specified using local preservatives for processing their food and 1.1% used factories to process their food. Having observed the trend, it was very clear that most respondents processed their food through sun drying. In this regard, people have harvested their produce and spread it under the sun, reducing the risk of food getting moldy or spoilt. Also, most households did not have specific areas to dry their food but instead used their compounds, public rocks, and house verandas as drying grounds for their produce which approach presented a health threat. The essence of sun drying was to remove water contents and increase aeration in food products to increase their shelf-life. Effective as sun drying may be, it has in most cases left communities vulnerable in times of natural calamities like floods and droughts because the foods could either decompose or be infested by pests. Also, those who used local preservatives gave examples like the use of red paper and Santana for sweet potato preservation, ash, and sawdust to preserve food items like beans and ground nuts among others.

Number of Meals

From the above responses, 56.8% of the respondents had two meals a day, while 36.7% of the respondents had three meals a day, 3.8% of the respondents had one meal a day and 2.7% of the respondents had more than three meals a day. Sit-down interviews and focus group discussions revealed the number of meals had daily, where a mechanism of coping with food scarcity and mainly a preserve of one's ability to access or acquire food. Follow-up interviews with participants indicated that when there is plenty of food respondents had more than three meals a day which effectively met their dietary needs. However, as the climate becomes drier and food becomes scarce, the number of meals is strategically reduced to prevent absolute starvation in cases where there is no food.

Also, the household population had an impact on the number of meals per day.

Table 2
Food efficiency and Number of Meals Per Day

Food efficiency	Three or more	Two or less	Total
No	70 (25.3%)	273 (63.9%)	343 (48.7%)
Yes	207 (74.7%)	154 (36.1%)	361 (51.3%)
Total	277 (100.0%)	427(100.0%)	704 (100.0%)

A Chi-square test of independence was conducted to test the relationship between food efficiency and the number of meals had per day with a chi-statistic of X-squared = 98.986, df = 1, p-value < 2.00, it was observed that the variables of food efficiency and the number of meals had per day had a statistically significant relationship and were therefore deemed dependant on each other. It was also observed that a significant percentage of participants who specified having two or more meals a day pointed out that they had sufficient food as a significant percentage of those who specified having two or fewer meals a day also did not have sufficient food. It was generally observed that the number of meals one had was a coping mechanism in that when there is food scarcity, the number of meals reduced and increased when food production was good.

Possible Causes of Food Insecurity

When asked about the possible causes of food insecurity, four responses were availed namely: Climate Change, Less Production, Increased Population, and Poor storage/ Consumption. From the responses, 84% of the respondents acknowledged that climate change is a significant driver of household food insecurity, while 59.0% pointed out that less production was a key driver of food insecurity, 49.4% pointed out that increased population was a factor in food security and 34.7% specified that poor storage/ consumption. Most of the participants acknowledged that climate change was a major driver of food insecurity in the district. This is because they could not plant crops which also led to less production in the gardens. Some respondents further indicated that the unpredictable weather had barred them from planting during the March- April rains and could have now been harvesting thus the lack of food.

Also, through focus group discussions, participants pointed out that the lack of enough land to produce sufficient food to feed their households was a driver of food insecurity. This was mainly a result of land tenure policies and traditions among the Iteso community which made land not easily accessible. It was further observed that the tenure systems and cultures disadvantaged women more than men. For instance, women did not inherit the land and did not have access to crucial economic resources as these were a preserve of the men.

Vulnerability to Food Insecurity

When asked about their vulnerability to food insecurity, the respondents were given four responses namely: Vulnerable, Not Vulnerable, Very Vulnerable, and Not sure. According to the responses, 49.6% of Participants were Vulnerable to food insecurity, 25.4% were Not Vulnerable to food insecurity while 15.1% of the participants were very vulnerable and 9.9% were not sure about their vulnerability to food insecurity. The varying degrees of vulnerability to food insecurity were a result of various factors both social and economic.

When the aspect of vulnerability to food insecurity in face of climate change was discussed in the focus group discussions, participants who specified to be vulnerable pointed out that the unfavourable weather conditions had made agriculture impossible and there was not much in terms of agricultural produce thus the vulnerability to food insecurity if climatic conditions continued.

Also, some respondents specified that the increasing vulnerability to food insecurity among households is the lack of organization and planning among household heads, for instance, households frequently sold foodstuffs which left them with no food for household consumption. During a sit down with a retired agricultural officer, he pointed out that food insecurity was not a common situation traditionally because people planned household agriculture well, clearly indicating which farm produce was for sale and which one was for household consumption, additionally with the supervision of area chiefs and clan leaders, every household had a granary full of staples to prevent the brunt effects of famine.

How to Address Food Insecurity

When asked about how food security should be ensured, respondents were given five responses namely: climate change mitigation, efficient storage, efficient Production, Economical Consumption, and Others.

According to the responses, 67.2% of the participants indicated that climate change mitigation was an effective way of ensuring food security, while 54.8 of the respondents specified that efficient storage was an effective way of ensuring food security, 52.8% of participants pointed out that efficient production was an effective path towards ensuring food security, 50.7% opined that economical consumption of produce and 12.4% believed that other approaches besides the provided ones where effective in ensuring food security. The high preference for climate change mitigation as a pathway to ensuring food security was because of its ability to enhance agriculture and its negative impacts on agriculture. Most respondents opined that despite the high population, effective and efficient agricultural production was the most viable option for climate change mitigation and the most viable option for ensuring food security.

The study also found that there were no reliable sources of food relief in times of crisis arising from climate change.

Table 3
Food Storage Vs Food Efficiency

Food storage	No	Yes	Total
Granaries	26 (7.6%)	40 (11.1%)	66 (9.4%)
Others	214 (62.4%)	185 (51.2%)	399 (56.7%)
Regular stores	103 (30.0%)	136 (37.7%)	239 (33.9%)
Total	343 (100.0%)	361 (100.0%)	704 (100.0%)

A Chi-square test of independence was conducted to test the relationship between food storage facilities and food efficiency. With a chi-square statistic of X-squared = 9.1797, df = 2, and pvalue = 0.01015, it was observed that there was a statistically significant relationship between food storage practices and food efficiency because a significant percentage of participants who indicated having granaries also specified to have enough food. Various explanations can explain the phenomenon, but the traditional aspect of food storage was a great contributor to food efficiency and those used regular food stores had a relative degree of food security, however, it was observed that a significant percentage of participants who specified use other mechanisms (sleeping houses) also specified not have enough food.

DISCUSSION

The study found that food management is a key adaptation mechanism because the greatest impact of climate was its brunt effect on food security. The study two a four-dimension approach to the analysis of food management i.e., food production, processing, storage, and consumption. The study found that a significant percentage of participants did not have adequate food due to the unreliable weather conditions which affected agricultural production. The study also found that agricultural production and storage were the key drivers of food insecurity, this was because less production and inefficient storage practices made produce vulnerable to waste and consequently food insecurity in the face of climate change. The study also observed that for effective food security despite climate change, efforts should be put into improving traditional food storage practices like the use of granaries, sleeping houses, and substandard stores among other practices which did not allow for a prolonged shelf life of the food product.

Regarding the efficacy of the existing climate change coping and adaptation practices, the high number of respondents who say they have done nothing about the climate change problems implies that there hasn't been sufficient sensitization concerning possible adaptation practices, or that the framers do not have enough resources to venture into adaptation measures such as planting improved seed, tree planting and practising sustainable agriculture. Early garden preparation as an adaptation to late rainfall onset enables the farmer to plant immediately when the rain starts so that

the crop benefits sufficiently from the short rain period that may follow. Planting as early as the rains start is effective since it ensures that the growing crop benefits sufficiently from the available rainfall. However, many farmers often fail to achieve this due to labour shortages in their homes. This is especially true for small-sized families with very young children who cannot participate in gardening. Thus, some portions of the land are tilled late, leading to poor harvest. This practice also requires sufficient information on the expected rainfall pattern. Otherwise, one is at risk of losing their planted crops in case the rain stops suddenly.

Also, Drought resistant crops, early maturing crops/varieties and improved seed are crucial adaptation mechanisms as such crops may have the capacity to produce considerable yield even when the rains are not sufficient or come late. However, very few farmers have access to the early maturing varieties and improved seeds as these usually come at a cost that the resource-poor farmers may not afford. Most farmers keep growing their traditional varieties, making this practice applicable to only a small fraction of society. Therefore, improving food security during climate change should incorporate increased social and economic accessibility of necessary agricultural inputs.

It was also observed that avoiding the sale of food, due to the reduced harvest per season, would increase the family's food reserves. However, this has a negative impact on access to other needs of the family such as medication, clothing, and education since crop production is the number one income source of most rural households. Therefore, families that stop selling their produce are at risk of having their children drop out of school (resulting into early marriages and a generation that may not help their parents during old age), being unable to buy clothing and mosquito nets for their members (resulting in malaria and pneumonia infections) and being unable to seek medical attention in case of sickness (resulting in miserable deaths). All these will eventually result in setbacks in the development of the communities. Another practice related to this was consuming food sparingly; this would allow the household to "survive" with little harvested produce but also puts the family members, especially children, at a risk of malnutrition that may escalate into death. Therefore, social-economic empowerment should be incorporated into mainstream climate change adaptation initiatives

Altering crop types depending on the rainfall situation in a given season is an effective adaptation measure as some crops can tolerate drought/excessive rainfall more than others. For example, if there's too much rainfall, the farmers grow sorghum instead of cassava since cassava is very susceptible to rotting. Some farmers mentioned that they sometimes decide to re-plant crops when the original ones are scorched and killed by lack of rainfall. This could be a good option though it has great implications on labour demand which is now diminishing as many people are seeking off-farm activities.

A small fraction of the participants mentioned soil and water conservation as a means of adapting to droughts and floods. It was evident from many gardens that farmers maintain grass bans between gardens with the purpose of conserving water and soil, and also ensuring that flood water can sink under these bans. The farmers, however, complained of a few community members that are failing

to adhere to this practice. This is such a commendable practice that should be encouraged. Other environmental conservation practices such as agroforestry and application of manure are potential climate change adaptation practices although they are not widespread. Water harvesting was also mentioned as an adaptation measure; however, this water seems to be used in the household and not for crop production since no farmer was found to be practising small-scale irrigation.

Seeking off farm jobs can be a saving option for the lucky peasants who may be able to find a job or employ themselves in other ways. In southwestern Nigeria, this was found to be the most common adaptation practice among the arable food crop farmers (Apat et al., 2009). However, it is worthwhile to note that all these "mouths" that abandon crop production will have to be fed by the remaining few farmers. Consequently, the amount of food produced will reduce and the food market prices will go high since more food from other areas will have to be supplied. This will eventually cripple the progress of those that have abandoned agriculture as they will be spending most of their income on food supplies. During the FGDs, the participants lamented that many young people have abandoned crop production; there are more mouths to feed than those engaged in food production.

Also, Cultivation in high areas is an effective adaptation measure to flood occurrence for those who have plots in such areas. This practice on the other hand is a dream for the people whose areas become entirely affected by floods like those who do not have access to high areas, warranting relocation. The community members also mentioned that they report to the sub-county officials for help when calamities such as floods and drought destroy their crops. The sub-county officials later forward the reports to the government and NGOs who usually provide food aid (maize flour and beans) and some seed. Nonetheless, the food aid usually provided is usually insufficient i.e., it cannot feed the households for the several months they take without any harvest. The households have to seek help elsewhere, such as from relatives who have employment in towns. Some farmers lamented that a lot of maize floors may be sent by NGOs, but each household may receive only two cups full. A Sub- County chairperson also lamented that his reports are usually not responded to immediately by the government department of disaster preparedness and awareness.

The study also found that culture was a key component for climate change adaptation in Serere district because it framed the context through which climate change occurred and was perceived among a particular group. From the field observation, a significant percentage of them specified that climate change was a result of both man-made and supernatural factors. The belief that supernatural beings had anything to do with the changing climatic conditions had a bearing on people's responses and therefore in a way culture influenced people's perception of climate change and also influenced how they responded to government initiatives in climate change adaptation and mitigation. Additionally, it was observed that traditional practices to some extent negatively impacted the environment leading to climate change for example rice cultivation and house construction in wetlands and bush burning as a means of clearing the land among others had an impact on the environment and consequently led to climate change. Similarly, it was also observed that climate change had a negative impact on climate, for instance, climate change-induced

migration led to cultural diffusion among the victims, and the loss of traditional plants and forests. Generally, it was observed that central-local climate change adaptation initiatives.

Regarding gender roles, it was observed that despite the seemingly equal impact of climate change on both genders, the indirect impacts of climate change had varyingly far-reaching social, political, and economic effects on men and women. For instance, it was observed that traditionally, that the role of earning household income was left to the male folk while ensuring household sustainability in terms of food production, ensuring there is enough food, its production, management, and consumption was left to women. And therefore, this disadvantaged women economically since most of their labour was unpaid unlike the men and also despite the droughts and floods, households still looked to the women folk to ensure there was household food. However, the scarcity that came with climate change had a bearing towards participants' psychological being since some became victims of violence, abuse and death in which case women were more vulnerable.

Lastly it was observed that people generally understood climate change and its impacts. However, the men had a high likelihood to participate in climate change while women were more caught up in instant gains for continued survival of their households. Also, despite the understanding climate change a significant portion of respondents believed that to some extent something could be done to address climate change, but they also believed that, to les extent their responsibility to mitigate climate change, they believed that the government had to lead in climate change adaptation and mitigation initiatives since the local communities did not the capacity. Therefore, there was a need for deliberate sensitisation to increase awareness on climate change, adaptation and mitigation and the significance of local community participation in this regard.

Regarding the farmers' perceptions of climate change and its effect on crop production. The results of the respondents‟ climate change perceptions imply that although the rural people do not know the science behind climate change, they have observed changes in their local weather and seasons. The citizens relate climate change to only environmental degradation in and around their areas; for example, cutting of trees and cultivation in wetlands to be responsible for increased drought; and, poor ploughing methods, bush burning and lack of grass bands being responsible for increased floods. Thus, the citizens are not aware of the global warming caused by the greenhouse gases emitted by industries and vehicles elsewhere, including places outside Uganda. These results are like those of the research conducted by the BBC World Service Trust, 2009, that found that most Ugandans often make little distinction between environmental degradation and climate change. In the same study, the media of which the radio is part was found to be the major source of climate change awareness (similar to findings from this study). The radio assumes the number one position in creating climate change awareness because many participants could afford it.

CONCLUSION

The study concluded that despite the increasing threat that climate change poses to local communities in Serere and the eastern region of Uganda, very little had been done to deliberately bring such communities to the discussion table where climate change adaptation and mitigation strategies are being identified and implemented. Therefore, this top-down approach which alienated local communities could effectively explain why the phenomenon persisted among local communities. Also, the study concluded that climate change mitigation initiatives should entail social empowerment initiatives to allow for sustainability. This is because the lack of alternative sources of income besides farming made communities more vulnerable. Therefore, there should be training in hand skills like tailoring, kneading, and backing among other stops to provide an alternative source of capital. In this way, vulnerability to the brunt effects of climate change will be reduced since there is a continuity in income flow despite climate change.

The study was premised on the diffusion of innovations theory and social systems theory. The study findings affirmed the thesis of the social systems theory by acknowledging the role of various institutions in climate change adaptation among the Iteso community. The study observed that the various social institutions like the family, education, religious and cultural institutions among others were a fundamental factor in enhancing sustainable community climate change adaptation. The study also affirmed the aspect of social acceptance in innovation acceptance because society had its traditional coping mechanisms that were always in conflict with mainstream innovation. Therefore, social acceptance was proven to be the last stage in the adoption of the innovation.
Studies should be conducted to establish the impacts of climate change on men and women so as to arrive at the necessary gender-sensitive climate change mitigation strategies. Studies should also be conducted to understand how minorities indigenously cope with climate change. Further studies should be conducted to find out sustainable climate change adaptation and mitigation approaches among local communities.

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ASSESSING COMMUNITY PERCEPTION OF POST-MINE BROWNFIELD'S EFFECT ON THE SOCIAL ENVIRONMENT AND VISUAL QUALITY OF URBAN LANDSCAPES IN KISUMU CITY, KENYA

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Abstract: *Brownfields (degraded landscapes) are considered as problem spaces, barriers and obstacles that do not fit well within the landscapes they are found within. Crime and other social evils besides hazards are usually associated with their abandoned, disused and derelict nature. They are not aesthetically appealing to residents of the neighborhoods in addition to occupying large areas that would be used more productively. While there is need to rehabilitate Kisumu's brownfields into more productive urban land uses, public perception of the social effects and visual quality of these sites is not clearly known. In accordance, this study postulates that rehabilitation of post-mine brownfields lies in understanding the social effects and visual quality they pose within the neighborhoods they are found in and which should not be neglected in the wake of spreading urban development to these areas. The purpose of this paper is to fill a gap in terms of assessing the public perception of the social effects and visual quality of post-mine brownfields within the urban landscapes. Case study research was carried with the unit of analysis being the brownfield sites and households living within a 500-metre radius of each brownfield site. A total of 96 participants selected randomly were involved in the survey within four brownfield neighborhoods that were purposively selected in the study due to long history of quarrying thus resulting into post-mine brownfields. The survey used questionnaires administered randomly and the findings were analyzed using percentages and presented in tables and figures. On site observation within the four sites was also carried through photography. The study found out that the post-mine brownfields affected the visual quality of the immediate areas due to waterlogging, visible rugged landscape, untamed vegetation and dumping of wastes. The findings revealed that the four postmine sites had very high levels of unpleasantness that affected the aesthetic value of the immediate surroundings. The study recommends that the negative spatial attributes of the sites such as untamed vegetation, dumping of wastes should be addressed to avoid possible hideouts for crime and other social evils that they pose as threats to the surrounding community. Planning for long term solution through rehabilitation re-uses that are productive and beneficial should be undertaken through holistic stakeholder engagement.*

Keywords: *Community perception, Degraded landscapes, Post-mine brownfields, Social environment, Visual quality, Urban landscapes, Spatial planning, Kisumu City Kenya,*

INTRODUCTION

Quarries and areas of surface mining within various parts of cities that remain untreated after closure of active mining result into diverse problems. They produce extensive damages to land and create diverse safety and environmental impacts (Milgrom 2008; Lin et al., 2005). According to Martinat et al. (2016) brownfields sites and their neighborhoods are greatly influenced by the neglected, abandoned, disused and devastated state that they present. These sites interfere with the functioning of the wider urban structure to the local levels where they are sited. The sites present problems of anti-social behavior in addition to other economic and environmental problems that they cause to the local neighboring residents to wider population at city level. The other social problems of brownfield sites are psychological in nature in terms of social stigma and fear that is connected with their neglected nature. All these negative attributes from the abandoned state negatively impact on the residents within such neighborhoods (Martinat et al., 2016). Abandoned sites of quarries, according to Buckley & Mason (2012), attract a host of harmful and unhealthy land uses. These sites are commonly targeted for illegal dumping of wastes. Neglected quarry sites often become hang-out sites of local gangs, fuelling various forms of crime. Siebielec (2012), points out frequent social problems as migrations, job loss, concentration of problematic inhabitants, vandalism and crime risk, movement of labor to be associated with such sites.

According to Tsolaki-Fiaka et al. (2018) the complete lack of security within abandoned quarry lands resulted in illegal dumping that affected the visual quality and this could result in social stigma for such areas. In addition, these unused quarry lands endanger the lives of the inhabitants due to lack of quarry fencing. The aesthetic alteration of the landform and change of geomorphological characteristics due to previous resource exploitation caused visible scars in such landscapes. On site observations by these authors revealed visual pollution due to illegal dumping of urban wastes, deteriorated landscape aesthetics, alteration of landscape landforms and the resultant reduction in land value (Tsolaki-Fiaka et al., 2018). According to Redondo-Vega et al., (2017); Legwaila et al., 2015; Nita (2012) abandoned quarry lands have visual impacts that may extend over large landscape areas that are noticeable as scars with colour contrasts. This affects the aesthetic appeal of the landscape and thus the scenic quality of the areas is reduced. Nita (2012) stresses the dissonance created in the visual and aesthetic values between the surrounding landscape and the abandoned quarry lands. Baczynska et al. (2018) considered the issue of landscape attractiveness of abandoned quarries in terms of uniqueness, differentiation and curiosity they evoked among local and foreign viewers who visited them. They established that even in their abandoned state quarries can be considered as: very attractive, attractive, slightly attractive and unattractive based on their visible landscape forms (Baczynska et al., 2018).

Open pit/surface mining of various resources such as stones extensively changes the landscape and can result in severe visual impacts of the affected landscapes. According to Simpson (1979), the physical change and contrast between the mine and its surroundings resulting from mining

operation vary over time and that the visual impact of change is dependent upon the viewer's perception of the modified landscape. There is great need to give a consideration to the visual impacts within and around the post-mine brownfields (Baczynska et al. 2018; Tsolaki-Fiaka et al. 2018; Legwaila et al., 2015; Simpson 1979). Simposon (1979), states that a person's perception of a mine is intertwined with the perception of the entire surrounding landscape and will be affected by distance from the mine, orientation of the mine, the viewing location and conditions of the areas surrounding the mine. Krause (2001), states that landscape is perceived as a visual resource. The holistic image of a landscape comprises not only its spatial and structural aspects but also the formal visual and cultural aesthetic expression of the landscape. The aesthetic value of landscape is one of the most threatened attributes of the human environment. This threat is particularly dramatic in post-mining landscapes. Legwaila et al., (2015); Sklenicka & Kasparova (2008), state that the key aesthetic problem of post-mining areas is the negative visual impact of the mining sites on the surrounding landscape. This means that the aesthetic value of the adjacent landscape is degraded mainly by the negative visual impact of the unreclaimed sites. The negative visual impact of the mining sites unavoidably lowers the aesthetic value of the landscape and its surroundings. So, post-mining landscape planning and rehabilitation activities should strictly consider the previous aesthetic characteristics of the land and their future development within an interdisciplinary approach.

Loures et al. (2015) assert that brownfields constitute environmentally impaired resources that need to be reintegrated into surrounding land uses of the community and as such be brought back to beneficial uses (Loures et al., 2015). According to Concerted Action on Brownfield and Economic Regeneration Network (CABERNET, 2012); Loures and Panagopoulos (2007) postindustrial landscapes that include post-mine brownfields play an important role in the development of a city both in terms of economy and environment. The presence of several derelict landscapes coupled with decreased new lands for urban development and concern for protection of the environment brings reclamation of derelict landscapes to the attention of several professionals. Their reclamation brings to an end the several problems they pose to the environment that includes ecological, social and visual quality problems as well. Kryzystofik et al. (2020); Martinat et al. (2016), Legwaila et al., 2015; Loures and Panagopoulos (2007) support the importance placed on the need to plan for rehabilitation of post-mine brownfields. These authors posit that making decisions on recent spatial development are particularly visible in large cities especially with regard to post-mining areas with focus being on their rehabilitation. Martinat et al. (2016) posit that a significant element of consideration of recent urban development and changes is the need to consider the significance presented by brownfield sites within a given city (Martinat et al., 2016). A study by Martinat et al. (2016), found out that awareness about brownfields problems was quite limited among the local population. Loures & Panagopoulos (2007) posit that landscapes from past industrial activities should be viewed as a

resource and a great opportunity to recover them through reclamation into new landscapes that offer multi-functions. The authors in this paper posit that the fact that post-mine brownfields are considered as barriers and obstacles should not shroud the very potential they present that is not yet realized in their various locations through rehabilitation.

We postulate that effective reuse of post-mine brownfields through rehabilitation starts with assessing the various problems they pose as concerns within the various local jurisdictions they are sited within through community perception. At the time of the study there was little known existing body of knowledge about the various post-mine sites in terms of their spatial attributes, effects on the environment and possible reuse options through rehabilitation to reintegrate them back into existing land uses in a compatible manner. This study sought to assess the community perception regarding the social effects and visual quality of the four post-mine sites on the urban landscapes within their neighborhoods. This was in terms of crimes and other social evils and the visual quality as perceived by the residents within the neighborhoods. This study postulates that understanding the social effects and visual quality of the post-mine brownfields is an important step in planning for their rehabilitation in an attempt to reintegrate them back into the planned urban landscape that then mitigates the problems they pose due to their neglected and abandoned state. Therefore, the current study intended to assess community perception of post-mine brownfield's effect on the social environment and visual quality of urban landscapes in Kisumu city, Kenya.

METHODOLOGY

The study was conducted in Kisumu City, Kenya. The study's geographical scope was limited to four post-mine sites within the four sub-locations of Nyawita, Migosi, Wathorego and Kanyawegi. The four sub-locations were selected purposively because of the long history of stone mining within them. By the time of the study, these sites had remained in abandoned, disused state due to closure of quarrying activities within them several years back. The brownfields studied were once the sites of stone mining that was converted into ballast and other concrete products.

Migosi Sub-location is within Kondele Location of Kisumu Central Constituency/Sub-County and was as a result of Municipal site and service scheme At the time of the study, Government of Kenya's Kenya National Bureau of Statistics GOK, KNBS (2009), census report revealed that it is densely populated at 4795 households within an area of 1.9 square kilometers and total population of 19,826 people. Nyawita Sub-location is found within Kondele Location of Kisumu Central Constituency/Sub-County. According Kisumu Integrated Sustainable Urban Development plan ISUD, (2013), Nyawita falls under the large belt of unplanned settlements and has informal housing mostly consisting of non-approved developments. At the time of the study, it was densely populated with 4099 households within an area of 1.3 square kilometers. According to GOK, KNBS (2009) at the time of the study it had a total population of 14,747 people.

Wathorego is within Kajulu West Location of Kisumu East Constituency/Sub-County. GOK, KNBS (2009) census report at the time of the study showed that it had a total population of 11,823 people, 2849 households within a total area of 9.0 square kilometers. Main economic activities include agriculture and quarrying for sand and stones. Quarrying for stones is carried out by companies that crush the stones into ballast and other products that they further use to process concrete products like building blocks, road kerbs and paving slabs (Kisumu ISUD, 2013). Kanyawegi Sub-location is within Kisumu South West Location of Kisumu West

Constituency/Sub-County. Land use designated for the area is peri-urban farmland i.e. agricultural use and land tenure is mostly private freehold (Kisumu ISUD, 2013). At the time of the study, it had a total population of 6,529 people. It was sparsely populated at 1454 households within an area of 17.4 square kilometers (GOK, KNBS, 2009). The main economic activities are agriculture, quarrying and various forms of businesses such as retail trading. The total population within the four Sub-locations according to GOK, KNBS (2009) at the time of study between October 2017 and March 2018 was 52,925 people and 13,197 households. However, from the reconnaissance carried out not all the population and households were aware of the post-mine brownfield within the sub-location.

Reconnaissance study was conducted between 2016 and 2017 to identify and locate the post-mine brownfields within the study area of Migosi, Nyawita, Wathorego and Kanyawegi sub-locations. The reconnaissance was carried out by interviewing the area sub-chiefs who are well versed with the location, number and landowners of the brownfields within their areas of jurisdiction. The study was carried out between October 2017 and March 2018 for data collection and analysis. All the four brownfields under study were identified and selected for study using purposive sampling method due to their large sizes. Each brownfield became a sample site due the fact that they were existing sites of former stone mining areas and that they no longer had mining activities ongoing. Other studies on brownfields have defined a brownfield neighborhood as a 500 meter (0.3 mile) circular radius around a brownfield (Pearsall, 2010; Fisher (2011). Essoka (2010), considered a slightly larger radius of 0.5 mile to allow for more general understanding of socio-economic character of areas adjacent to brownfields. This study was based on households that are living within the 500 metres from the boundary of the brownfield within each of the four sub-locations. According to GOK, KNBS (2009), the four sub locations where the four post mine sites are found have a total of 13,127 households. A total of 3300 households constituting a quarter number for all the households within the four sites was used to calculate the total sample size for all the four sites. Sample size calculation was according to Mugenda & Mugenda (2003) for population less than 10,000.

Selecting the households for each brownfield site was based on the sampling frame above with a total of 96 households for all the four sites. The number of households that constituted the sample for each sub location was therefore Migosi 35 households, Nyawita 30, Wathorego 21 and Kanyawegi 10 households Random sampling was used to collect data from the households from the boundary of each site and in the subsequent radii within the 500 metres boundary. Data was

collected from the willing respondents within each diameter of the concentric rings around each site with each first household being selected randomly and others within the ring picked randomly at various ends all-round the diameter. Proportional stratified sampling technique was used to calculate the number of households to form the sub samples to be included in the survey within each of the four sub locations of the study area. The primary data was collected through questionnaire, observation guide and photography. The respondents were asked their perception on various effects of the post-mine sites within their neighborhoods. On site observation was carried at random times of the day for each of the four sites under study. Observation and digital photography helped the researcher to cross check some of the responses from the respondents done through questionnaire. Quantitative data was analyzed using descriptive statistics including percentages. Analyzed data has been presented using texts, tables and figures.

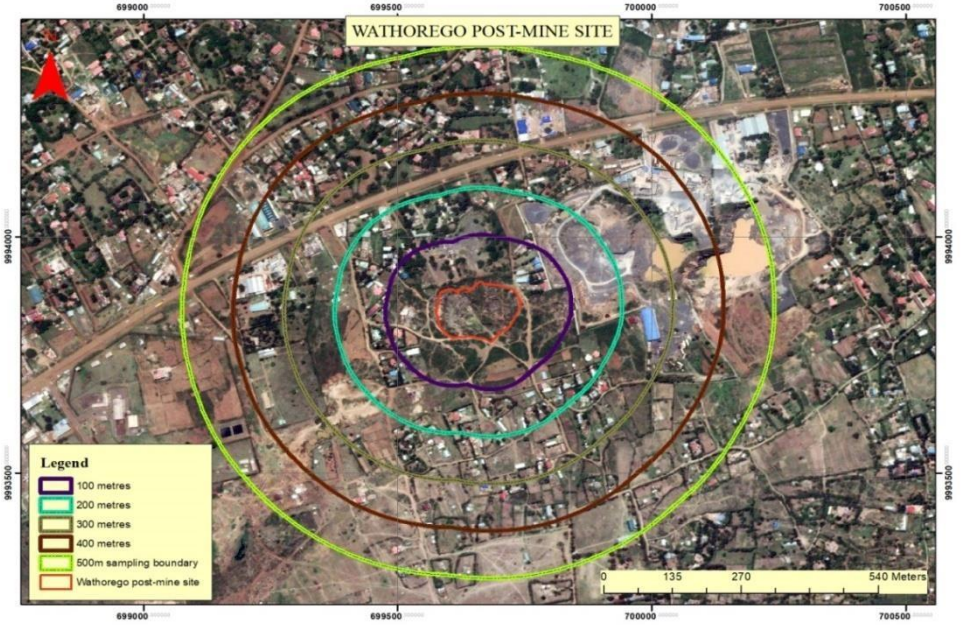

Figure 1: Satellite aerial image showing the sampling radius intervals and the 500 metres sampling boundary around the Wathorego post-mine site.

Source: Satellite aerial image (2018).

RESULTS

Demographic Characteristics of the Respondents

Respondents within the four sub-locations of the study area comprised 41% female and 59% male. The age distribution of the respondents showed that 46% were aged between years 18 and 30, 30% aged 31 to 40years, 15% were aged between 41 and 55while 9% were aged over 55years. Most respondents therefore were between ages 18 and 30. The age distribution is skewed to older age groups implying that most of the participants were mature persons. They were therefore, expected

to respond adequately to the study questions that were about the effects of the post-mine brownfields within their neighborhoods at the time of the study. Marital status of the respondents was that 64% were married 34% single. Educational attainment of the respondents indicated that 22% had attained primary education, 43% secondary education and 35% had tertiary education and above. The implication of these findings to the study is that 78% of the respondents were educated beyond primary school, hence expected to understand and objectively respond to questions regarding the post-mine brownfields within their neighborhoods.

How long the respondents had lived within the area of study around the brownfield was also analyzed. Those who had stayed for less than two years constituted 14%, two to five years of stay was 33% while the majority at 53% had stayed for more than five years. The length of residence results indicates that majority of the respondents had lived in their various post-mine neighborhoods for a period that would ensure they were aware of the existence of the brownfields and their effects on the neighborhoods.

Perceived Social Effects and Visual Quality

The survey sought the community perception on the social effects that was studied in terms of crime other forms of evil within the immediate surroundings. Visual pleasantness or not constituted the survey findings on visual quality of the immediate surroundings where the postmine brownfields were sited. The following Table 1 summarizes the social effects and effect on the visual quality across the four sites under study.

Table 1
Social effects of the post-mine brownfields on environment

	Nyawita post-mine site		**Migosi post-mine site**		**Wathorego post-mine site**		**Kanyawegi post-mine site**	
	Agreed	Disagreed	Agreed	Disagreed	Agreed	Disagreed	Agreed	Disagreed
Crime & other Social evil	82%	18%	86%	14%	94%	6%	100%	0%
Effect on visual quality	90%	10%	76%	24%	90%	10%	100%	0%

Public Perception on Crime and Other Forms of Evil

Nyawita post-mine brownfield according to 82% of the respondents as indicated in Table 1 above is perceived as a threat in terms of crime/insecurity as a hiding ground for thieves and other forms of evil, while 18% did not consider it a security threat. Its abandoned nature at 18% was attributed to the security threat, 14% attributed to the untamed vegetation that is wildly growing within the

entire post-mine and 68% was attributed to the hideouts that exist within the post-mine due to the deep depths at several points. The majority therefore attributed the deep depth that creates possible hideouts within the post-mine to the security threat. Those who didn't consider it a security threat attributed clears views into the post-mine at 86% while some attributed the distance from their residence to the post-mine at 14%.

Twenty six percent of Migosi respondents attributed its abandoned nature to be a security threat. Untamed vegetation that is wildly growing within the entire post-mine was attributed to a security threat by 29% and 45% attributed the hideouts that exist within the post-mine due to the deep depths at several points. The majority therefore attributed the deep depth that creates possible hideouts within the post-mine to the security threat. Those who didn't consider it a security threat attributed clears views into the post-mine at 62% while some attributed the distance from their residence to the post-mine at 38%. Twenty percent of Kanyawegi respondents attributed its abandoned nature to be a security threat while 80% attributed the security threat to the hideouts that exist within the post-mine due to the deep depths at several points. The majority therefore attributed the deep depth that creates possible hideouts within the post-mine to the security threat. On-site observation and site analysis at the time of the study showed that few residential houses were found close to the abandoned quarry boundaries hence no dumping of wastes was evident.

Wathorego's post-mine had its abandoned nature attributed to be a security threat by 9%, 34% attributed the untamed vegetation that is wildly growing within the entire post-mine and 57% was attributed to the hideouts that exist within the post-mine due to the deep depths at several points. The majority therefore attributed the deep depth that creates possible hideouts within the postmine to the security threat. Those who didn't consider it a security threat attributed the far distance from their residence to the post-mine at on-site observation and site analysis showed that the area immediately around the quarry boundaries has few upcoming developments but they were few and at least 50 to 80 metres distance from the abandoned quarry.

Public perception on visual quality/aesthetics

The aspects that affected the visual quality/aesthetics for the four post-mine brownfield sites was considered in terms of water logging, visible rugged landscape, untamed vegetation and dumping of wastes. Figure 2 below summarizes the results.

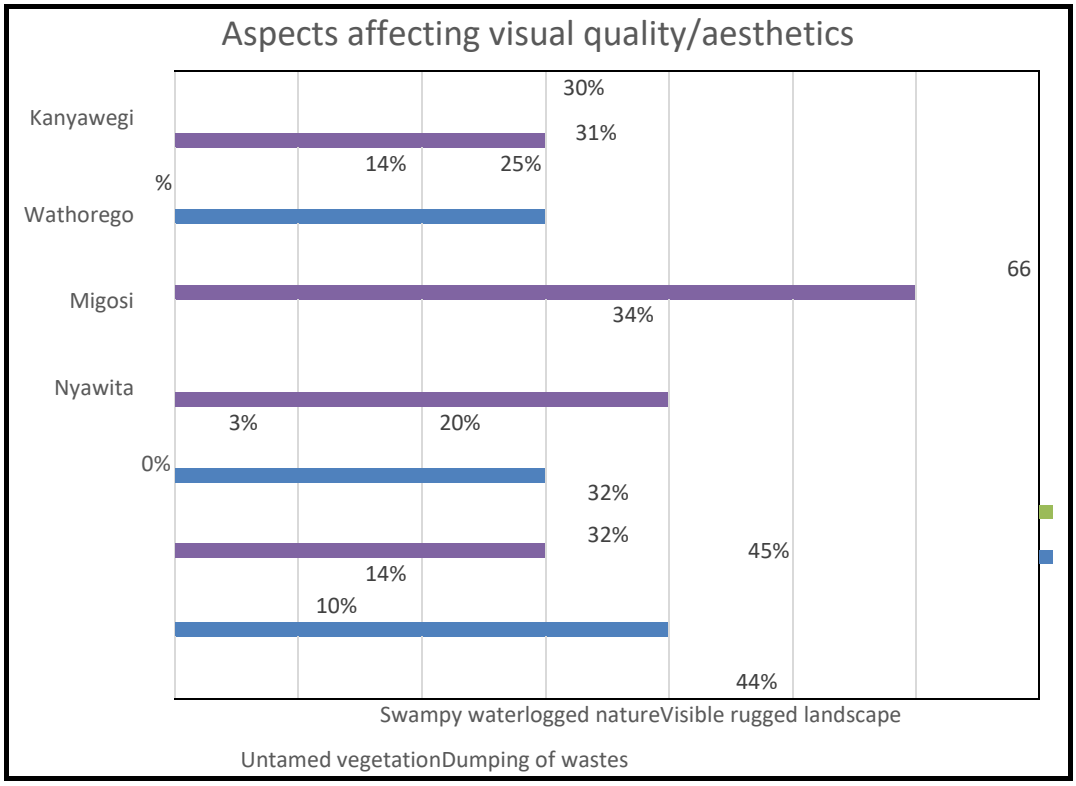

Figure 2 Aspects affecting visual quality/aesthetics within the four post-mines.

Visual quality for the Nyawita post-mine was considered in terms of views on the physical appearance/state of the quarry. Visible aspects included the dumping of wastes at various ends, untamed vegetation within the post-mine, visible rugged landscape appearance exposed by the deep depths, swampy waterlogged nature that was evident at the shallow entry point of the postmine as documented from the on-site observation and site analysis. As indicated in Figure 3 above, dumping of wastes was considered by 44% of the respondents to be affecting the visual quality and aesthetic value of the immediate surroundings, while untamed vegetation was considered by 10%, visible rugged landscape by 14% and the swampy water logged nature was considered by 32% by the respondents. The 10% of the respondents who did not consider the visual quality of the post-mine to be affecting the aesthetic value in a negative way attributed this to minimal dumping of wastes by 60%, few untamed vegetation by 20% and minimal rugged landscape by 20%. None of the respondents considered the water logging to be minimal and this supported the on-site observation and site analysis that had been carried out that revealed the water logging that was evident within the shallow entry point into the post-mine. The dry parts of the quarry during the observation and site analysis also showed signs of being water logged in times of heavy rains.

Plate 1 : Swampy waterlogged area next to the Nyawita brownfield entry point.

Plate 2: Dumping of household wastes on the northern side of the Nyawita brownfield.

Plate 3: Quarry depth at one end & creeping vine vegetation on the rugged quarry wall at Nyawita post-mine site.

Plate 4: Untamed vegetation along the quarry wall on the southern border.

Visible aspects affecting visual quality at Migosi included the dumping of wastes at various ends, untamed vegetation within and around the post-mine, visible rugged landscape appearance at some points, swampy waterlogged nature that was evident on the entire post-mine as documented from the on-site observation and site analysis. Dumping of wastes was considered by 32% of the respondents while untamed vegetation was considered by 20%, visible rugged landscape by 3% and the swampy water logged nature was considered by 45% of the respondents. None of the respondents considered the water logging to be minimal and this supported the on-site observation and site analysis that had been carried out that revealed the entire Migosi post-mine to be completely subdued in stagnant water without any outlet at any end to release the surface run off that collected within the post-mine.

Visible aspects at Wathorego included the dumping of wastes at various ends, untamed vegetation within and around the post-mine, visible rugged landscape appearance at some points, swampy waterlogged nature that was evident on the entire post-mine as documented from the on-site observation and site analysis. Dumping of wastes was considered by 32% of the respondents to be

affecting the visual quality and aesthetic value of the immediate surroundings, while untamed vegetation was considered at 20%, visible rugged landscape by 3% and the swampy water logged nature was considered by 45% of the respondents.

Plate 5 : Rugged quarry walls at the deep end of Wathorego brownfield.
Source: Author (2017)

Plate 6: Water logging within the deepest end of Wathorego brownfield.
Source: Author (2017)

Visible aspects affecting visual quality at Kanyawegi included the untamed vegetation within and around the post-mine, visible rugged landscape appearance at most points, swampy waterlogged nature that was evident on one end of the post-mine as documented from the on-site observation. Visible rugged landscape was considered by 34% while the swampy water logged nature was considered by 66% of the respondents. The four post-mine sites have an effect on the visual quality of the immediate surrounding and this was rated in terms of how unpleasant it was to the eye.

The visual quality of each post-mine brownfield has an effect on the aesthetic value of the immediate surrounding and this was of concern. The aspects used to rate visual quality included the aspects on Figure 2 above (swampy waterlogged nature, visible rugged landscape, untamed vegetation and dumping of wastes). The views of the respondents were as follows (Table 2):

Table 2
Rating for visual unpleasantness for the four post-mines

Visual quality	Points/ Percentage	Migosi	Nyawita	Wathorego	Kanyawegi	Average across the sites
No unpleasantness	0	5%	6%	10%	0%	5.25%
Very low unpleasantness	1-20	7%	0%	0%	0%	1.75%
Low unpleasantness	21-40	9%	2%	19%	0%	7.5%
Medium unpleasantness	41-60	17%	42%	16%	20%	23.75%
High unpleasantness	61-80	26%	24%	16%	33%	24.75%
Very high unpleasantness	81-100	36%	26%	39%	47%	37%
Total		**100%**	**100%**	**100%**	**100%**	

The unpleasantness was ranked from lowest indicating no unpleasantness to the highest indicating very high unpleasantness. From the Table 2 above, very high unpleasantness was selected by majority of the respondents across all the four post-mine sites. More than 60% of the respondents across the four post-mine sites rated the visual unpleasantness to be high to very high with ranges between 61-80 and 81-100 respectively. This confirms the findings of the on-site observation during the site visits that revealed this through the waterlogged nature, visible rugged landscapes, untamed vegetation and uncontrolled dumping of wastes. Very few respondents across the four sites felt that there was no unpleasantness as a result of the four post-mine sites at the time of the study. This finding can be attributed to the respondents who lived far away from the post-mine boundaries who were not aware of any dumping and other negative attributes of the sites that those who interacted closely with the sites were well aware of.

DISCUSSION

The study sought to assess the effects of the post-mine brownfields in terms of social effects and effects on the visual quality. Social effect was studied in terms of community perception of crime and other social evils. The four sites had varying depths from 3 metres to 15 metres that posed great risk and danger of presenting possible hideouts for crime and other social evils. According to Buckley & Mason (2012) studies have long linked high crime rates to areas that have visible physical deterioration. Other authors (Tsolaki-Fiaka et al., 2018; Baczynska et al 2018; RedondoVega et al. 2017; Martinat et al (2016); Legwaila et al., 2015; Nita, 2012) stressed the

problems attributed to disused, abandoned state of the quarry lands that they presented to the neighborhoods within which they are located. The post-mine brownfields in this Kisumu case study were overgrown with untended vegetation and filled with trash from illegal dumping. At the time of the study, there were concerns by the County Government of Kisumu on the need for sustainable mining and as well as rehabilitation of abandoned quarry lands. At the time of the study all the four post-mine sites exhibited abandoned, disused, neglected nature that posed security threat to the immediate residents and the neighborhood at large. The four post-mine brownfields in this study had overgrown untamed vegetation, with wastes from illegal uncontrolled dumping.

Visual analysis for this study was based on the spatial attributes of the quarry and its impact on the immediate surroundings. The spatial attributes and that of immediate surrounding were analyzed in terms of presence/extent of dumping of wastes, untamed vegetation, visible rugged landscape and swampy water logged nature. The relative distance of the respondents' residence to the postmine was considered. The relative distance from the boundary of the sites revealed varying responses from the residents. Simpson (1979) posit that public attitude about abandoned mines is influenced or should be influenced by the visibility of the mines. According to Legwaila et al. (2015) aspects of landform that impact on landscape quality in abandoned mine lands include rock exposure, soils and terrain (slope and elevation) while properties of visual quality is in terms of colour, line, texture, form and scale. These authors stress the fact that the main components of quarry landform present safety and visual quality challenges. They cause contrast in form and colour between the quarry landform and the nearby undisturbed landscapes (Legwaila et al., 2015). Migosi and Nyawita post-mines have been surrounded by residential houses and the only open areas around the quarry pits are the undeveloped plots but the respondents were aware of its presence and felt it had negative visual impact on aesthetic value of the immediate surroundings. Kanyawegi post-mine was screened by vegetation and by the high topography of the quarried area. Wathorego post-mine was screened by vegetation on one end that is on the high topography while the other sides were exposed to nearby access roads and were not screened off with vegetation. Majority of the respondents in all the post-mines despite the relative distance from their residence to the abandoned quarries had a feeling that the visual impact negatively affected the aesthetic value of the immediate surroundings.

Baczynska et al. (2018), state that areas of abandoned quarries are an important element of the environment in terms of both their regional and national meaning. Excavated holes left after exploitation of solid rock minerals are characterized by many features resulting into various landscapes. These authors suggest that the main indicator of a quarries' attractiveness is their uniqueness, aesthetic appeal, interest, and the curiosity they raise among the viewers. This leads to classification based on attractiveness in terms of: very attractive, attractive, slightly attractive, and unattractive quarries. These authors established that unattractive quarry landscapes showed little vertical differences, had bad preservation state and had no contrast to the surrounding areas that ensured they remained hardly visible (Baczynska et al., 2018).

Findings for this paper revealed that all the four post-mines were characterized by high exposed, rugged stone walls and untamed vegetation that provided excellent hiding areas both during the day and night hence posing a security threat within their neighborhoods. Majority of the respondents across the four sites rated the visual quality they presented at the time of the study to be highly unpleasant based on the negative spatial attributes the exhibited. The four abandoned quarries in this study had changes in their landform, texture and this created a contrast between the quarry pit and their surroundings leading to major visual impacts. This confirms the earlier findings by Tsolaki-Fiaka et al., (2018); Legwaila et al., (2015); Sklenicka and Kasparova (2008) on the negative visual impact of post-mine sites on the surrounding landscape that unavoidably lowers the aesthetic value of the landscape and its surroundings. The negative aesthetic value associated with these sites further leads to social stigma for such areas (Martinat et al., 2016).

Based on the findings of this study, the authors propose the holistic long term planning for rehabilitation of the existing post-mine brownfields. The authors argue that continued presence of post-mine brownfields without planning for their reuse into beneficial land uses through rehabilitation means the physical and social problems they pose will continue to be felt within their localities. If their present state is not addressed, then the risk of hazards due to accidents, safety threats due to crime, social evils and problems like illegal dumping that impact negatively on the environment will continue to be felt within the neighborhoods they are located in. CABERNET (2012); Koudela et al. (2004) state that post-mine brownfields reduce an area's intensity for beneficial and productive land uses. This negatively impact on the local neighborhood and the urban economy at large. The notion that these sites in their abandoned state are scars on the face of cities, are liabilities that degrade the value of the surrounding land and are barriers to local development (CABERNET, 2005) should be reversed and mitigated through rehabilitation that allows for appropriate reuse land use options. Rehabilitation to eliminate their negative effects so as to achieve social acceptance, environmental sensitivity, and economic gain should be prioritized. If not done, environmental stigma associated with these sites continues and the urban landscape in general suffers.

CONCLUSION

The study has drawn conclusion that different residents within the post-mine boundaries had different perception regarding the social effects and effect on visual quality that they posed within the neighborhoods. Those farther away from the post-mine sites but within the study radius did not feel the sites were a security threat that aided in committing crime and other social evils unlike those who lived closest and had regular interaction with the abandoned and neglected spaces. The negative attributes that can aid in committing various social evils should be addressed through long term planning for reuse through rehabilitation. The brownfield land owners should address short term problems caused by untamed vegetation to eliminate possible hideouts that aid in committing various crimes and other social evils within the neighborhoods. Planning for long term reuse through beneficial and productive land uses would overcome the current negative attributes such as abandoned nature, untamed vegetation and deep depths that the survey findings revealed posed security threats and were contributing to negative visual quality within the neighborhoods.

All the negative spatial attributes like water logging, deep depths, and untamed vegetation for the four post-mine sites should be addressed to convert them into positive attributes that are beneficial for the preferred reuse options when planning for rehabilitation. Addressing these negative spatial attributes leads to elimination of the negative effects they pose within these neighborhoods. The study recommends that all the four abandoned post-mine sites should have their untamed vegetation managed to avoid possible hideouts that may be security threats. Water logging prevalent in all of the should be addressed by planning for proper storm water management within and around them for the preferred reuse option to be successful and to reverse and eliminate the current problems associated with this negative attribute.

Visual unpleasantness across the four post-mine sites that was supported by majority of the respondents should be addressed. Those who lived closest to the post-mine sites felt the negative attributes more than those who lived farther away and were not aware of such acts as uncontrolled use of the sites to dump wastes. Addressing long term solution to these problem spaces that are currently considered obstacles and barriers to neighborhood development will also address the problem of negative visual quality. Integrating new re-use land uses that are compatible with the existing residential land use will ensure productive and beneficial uses that are visually pleasant to the residents within the neighborhood. There is need for the regional authorities like County Government of Kisumu to have an elaborate database of the various post-mine brownfields within their jurisdiction to aid in planning the rehabilitation into beneficial uses.

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THE ROLE OF STRATEGIC RESOURCE UTILIZATION IN INTERNAL EFFICIENCY OF PUBLIC SECONDARY SCHOOLS IN MOMBASA COUNTY, KENYA

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Abstract: *The purpose of the study was to evaluate the role of strategic resource utilization in internal efficiency of public secondary schools in Mombasa County. The study adopted a convergent parallel mixed methods design where data was analyzed both qualitatively and quantitatively. Stratified random sampling techniques were used to arrive at the study sample size of 134 respondents. The study sample size was drawn from the school principals, teachers and BOM chairpersons. Research instruments used to gather information during the study include questionnaires, interviews, and document analysis. The instruments were validated and pilots were conducted. Reliability in this research was determined through tests such as t-tests, correlation, ANOVA, and regression analyses. Descriptive statistics in the form of mean, variability such as standard deviation and variance were applied. The data was then presented in tables, graphs, pie charts and percentages. The results obtained through correlation and regression show that resource utilization significantly affect the internal efficiency. Therefore, when other factors are held constant, for every unit change in the independent variables, the internal efficiency increases thus indicating a strong relationship. The study provides useful information that may make it easy for education stakeholders to address challenges of resource utilization and the realization of internal efficiency. As a recommendation, the study provides a base for policymakers to inform and formulate policies on applying strategic planning in improving the internal efficiencies of public secondary schools in Kenya.*

Keywords: *Academic performance, Completion rate, Government Policy, School strategic resource utilization*

INTRODUCTION

Strategic planning has become part and parcel of this global world. Across all economic and social sectors, it has benefits arising from its full implementation. It gives both institutions and organizations a smooth run in relation to effectiveness and efficiency. To achieve an internally efficient system, there is a need for provision, improvement and effective allocation and utilization of facilities and resources in educational institutions in most developed nations

(OECD, 2021). In the education institutions, it was first perceived that its implementation would help them address the quality of education and efficiency in utilizing limited educational resources. The nations in the west, such as the USA, Japan, and Europe have achieved their economic milestone by investing heavily in the careers of students that complete their studies successfully. The genesis of strategic planning is linked to firms that need to enhance their productivity. The Americans adopted strategic planning as a prudent way of managing educational resources at various levels. Regarding resource utilization as an indicator of strategic plan implementation, the US government saw the need to allocate a significant share of its financial resources to education, specifically targeting spending more per student. The government devotes about 75% of total expenditure to core-educational services. This significantly positively impacts the internal efficiency of education institutions (OECD, 2021).

In France, strategic planning allowed efficient resource management decisions; more resources do not necessarily stand for better results but their utilization aspect. Therefore, the French government could meet broad social demands by adopting strategic plans. Many industries and business firms in Germany adopted strategic plans to maximize future advantages and become internally and externally efficient (Lindermayr, 2017). Based on the research done in Cuba, all public education institutions offering primary education are state-owned. For this reason, there is an indication that all education institutions receive very high allocations and are thus ranked one of the highest annual budget allocations in the world. The institutions have therefore recorded a high utilization rate. This is estimated at 13 percent of Cuba's annual budget (Lopez, 2017).

The government of Kenya has been laying out strategies that can be used to improve academic performance and increase the rate of student completion. For instance, the policy of developing and adopting the use strategic plans in public secondary schools, scholarships (Presidential Uwezo scholarships), training of the teachers, allocating a big share of the financial budget to education, free tuition education in all public schools, allocating and utilizing of instructional and physical, financial and human resources. Nevertheless, academic performance in public secondary schools in Kenya is declining, and the quality is also decreasing. Despite the government policy of 100% transition, no repetition, and Free Day Secondary Education (FDSE) policies, there are several challenges that the country faces with the implementation of strategic plans that hinder the realization of internal efficiency (Onyango, Orodho & Nderitu, 2020). The directive by the government on the development and adoption of strategic plans in schools has seen Mombasa County come up.

In Mombasa County, several schools have adopted strategic planning to address the completion rate of students and improve academic performance in national examinations. Although the government's effort is to ensure strategic plans are implemented, there are still many challenges that the county faces, such as low completion levels of students and inadequate resource management practices, among others (Mombasa County Government 2018; Madiha, Mwaura & Philomena 2019). With this, it is evident that students' academic achievement and high completion rates in secondary education are crucial, but a 100% completion rate has not yet been achieved, affecting schools negatively. On the other hand, KCSE performance in the schools is

still deficient even with the government's financing education. In Mombasa County, public schools have not achieved significant positive changes in academic performance in KCSE and internal efficiency. In addition, there has been little effort to conduct a study to establish the role of strategic resource utilization on internal efficiency. Therefore, the study intended to examine the role of strategic resource utilization in the internal efficiency of public secondary schools in Mombasa County, Kenya.

Resource Utilization and Internal Efficiency: An internally efficient education system produces a maximum output out of a minimum input without wastage like repetition and dropouts. So, efficiency in education cannot be overlooked (Onyango, Orodho & Nderitu, 2020). In education, internal efficiency refers to the ability of an institution to graduate its students with minimum resources. In most cases, internally efficient systems aim at avoiding wastage through improper and indiscriminate allocation and utilization of resources that an institution has at a given time. As a concept, efficiency has some background related to economics. It refers to the optimal correlation between education inputs and outputs (students who complete their secondary education successfully). An education system is termed internally efficient if there is a high completion rate of learners and students who successfully achieve high scores in KCSE and join colleges and universities. Schools' use of resources plays an integral role in ensuring that strategic plan implementation succeeds within a school and as such. Therefore, their role and impact should not be underestimated.

Resource utilization is the degree to which resources are used to achieve a specified goal or objective (Murithi, 2016). It also keeps the managers and other critical stakeholders on their toes to remain agile, proactive, and in readiness for rescheduling where there is a need and prioritize key areas as quickly as possible. Resource utilization is an important aspect that cannot be ignored. It ensures that there is the maintenance of productivity where it keeps check on underperforming and overburdened areas for appropriate allocation and reallocation. Again, it enables maximum use of resources at disposal to yield maximum results. Resource utilization refers to the strategic process of measuring how effective resources are in achieving internal efficiency. Resource utilization is successful depending on the educational resources that schools possess. Resources can be in the form of time, financial, human, and forms of material resources. Material resources include: classrooms, laboratories, a library, dormitories, office space for staff, equipment, internet facilities, sources of power supply, visual and audiovisual gadgets, computers and printers, and photocopier machines. Every human activity has to start by considering the objectives or output expected. Therefore, resources must be efficiently utilized to achieve school.

Educational resource utilization holds an important position as far as the achievement of goals and objectives is concerned. In reference to Ayodele & Ogbiye, (2018), the rate at which an institution achieves its goals and targets is related to the educational resources utilized. It is how many resources are allocated and how well the available resources are utilized effectively to enhance education development. Resource utilization requires effective and consistent management of the resources such as time, material resources like classrooms, laboratories,

libraries, dormitories, and offices for staff, books, equipment, internet facilities, power supply, projectors, computers and printers, and photocopier machines. In a study by Odenyo and Rosemary, (2018), underutilization of resources negatively impacts internal efficiency. Human resource utilization has always been ignored. They include the teachers, the support staff and other key stakeholders such as the school community. In most cases, this resource is over-utilized in understaffed schools.

Ayodele and Ogbiye, (2018) revealed that universities in Ekiti utilized resources moderately and that a significant relationship existed between resource utilization and internal efficiency. It was realized that the utilization of educational resources is significant because of the role played in achieving educational objectives and goals. Further, it is essential to note that it is not only how much resources are allocated but also how well the available resources are utilized effectively and according to the need to attain an internally efficient education system, thus, would help in the development of education. The study highlighted resource utilization as the only determinant factor of internal efficiency with cohort analysis.
The current study determined the role of strategic plan implementation on internal efficiency in Kenya using a mixed methods design. Five indicators of strategic plan implementation were studied.

A related study by Mukhanji et al., (2016) indicates that student enrolment and completion rates of students' increase is attributed to increased private and public funding for universities. If the government reduced funding, enrolment decreased. An increase in enrolment affects resource allocation and utilization hence the shortage of resources. The researcher studied universities, covering the enrolment aspect concerning resource utilization. The study adopted a descriptive survey design with a questionnaire as the only tool for data collection and targeted strategic plan implementation with resource utilization as one of its indicators. The current study targeted all categories of public secondary schools, and a mixed-method design was applied for a deeper understanding.

In a study by Sang et al., (2015), on the "Level of implementation of strategic plans in secondary schools in Nandi county,' the findings revealed that the majority of secondary schools in the county did not have operational strategic plans and the ones that had strategic plans prioritized resource management in order to realize internal efficiency. The schools that did not have strategic plans cited resource challenges due to poor mechanisms of mobilizing and utilizing the resources they possess as corroborated by (Luhangala & Anyieni, 2019). The study covered the effect of strategic plans on academic performance and resource challenges. The current study examined the role of strategic plan implementation on internal efficiency which had not been adequately handled. A mixed method was applicable since the descriptive method used was not exhaustive.

The government of Kenya has intended to create efficient internal systems in all public secondary schools. For this reason, strategic planning in public secondary schools is being championed to create an internally efficient system and performance-based management driven to ensure

education reform and ensure budgeting for effective resource utilization. The government has rolled out some funding programmes in secondary schools in an attempt to promote a high completion rate and a high performance in academics among learners in public secondary schools. Despite a high enrolment of students in form one attributed to the policy of no repetition and 100% transition to secondary school, minor achievement in terms of academic performance has been recorded in the county (Mombasa County Government, 2018; Sidi, Kindiki & Ongeti, 2020). The government also ensures that external and internal monitoring is done so as to ensure strategic resource utilization, students' poor performance and low completion rates in the county still deny the society development opportunities; consequently, the county misses potential earnings from its citizens' current and future economic activities. This yearly decline in academic performance in national examinations has led to a public outcry (Madiha, Mwaura & Philomena, 2019). As a result, the researcher sought to fill the gap by conducting a study to examine the role of strategic resource utilization in internal efficiency of public secondary schools in Mombasa County, Kenya.

METHODOLOGY

The study adopted a mixed method design where triangulation was used. Qualitative and quantitative data was collected concurrently, compared and related, and then merged during analysis and interpretation as posited by (Schoonenboom & Burke, 2017) see Fig. 1.

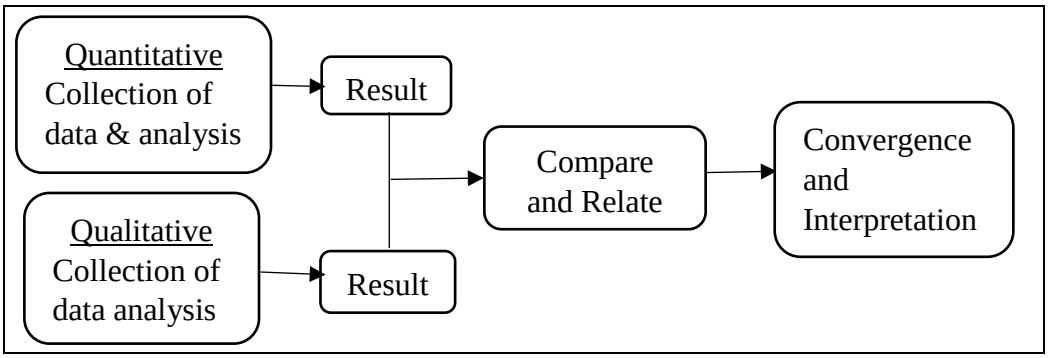

Figure 1 Convergent Parallel Mixed Method

Sampling Techniques

Stratified random sampling technique was applied. The schools were stratified into four categories. The schools, principals, and BOM chairpersons were randomly sampled. As a general principle, it is best to have a large sample. Further, Gay, Mills & Airasian (2006) stipulate that a sample size of at least 20% to 50% of the population is a good representation, especially for small populations, while a sample size of 10% is representative enough for large populations. Therefore, out of 40 schools, 13 principals and 12 BOM chairpersons were sampled at 30%, while 108 teachers were sampled at 20% from each stratum. The total sample to be studied is made up of 134 respondents.

Data Collection Instruments

Research instruments used to gather information during the study include questionnaires, interviews, and document analysis.

Validity of the Instrument

The pilot study conducted improved face validity and content validity, (Orodho,2009). Therefore, research instruments were submitted to university supervisors to ascertain content validity through appraisal of the tools and verification by the supervisors. Blank spaces and responses in the instruments that seemed inaccurate or inconsistent indicated weaknesses that were reviewed after piloting**.**

Reliability of the Instrument

Test-retest reliability was conducted to confirm reliability. The researcher gave 12 teachers questionnaires to fill, 3 principals and 3 BOM chairpersons were interviewed. Then after two weeks, similar instruments were re-administered to the same respondents, after which statistical tests were done to determine the reliability of the data. Cronbach's alpha test was done, and a correlation coefficient for the two tests calculated.

Data Analysis procedures

Data analysis was done both qualitatively and quantitatively applying convergent parallel mixed method design as shown in Fig 1. Qualitative data collected from the interview and document analysis were organized into significant patterns to create meaning. Qualitative data from the principals' interviews were subjected to inductive content analysis through coding, creating categories and abstractions to enrich the analysis and findings of the study (Elo & Kyngas 2008). The results were transcribed and put in themes before being reported thematically. Quantitative data was subjected to descriptive and inferential analysis with data from the teachers' questionnaire. Data was coded, labeled to variables, and organized before being entered into SPSS.

Tables, graphs, pie charts, frequencies, means, and percentages were used to analyze data on the implementation of strategic plans and the internal efficiency of secondary schools. The data collected was subjected to multiple correlation coefficients to establish the direction and the strength of the relationship between the independent and dependent variables (Sharma, 2018). Pearson product-moment correlation coefficient (r) was used. Further, multiple linear regression was applied to explain scores on a criterion variable based on obtained scores on two or more predictor variables and knowledge of the relationships among all the variables. Outputs of analyzed data were then presented in tables, percentages, frequencies, graphs and pie charts. A multiple regression analysis was used to establish the significance of independent variables. Analysis of Variance (ANOVA) was used to determine the variability or statistical differences between means of three or more independent groups in the data set. Finally, a one-way ANOVA was used to compare the effects of an independent variable on dependent variables.

RESULTS

Demographic Characteristics of the Respondents

The study sought to examine the demographic characteristics of the respondents. The characteristics examined included the following:

Regarding the gender distribution of the respondents, slightly more than a half (51.8%) of the respondents was male while only 46.3% of them were female.

Regarding the age bracket of the respondents, the youngest respondents were in the bracket of 21-30 years and had the least proportion (7.5%). This was followed by two age brackets of 31- 40 and above 50 years, at 25.9% each. The most common age bracket (40.7%) was 41- 50 years. The majority of the teachers who participated in the study were within the age bracket of 41-50 (40.7%), which is ideal for purposes of maturity, the performance of duties, and experience gained.

On the levels of education, the least respondents were Diploma holders (7.5%), Masters Holders at 34.6%, and finally Bachelors holders accounting for 57.9%. Therefore, the majority of the teachers are graduates (57.4%), which is consistent with the current trend in the teaching profession in secondary schools in Kenya

Resource Utilization and Internal Efficiency

The study sought to examine the role of strategic resource utilization on internal efficiency of public secondary schools in Mombasa County, Kenya. The strategic resource utilization was measured through adequacy of resources and level of Resource Utilization in School.

Adequacy of Resources

Respondents were asked to rate (on a scale of 1-5 where 1 is not available and 5 is more than enough) the adequacy of the key resources in their institutions. These resources include textbooks, toilets/ latrines, departmental offices, classrooms, feeding programmes, school transport, library, and laboratories. The results obtained are presented in Table 1.

Table 1
Adequacy of Resources

Category	Not available	Not adequate	Uncertain	Adequate	More
Textbooks	0.0	1.9	7.4	79.6	11.1
Toilets/Latrines	0.0	9.3	14.8	68.5	7.4
Depart offices	5.6	24.1	29.6	40.7	0.0
Classrooms	0.0	20.4	24.1	53.7	1.9
Feeding prog	0.0	7.4	16.7	72.2	3.7
School transport	13.0	11.1	18.5	55.6	1.9
Library	0.0	22.2	13.0	48.1	1.0
Laboratory	0.0	13.0	22.2	34.0	0.0

Table 1 shows that most schools have adequate resources in general. From the findings, all resources are adequate, with textbooks (79.6%), the school feeding programme (72.2%), and toilets and latrines (68.5%). Textbooks were even more than enough (11.1%). Departmental offices (5.6%), transport (13%), and library (13%) are some of the resources that are not available in some schools. On average, Table 4.27 shows that most schools have adequate resources.

Further, respondents were asked to rate (on a scale of 1-5, where 1 is a very low utilization level and 5 indicates a very high utilization rate). The results are shown in Fig 2.

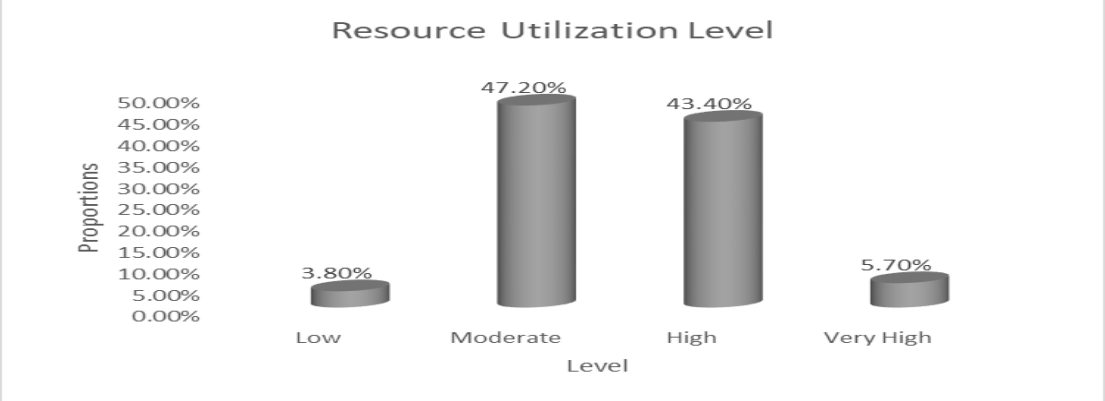

Figure 2 the Level of Resource Utilization in School

The resource utilization was not very low, as only 3.8% had a low utilization level, 47.2% had a Moderate utilization, and 40.3% utilized their resources to a great extent with a very high utilization of resources at only 5.7%. This shows that most schools' resource utilization rate was moderate.

The utilization of resources is moderate because there are challenges due to the inadequacy of such resources. On utilization of resources, respondents were asked on a scale of 1 to 5 (1=strongly disagree, 2=disagree, 3=uncertain, 4=agree, and 5 strongly agree) to give their perception of various indicators of resource utilization. The average response was also computed, and the results are presented in Table 2

Table 2

Descriptive results of Resource Utilization

		2	**3**	**4**	**5**	**Mean**	**Std Dev**
The school utilizes Government resources According to need		7.4	77.8	14.8	4.07	0.47	
The school ensures Timely allocation and Utilization of resources	3.7	20.4	63.0	13.0	3.85	0.684	
Proper utilization 0.584 leads to improved performance	1.9	5.6	70.4	22.2	4.13		
Resources are 0.474 utilized efficiently to achieve a high completion rate		13	77.8	9.3	3.96		
Overall Resource utilization		1.9	85.1	13	4.00	0.399	

The results from Table 2 show that most respondents (77.8%) agreed that the schools utilize the government resources allocated according to need or priority. Only 7.4% were uncertain about utilizing the government's resources. Furthermore, respondents (63%) agreed with their schools that there is usually timely allocation and utilization of resources, while 3% were the only ones that disagreed with the statement.

High percentage is attributed to the fact that government funding must be monitored and audited. Resource utilization and academic performance are intertwined, so 70.4% agreed that effective resource utilization enhances academic performance. On the other hand, 1.9% of respondents disagreed with the statement that strategic resource utilization improves academic performance.

Concerning resource utilization and completion rates, 77.8% of respondents agreed that effective utilization of resources leads to a high rate of students completing school, 9.3% strongly agreed with the statement, and 13% were uncertain. In conclusion, Table 2 shows that respondents agreed with all the statements on the indicators of resource utilization. There were no extreme responses, as shown by slight standard deviations.

Correlation Analysis Between Resource Utilization and Internal Efficiency

Pearson correlation coefficient was computed to measure the strength of the relationship between resource utilization and internal efficiency. Table 3 presents the results.

Table 3

Correlation Coefficient between Resource utilization and Internal Efficiency

Internal efficiency		Resource utilization	
Resource utilization	Pearson Correlation	1	.750**
	Sig. (2-tailed)		.000
	N	106	106
Internal efficiency	Pearson Correlation	.750**	1
	Sig. (2- tailed)	.000	
	N	106	106

****. Correlation is significant at the 0.01 level (2-tailed).**

Regression Analysis Between Resource Utilization and Internal Efficiency

Table 3 shows that there is a strong positive signification correlation between resource utilization and internal efficiency. This implies that as resource utilization increases, the internal efficiency increases. A regression model was fitted between resource mobilization and internal efficiency.

Table 4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.306[a]	.094	.076	.34147

a. Predictors: (Constant), Resource utilization

Table 4 shows that 9.4% (R square) of all the variations in internal efficiency are accounted for by Resource utilization. Other factors not in the model account for 80.6% of all the variations in internal efficiency.

Table 5

ANOVA Results

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.626	1	0.626	5.365	.025[b]
	Residual	6.063	106	0.117		
	Total	6.689	107			

a. Dependent Variable: efficiency
b. Predictors: (Constant), Resource utilization

Table 5 shows a significant relationship between resource utilization and internal efficiency.

Table 6

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.749	.473		5.811	.000
	Resource utilization	.272	.118	.306	2.316	.025
a. Dependent Variable: efficiency						

Table 6 shows that resource utilization has a significant influence on internal efficiency. Keeping other factors constant, for every unit change in resource utilization, efficiency increases by 27.2%. The equation gives the resultant model 4.1 as

Y_i = 2.749+0.272X_i …….. (4.2)

Where Y_i is the internal efficiency and X_i is the resource utilization

It can be concluded that resource utilization has a significant influence on internal efficiency.

DISCUSSION

The study findings revealed that, on average, schools moderately utilized 47.2% of their resources. Most respondents emphasized that utilization was done according to priority areas of need, following procurement procedures, budgeting, and ensuring that the principals form part of the procuring team. This was seen to curb indulging in other projects that may not be important at the time. According to (Ayodele et al., 2018), the productivity of secondary education has been quite discouraging due to a decline in students' academic performance, yet a high amount of financial resources is vested in education. Therefore, it is expected that the secondary school system will be efficient so that a given quantity of output is obtained with minimum input. The principals stated that the utilization of educational resources is significant because of the roles in the achievement of educational objectives and goals. Educational resources are significant in that they help in boosting learning for a better understanding of more complicated concepts, especially instructional materials. These materials induce critical thinking in the learners, making them independent in tackling their activities. Further, learners' academic performance can be influenced by the availability, distribution, and utilization of educational resources.

The interviewees were asked if budgets were a priority during the implementation stage. Budgeting is a practice that needs to be embraced by all institutions because it translates the mission and vision of schools into reality by outlining specific programs and funding since it saves the stakeholders unnecessary stress. In addition, it helps allocate and utilize resources where there is a need. According to Mukhanji et al., (2016) and Ngari and Wakiaga (2018), four factors affect internal efficiency in terms of resources; inadequate funding amidst growing need, limited financial resources in planning for future emergencies, and earmarked funds. In reference to Kolil (2019) when urgent needs exceed regular budgets, schools rely upon emergency funding appeals to fill the gaps that pose great challenges.

The study showed that the level of utilization of resources in public secondary schools was moderate. This meant that the utilization of resources such as classrooms, laboratories, libraries, dormitories, office space for staff, internet facilities, sources of power supply, visual and audio-visual gadgets, computers and printers, as well as photocopier machines, among others, were moderately utilized which is also in line with Kolawole (2018). The observed reason for this was that most schools in Mombasa had slightly low performance and completion rates. However, the progression rate increased steadily throughout the four sessions considered in this study. This may be due to the increased efforts of the present administration to revive the education industry in the State. In addition, the study revealed a significant relationship between physical resource utilization and internal efficiency (Olang'o, et al, 2021).

The finding supports the submission of Usoh and Preston (2017), who concluded that a significant relationship existed between resource utilization and internal efficiency. This is because where there was underutilization of physical, human, and financial resources, little was achieved, and such schools recorded a low completion rate of students and a low academic performance. Shortage or lack of such resources also led to the recording of the performance and a low completion rate. On the other hand, most findings revealed that adequate utilization of

resources would lead to high internal efficiency. This is in line with the submissions of Opoku (2016), who found that resource utilization contributed significantly to the internal efficiency of secondary schools in Ghana.
In addition, from the findings of this current study, it was evident that teaching and learning resources were crucial for achieving high completion rates in secondary schools in Kenya, as posited by Densford, Rosemary and Ngugi (2018). Unfortunately, secondary schools in Kenya have inadequate teaching and learning resources. They further state that if resources are strained, learning is impeded, leading to low academic achievement and completion rates for students. Overall, it was concluded from the findings that physical, financial, and human resources contribute significantly to students' completion rates and performance in secondary schools in Kenya.

All respondents cited resource shortage as a key factor hindering internal efficiency realization. According to Olang'o, et al (2021), insufficient funds affect academic performance. According to Obinga, Waita and Nyaga, (2017), resources are significant in the education sector because they are the school's backbone. Adequacy of resources plays a crucial role in achieving a high completion rate for students and improved academic performance. Due to compulsory and free secondary education, the government strives to make materials such as textbooks, exercise books, and other instructional materials available. However, this has not been possible because the book ratio of 1:1 has not yet been attained. This is because of the policy of 100% transition to secondary schools, which has recorded very high enrolment rates, thus negatively impacting internal efficiency.

Further, Obinga et al, (2017), findings indicated that if schools lack resources or the available ones are insufficient, then internal efficiency is compromised. Resources such as classrooms, libraries, buses, and books, among other materials and resources, play a great role. Large classes caused such inadequacy due to the 100% transition to secondary school. These high enrolment rates deficit schools in terms of resources leading to a high wastage rate such as low completion rate of students and low academic performance in KCSE. The high enrolment rate in public secondary schools has led to overstraining school resources. Some students go as far as sharing inadequate resources. As a result, the morale of students is lowered, leading to dropouts and low academic achievement for those who manage to complete their secondary education. According to Imbovah, et al. (2018), there is concurrence with the findings that financial, physical, or human resources affect internal efficiency. Furthermore, they affirm that headteachers who lack the resources and management capacity also face crises when it comes to utilization. The policy of 100% transition has also seen the government of Kenya straining its financial and human resources. Free Day Secondary Education was also introduced to open access to all school learners and ensure a high completion rate. Due to resource crises posed by a high enrolment and the scarce resources at disposal, IGAs contribute significantly to curbing the crisis. However, if schools do not lead utilizing resources effectively, they should expect a low academic performance.

CONCLUSION

Strategic resource utilization was examined through the utilization and adequacy of such resources. The study established that schools had adequate resources such as exercise books and textbooks. This is because the government took over the programme of supplying textbooks to all public schools to ensure a 1:1 ratio to reduce strain on instructional resources. The physical, financial and human resources were the most affected because of the 100% transition to secondary school. It was also confirmed that the level of resource utilization was moderate. Therefore, it was recommended that priority areas be determined first, budgeting and allocating as the need arises for effective utilization. Management of public schools should adhere to and implement strategic plans as required by the education stakeholders in order to realize internal efficiency in terms of academic performance and completion rates. Following policy guidelines on effective utilization and having a budget for all school activities and functions is highly recommended.

DECLARATION OF COMPETING INTERESTS

We wish to sincerely declare that this paper has been purely developed from my PhD thesis. The research was entirely self-sponsored. We would also wish to make a declaration that no personal, business interests or affiliations to any school, company or organization that may claim party or will be affected or benefit from the research findings of this study.

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FOOD SECURITY EDUCATION: LINKING AGRICULTURE, NUTRITION, AND ENTREPRENEURSHIP IN SECONDARY SCHOOLS

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Abstract

Food security education in secondary schools plays a vital role in equipping students with the knowledge, skills, and attitudes necessary to address the interconnected challenges of agriculture, nutrition, and sustainable livelihoods. This conceptual article synthesises current research on integrating food security education into secondary school curricula, highlighting how practical agricultural activities, nutrition awareness, and entrepreneurship training can foster youth development. Evidence suggests that students who engage in school gardens, agro-based projects, and entrepreneurship programmes develop improved understanding of food production, dietary practices, and business skills, while also enhancing critical thinking and problem-solving abilities. Despite these benefits, challenges such as inadequate resources, insufficiently trained educators, and limited policy support persist. The article concludes by recommending the incorporation of comprehensive food security education, capacity-building initiatives for teachers, and partnerships with local agricultural stakeholders to maximise the developmental impact on students and their communities.

Keywords: *Food security education, secondary schools, agriculture, nutrition, intrepreneurship, youth development, sustainable livelihoods*

INTRODUCTION

Education in the 21st century increasingly recognises the importance of equipping young people with skills that go beyond traditional academic knowledge, particularly in addressing pressing global challenges such as food insecurity, malnutrition, and youth unemployment (FAO, 2022; UNESCO, 2021). Secondary schools represent a strategic platform for cultivating practical knowledge and life skills that can directly influence students' capacity to engage with agriculture, nutrition, and entrepreneurship. Food security education, therefore, is not only about imparting theoretical understanding of food systems but also about fostering the practical skills, critical thinking, and entrepreneurial mindsets necessary for sustainable livelihoods and societal development (Akanbi et al., 2020).

Globally, youth engagement in agriculture and nutrition education has been linked to improved food literacy, healthier dietary practices, and enhanced entrepreneurial activity (World Bank,

2020). In the African context, where youth unemployment remains high and agriculture continues to underpin local economies, integrating food security education into secondary school curricula has become increasingly relevant (Oduro et al., 2019). Schools that implement practical projects such as school gardens, agro-based clubs, and nutrition campaigns provide students with experiential learning opportunities that strengthen problem-solving, teamwork, and innovation (Mugisha & Wanyana, 2021). Despite these potential benefits, challenges exist, including limited resources, insufficiently trained educators, and weak policy frameworks that constrain the effective implementation of food security education programmes in secondary schools (FAO, 2022; Osei et al., 2020). Moreover, there is a gap in understanding how combining agriculture, nutrition, and entrepreneurship within school-based programmes can holistically prepare youth for both academic and practical life challenges. This article, therefore, explores the role of food security education in secondary schools, examining how linking agriculture, nutrition, and entrepreneurship can enhance students' knowledge, personal development, and readiness for sustainable livelihoods. By synthesising current research, identifying challenges, and highlighting best practices, the study provides insights into policy and curricular innovations that can promote youth development. As such, the current study intends to examine how food security education, through practical and integrated approaches, can equip secondary school students with the knowledge and skills necessary for sustainable agricultural practices, improved nutrition, and entrepreneurial engagement.

LINKING AGRICULTURE, NUTRITION AND ENTREPRENEURSHIP

Integrating agriculture into secondary school education provides students with experiential learning opportunities that extend beyond traditional classroom instruction. School-based agricultural programmes, such as school gardens, agro-clubs, and community farming projects, enable students to gain hands-on experience in modern farming techniques, including crop rotation, soil fertility management, irrigation systems, pest and disease control, and sustainable resource use (FAO, 2022; Oduro et al., 2019). These practical platforms allow learners to translate theoretical knowledge from science, biology, and environmental studies into real-world applications, enhancing comprehension and retention. Furthermore, involvement in school agriculture cultivates soft skills such as teamwork, leadership, critical thinking, and problem-solving, as students collaboratively plan, implement, and monitor agricultural projects. Over time, students develop a deeper appreciation for sustainable agricultural practices, understanding the environmental, economic, and social implications of food production, which contributes to the development of responsible future citizens and potential agricultural entrepreneurs.

Beyond individual skill acquisition, school-based agriculture fosters community engagement and social responsibility among students. By participating in community farming projects, students interact with local farmers, learn indigenous agricultural techniques, and understand the role of agriculture in sustaining household food security and local economies (Mugisha & Wanyana, 2021). This exposure bridges the gap between theoretical education and the realities of rural livelihoods, providing students with insights into the challenges and opportunities in food production. Additionally, agricultural programmes help cultivate environmental stewardship, as

students learn about soil conservation, water management, and climate-smart farming practices, reinforcing their role in promoting sustainable development. By connecting schools with local communities, students gain not only practical agricultural experience but also an understanding of social dynamics, collaboration, and the impact of their actions on community resilience.

The integration of agriculture into secondary education contributes significantly to holistic youth development. Students acquire technical knowledge, problem-solving skills, and entrepreneurial potential that prepare them for future careers or self-employment in the agricultural sector (FAO, 2022). Moreover, the practical experiences foster confidence, responsibility, and a sense of accomplishment as students witness the tangible results of their efforts in the form of crops grown and yields harvested. By cultivating these competencies early, secondary schools become incubators of innovation, equipping students to address contemporary challenges in food production, nutrition, and sustainable resource management. Such programmes also align with global education and development priorities, particularly the United Nations Sustainable Development Goals (SDG 2: Zero Hunger; SDG 4: Quality Education; SDG 8: Decent Work and Economic Growth), reinforcing the role of schools in building a generation of skilled, resilient, and informed youth.

Nutrition education complements agricultural learning by equipping students with the knowledge and skills needed to make informed dietary choices. By teaching students about balanced diets, essential micronutrients, and food safety practices, schools enhance students' ability to understand the complex relationship between food consumption, health, and well-being (UNICEF, 2020; Akanbi et al., 2020). When combined with practical activities, such as meal planning, school kitchen gardening, and dietary awareness campaigns, nutrition education goes beyond theory to develop applied competencies. Students learn how to select, grow, and prepare nutritious foods, thereby improving both personal and household food security. The integration of nutrition into school curricula promotes food literacy, empowering students to critically evaluate their diets, recognize deficiencies, and adopt healthier eating habits that can prevent malnutrition and diet-related diseases.

Practical experiences in school gardens allow students to directly connect agricultural activities with nutritional outcomes. When learners grow crops such as leafy vegetables, legumes, and fruits, they gain first-hand knowledge of their nutritional value and health benefits, reinforcing the link between food production and human well-being (FAO, 2022). This experiential approach helps students understand how agricultural productivity affects the availability of essential nutrients and overall food quality. Moreover, school-based nutrition initiatives often involve collaborative activities, such as cooking demonstrations, nutrition clubs, and peer-led campaigns, which enhance communication, teamwork, and leadership skills. Students also develop problem-solving capabilities as they explore creative ways to utilize available resources for healthy meal preparation, linking theoretical knowledge with real-world applications.

Integrating nutrition education into secondary schools not only benefits students individually but also contributes to broader community health outcomes. By equipping young people with the

knowledge and skills to promote healthy dietary habits, schools help create a culture of nutritional awareness that extends to families and local communities (Akanbi et al., 2020; Mugisha & Wanyana, 2021). Students can act as agents of change, organizing workshops, sharing information, and applying innovative approaches to improve food security and dietary practices locally. This emphasis on practical and applied nutrition education reinforces sustainable food systems, encourages social responsibility, and strengthens students' personal development by instilling discipline, planning abilities, and a proactive attitude toward health and wellness.

Entrepreneurship education enhances the value of agricultural and nutrition programmes by equipping students with the skills needed to convert knowledge into viable economic activities. Through lessons on market analysis, product packaging, budgeting, and small-scale marketing, students learn to transform agricultural outputs into sustainable businesses (World Bank, 2020; Osei et al., 2020). Such activities encourage innovation, self-reliance, and creative problem-solving, providing learners with real-world experiences in financial planning, business management, and decision-making. Students gain confidence in their abilities to identify opportunities, manage resources efficiently, and create solutions that meet local community needs, all while linking classroom learning to entrepreneurial practice.

School-based entrepreneurship projects, such as selling surplus produce from school gardens or value-added agro-products, provide tangible opportunities for students to experience business operations firsthand. These initiatives not only reinforce technical and financial skills but also generate revenue that can sustain school agricultural programmes and fund further educational activities (FAO, 2022). By engaging in these projects, students understand the economic potential of agriculture and nutrition, fostering a sense of ownership, accountability, and social responsibility. Additionally, such experiences enhance communication, negotiation, and marketing skills, which are critical for youth employability and long-term career readiness in both agricultural and non-agricultural sectors.

The integration of entrepreneurship within agricultural and nutrition education promotes innovation and community engagement. Students learn to apply creative approaches to production, processing, and marketing while addressing local food security challenges (Osei et al., 2020). For instance, transforming school-grown vegetables into packaged products for local markets teaches value addition, branding, and customer service skills, equipping learners with competencies that extend beyond the classroom. Furthermore, these activities foster economic empowerment among students, reduce dependence on external support, and contribute to community development by ensuring a steady supply of nutritious, locally sourced food. By nurturing entrepreneurial mindsets alongside agricultural and nutritional knowledge, secondary schools prepare students to become proactive, innovative, and socially responsible agents of change in their communities.

By linking agriculture, nutrition, and entrepreneurship, secondary schools can provide a comprehensive educational experience that promotes both personal development and community resilience. Students not only acquire practical skills in food production and nutrition but also develop entrepreneurial competencies that prepare them for future careers, contribute to local food

security, and promote sustainable economic development (Akanbi et al., 2020; World Bank, 2020). This integrated approach aligns with global education priorities, including the United Nations Sustainable Development Goals (SDG 2: Zero Hunger, SDG 4: Quality Education, and SDG 8: Decent Work and Economic Growth), emphasizing the role of schools as incubators of practical knowledge and lifelong skills.

Despite the potential benefits of integrating agriculture, nutrition, and entrepreneurship into secondary school education, limited funding remains one of the most significant barriers to successful programme implementation. Many schools lack the financial resources needed to establish and maintain school gardens, agro-clubs, and community farming projects, which are vital for experiential learning. Essential inputs such as seeds, fertilizers, irrigation systems, tools, and storage facilities are often unavailable, outdated, or insufficient, reducing students' opportunities to engage in hands-on agricultural practice (Mugisha & Wanyana, 2021; Adeyemo & Mabe, 2023). Without adequate funding, schools are forced to rely heavily on theoretical instruction, which cannot fully convey the practical skills and knowledge required for sustainable food production and entrepreneurship. This financial constraint also limits the scope of student-led enterprises, reducing potential revenue generation that could support programme continuity and expand learning opportunities. The lack of funding, therefore, affects not only the practical dimension of education but also the long-term sustainability of integrated food security programmes in secondary schools.

Inadequate infrastructure further compounds these challenges, creating significant obstacles for practical learning and programme success. Many schools lack functional demonstration plots, storage facilities, processing areas, or kitchen gardens necessary to link agriculture with nutrition education effectively (FAO, 2022). Poorly maintained facilities and insufficient access to land for practical activities restrict students' ability to engage in experiential learning, which is critical for understanding sustainable food production systems and healthy eating practices. The absence of proper infrastructure also limits the schools' ability to organize agro-clubs, conduct workshops, or implement community farming initiatives, undermining both academic and entrepreneurial outcomes. Furthermore, infrastructural deficiencies can discourage students from participating in these programmes, leading to reduced engagement and lower levels of skill acquisition. This highlights the need for comprehensive planning and investment in school facilities to support integrated food security education.

Challenges in Linking Agriculture, Nutrition, and Entrepreneurship in Secondary Schools

Teacher capacity and professional preparedness present another major challenge in the implementation of integrated programmes. Many educators lack specialized training in modern agricultural practices, nutrition science, and entrepreneurship pedagogy, which limits their ability to facilitate practical activities and link classroom instruction to real-world applications (Oladosu et al., 2021). Teachers may also have limited experience in project-based learning or

interdisciplinary teaching, further reducing the effectiveness of school-based programmes. Additionally, heavy workloads, large class sizes, and competing academic responsibilities often prevent teachers from dedicating sufficient time and attention to supervise and mentor students in these hands-on initiatives. Without proper teacher preparation and ongoing professional development, the potential of integrated food security education to enhance students' practical skills, nutritional awareness, and entrepreneurial capabilities remains constrained.

Curriculum rigidity and policy gaps also restrict the effective integration of agriculture, nutrition, and entrepreneurship into secondary education. Traditional curricula often prioritize examination-oriented academic subjects over applied, experiential learning, leaving little room for cross-cutting programmes that foster practical knowledge and life skills (UNESCO, 2021). Furthermore, the absence of clear policy guidance and coherent regulatory frameworks from education authorities creates uncertainty and inconsistency in programme implementation. Schools may lack direction on best practices for combining agricultural, nutritional, and entrepreneurial instruction, or they may not receive adequate support for resource allocation, teacher training, and assessment of student outcomes. As a result, even schools with motivated educators and engaged students may struggle to implement these programmes effectively. Stronger policy frameworks and curriculum reforms are necessary to ensure integrated food security education becomes a sustainable and embedded component of secondary schooling.

Logistical and systemic challenges further undermine programme success. Limited access to quality agricultural inputs, weak linkages with local markets, and inadequate monitoring and evaluation mechanisms reduce both the effectiveness and sustainability of school-based programmes (Agyepong & Asiedu, 2020; FAO, 2022). Student-led entrepreneurial initiatives often face difficulties in marketing their produce or generating revenue due to a lack of business networks and technical support. In addition, broader socio-economic factors such as community food insecurity, seasonal labor demands, and limited parental engagement can influence student participation and the continuity of school programmes. These systemic constraints highlight the need for coordinated support at multiple levels, including school administration, local communities, and government agencies, to address logistical barriers and ensure that programmes achieve their intended educational, nutritional, and economic outcomes.

Strategies for Linking Agriculture, Nutrition, and Entrepreneurship in Secondary Schools

Enhancing funding and resource allocation is critical to the success of integrated food security education in secondary schools. Financial support is needed to establish and maintain school gardens, demonstration plots, agro-clubs, and kitchen gardens. Funding can be sourced from government allocations, partnerships with NGOs, local businesses, and community contributions. Adequate resources, including seeds, fertilizers, irrigation systems, tools, and storage facilities, provide students with hands-on experiences that reinforce theoretical learning and cultivate practical skills (FAO, 2022; Adeyemo & Mabe, 2023).

Investing in teacher capacity-building is essential to ensure high-quality programme delivery. Educators should receive specialized training in modern agricultural techniques, nutritional science, and entrepreneurship education. Professional development programmes, workshops, and mentorship opportunities equip teachers to facilitate project-based learning, supervise student-led initiatives, and link classroom instruction to practical applications (Oladosu et al., 2021; Osei & Dapaah, 2022). Continuous assessment and peer learning further enhance teachers' ability to guide students effectively.

Curriculum integration and flexibility support the seamless incorporation of agriculture, nutrition, and entrepreneurship into secondary education. Interdisciplinary approaches linking biology, science, business studies, and home economics with practical agricultural and nutrition projects provide a holistic learning experience. Clear policy frameworks and programme guidelines from education authorities ensure consistency, provide direction to schools, and promote engagement in integrated food security initiatives (UNESCO, 2021; FAO, 2022).

Developing appropriate infrastructure strengthens practical learning and programme outcomes. Adequate land for school gardens, access to water for irrigation, storage facilities for produce, and spaces for processing and entrepreneurial activities enable students to practice modern farming techniques, conduct nutritional experiments, and engage in small-scale business ventures. Functional infrastructure enhances both agricultural knowledge and entrepreneurial capacity among students (Mugisha & Wanyana, 2021).

Building strong partnerships and fostering community engagement increases programme relevance and sustainability. Collaboration with local agricultural agencies, universities, NGOs, and private sector actors provides technical expertise, mentorship, and market linkages for student projects. Active participation by parents and community stakeholders ensures programmes are contextually relevant and culturally appropriate, enhancing student motivation and the likelihood of success (Agyepong & Asiedu, 2020).

Embedding monitoring, evaluation, and continuous improvement mechanisms ensures that integrated food security programmes remain effective and responsive. Structured systems for tracking student participation, learning outcomes, nutritional improvements, and entrepreneurial performance provide feedback for programme refinement. Evidence-based adaptation supports sustainability, informs resource allocation, and strengthens policy advocacy for scaling integrated food security education across regions (World Bank, 2020; FAO, 2022).

CONCLUSION

Food security education in secondary schools plays a vital role in linking agriculture, nutrition, and entrepreneurship to promote holistic youth development. Integrating practical agricultural activities, nutrition knowledge, and entrepreneurial skills equips students with the competencies to understand sustainable food systems, make informed dietary choices, and engage in income-generating initiatives. While the benefits of such programmes are clear, challenges including

limited funding, inadequate infrastructure, insufficient teacher training, and policy gaps hinder their full effectiveness. Addressing these challenges is essential to ensure that students gain the full educational, nutritional, and economic advantages of integrated food security education.

To enhance the effectiveness and sustainability of food security education in secondary schools, it is recommended that governments and stakeholders increase funding and resources, provide targeted teacher training, and develop flexible curricula that integrate agriculture, nutrition, and entrepreneurship. Schools should strengthen infrastructure, such as school gardens and processing facilities, and foster partnerships with local agricultural agencies, NGOs, and communities to support hands-on learning and market linkages. Finally, implementing monitoring and evaluation mechanisms will ensure continuous improvement, helping students acquire practical skills, nutritional literacy, and entrepreneurial competencies that contribute to both personal development and broader community food security.

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