Revitalizing Degraded and Abandoned Lands: Reflections from Local Government Involvement in Mud Brick Production - Tanzania

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ABSTRACT

The study assessed local government involvement in revitalising abandoned holes and degraded lands around brick-making sites in Morogoro Municipality. Specifically, it delineated the effects of mudbrick-making activities on the communities surrounding the brick-making sites, identified alternative uses of the abandoned holes in the brick-making sites, and established the knowledge required by the community and brick-makers for improving abandoned land use for sustainability. Several techniques were utilised in data collection, including interviews and focus group discussions with village and ward leaders, district environmental officers, district community development officers, district planners, mud brick makers, and some members of the community from three specific wards, namely Kauzeni, Mindu, and Kihonda Maghorofani. The findings revealed a significant contribution of the mudbrick-making industry to enhancing income and improving the living standards of communities through employment creation. Particularly, women were involved in selling food to brick makers, while youth actively participated in brick-making activities. The abandoned holes resulting from soil extraction were repurposed for fishing, vegetable cultivation, and sugar cane production. The income accrued from these activities improved housing standards and increased social interaction among people from different regions, including seasonal migrants attracted to brick-making activities. Despite the noted positive effects, mud brick activities contributed significantly to land degradation due to the traditional technologies used in the process, resulting in large holes that posed risks to human and livestock lives. The study recommends enhancing brick makers' and landowners' awareness of implementing mud brick-making activities with appropriate sustainable environmental protection to improve the socio-economic status of both brick makers and the broader community.

Keywords: Abandoned Holes/Lands, Brick-Making Sites, Degraded Land, Local Government, Mud Bricks

I. INTRODUCTION

Globally fired brick, an ancient building construction material, has been widely used for centuries due to its ease of manufacturing from readily available raw materials, such as soil, and its advantageous mechanical properties Yin et al., (2013), Gallipoli et al, (2017), Maraveas, (2020). The soil brick-making industry is a globally preferred and affordable construction material that is desired in almost every country (Hashemi & Cruickshank, 2015; Shihembetsa &Madete, 2018; Morel et al., 2021). The industry is experiencing growth due to increasing demand for bricks in towns and rural areas driven by economic growth, urbanization, and affluence. The scarcity of wood and construction stones has led to the use of mud and clay bricks as alternative construction materials worldwide (Ngcofe & Cole, 2014). The majority of brick production globally is attributed to an unorganized small-scale industry that employs energy-inefficient traditional techniques.

This industry plays a significant role in providing employment opportunities, both for local workers and migrant workers, as it is labour-intensive (Roy & Kunduri, 2018). It contributes to generating income for about 3 million rural people on a seasonal basis (Islam, 2018). The development of the brick industry is impeded by a shortage of skilled labour (Das & Devi, 2018). However, brick production requires cultivable soil, which is also valuable for agriculture. Recently, China and India have recognised the damaging impact of on-going brick making industry on valuable natural resources such as land. This apprehension rises from the conceivable risks it contain to future agricultural endeavours and the alarming rate at which soil is being depleted due to extensive use of bricks in construction (Wolff et al., 2015, Goel et al., 2017).

The high demand for affordable construction materials in Sub-Saharan Africa's urbanization era has led to the uncontrolled and unplanned production of soil bricks, primarily in agricultural fertile land areas near water sources for convenience (Mabogo, 2021). Brick manufacturers require silty clay loam to silty clay soils with good drainage, which are also suitable for agriculture and settlement. This practice leads to land degradation, threatening food security and nutrition by depleting top fertile soil (Osman, 2014). Moreover, the growth of economy is closely related with the

increasing demands for brick (Sample & Pakiding, 2015). This demand is further pushed by the expansion of urbanization and industrialization, which contribute to substantial requirement for building activities (Kathuri & Balasubramanian, 2013)

As in many parts of Africa, Tanzania also has been experiencing brick making activities for over decades. This has been amplified by population increase and urbanization that demand for improved settlements (Kumar et al., 2021). Mud brick making activity in Morogoro region and Tanzania at large is predominantly conducted by low income people with no employment whether formal or informal, and usually they lack specific formal skills (Jerin, 2016, Plan, 2018). The industry further serve as a basis for other income generating activities such as small-scale fish and vegetable production, benefiting the broader community including youth and women (Noll, 2015). The same piece of land can also be utilized sequentially by implementing proper planning to provide more diverse opportunities for income generation. This when properly practiced can contribute to improve gender division of labour within the communities (Donkor & Obonyo, 2015).

II. THEORETICAL FRAMEWORK

The study employed political economy theory, which recognizes the intricate political dynamics in decision making processes. It aims to investigate how power and authority influence economic choices within a society (Serrat, 2023). Political economy analysis does not offer quick solutions, but it promotes more informed and strategic engagement. It is thus necessary for governments at all levels to realize the role of different actors in the economy and reflect the desires and welfare of citizens such as protection of their environment. The behaviour of few individuals who degrade the land must be addressed. Since the industry significantly contributes to the community's income, it is essential to promote friendly and sustainable environmental practices. In this context, exploring innovative ideas for utilizing excavated earth material in brick making can be beneficial.

Providing information to manufacturers, consumers, workers, and local governments will enable them to assess the current state and contributions of these hidden and unrecognized sector. Moreover, it will empower brick manufacturers to make informed decisions regarding their investments and adopt friendly environmental practices. The study's findings are expected to assist policy makers in formulating policies that improve these industries while conserving the environment through the implementation of effective socio- economic measures.

III. LITERATURE REVIEW

In recent decades, earth construction received renewed attention from the academic community due to the common knowledge that populations are growing, resources are finite, and relying on energy-intensive materials such as steel and concrete is not practical thus need environmentally sustainable solutions (Kibert, 2016; Schroeder, 2016). In response, countries such as France, New Zealand, Australia, Germany, Spain, Peru, Zimbabwe, and the state of New Mexico have all put forth national documents regarding the use of natural earth as a construction material (Schroeder, 2012; Hashemi & Cruickshank, 2015).

In many rural areas of Africa, people commonly live in mud sheds with walls reinforced with timber or grass fibres, often topped with thatched roofs. However, these traditional constructions are not weather-resistant (Costa, 2018). In recent years, there has been an increasing adoption of burnt mud bricks for more durable constructions, particularly among the middle-income population. This construction technology is simple, requiring no special machines or materials. The quality of the bricks is not significantly affected by minor variations in production conditions, such as the composition of raw materials, burning temperatures, or duration of burning. Consequently, the production process does not require extensive skills, and the resulting bricks are easy to handle (Niroumand et al., 2013).

In Tanzania the traditional brick-making method relies on minimal tools, namely a garden hoe for digging and a wooden mould for brick formation (Hale, 2015). The process involves adding water directly to the dug soil and mixing it using the garden hoe and stomping feet. The water content is adjusted based on the soil's texture until optimal workability is achieved. The process uses a garden hoe for digging the land and a locally made wooden mould to form the bricks. The formed bricks are then laid out in the sun to dry for some days depending on the type of soil and climate condition (Magembe et al., 2015).

However, soil brick-making activities have contributed to significant land degradation due to the abandoned holes left behind after taking out the soil for mud bricks (Osman, 2014). Such holes when left without being used hinder the land from other uses such as agriculture, livestock keeping and settlement (Blaikie and Brookfield, 2015).

Local communities around these areas have less knowledge on how to utilize the degraded land and abandoned holes effectively. The holes could otherwise be utilized for environmentally friendly activities to support social and economic aspects of human life.

Provision of information to manufacturers, consumers, workers and local government authorities is fundamental for assessing the contributions and current situation of these hidden and unrecognized sectors (Biswas et al, 2018). This knowledge can enable realistic decision making regarding investment and adaptation of environmental friendly approaches to land resource use by brick makers (Goel & Kalamdhad, 2017). However, there is limited understanding of the social–economic effects of mud bricks making business and the involvement of local government in utilizing the abandoned holes. This paper therefore, aims to assess the involvement of local government in revitalizing the degraded abandoned land caused by mud brick making activities along the brick making sites in Morogoro Municipality.

IV. METHODOLOGY

The article used a mixed method of cross-sectional research design. Data was collected once at one point in time in the study areas since variables were not expected to change over time. In relatively less-known areas, where there is little experience and theory available to serve as a guide, intensive study is a very useful method of gaining insight instead of revisiting the study area (Setia, 2016).

The study was conducted in three wards namely Kauzeni, Mindu and Kihonda Maghorofani in Morogoro Municipal Council, Morogoro region. The selection of the wards was done purposefully because they are practicing brick-making activities in the areas. Morogoro Municipal Council was selected because it is one of the districts which is in an urban setting with a concentration of mud brick-making sites. Moreover, the council was chosen because of its strategic location of connecting many regions of the country from central, southern, and northern highlands. The relatively good transport network to Morogoro makes it a suitable area for labourers to move from the peripheries to work in the mud brick industry.

The study population involved all community along brick making sites in three selected sites. The selection of wards was done purposefully because the wards have many brick-making sites compared to other wards in the Municipality. The study participants involved, brick makers (labourers) in all three sites who were purposefully selected. Key informants included Ward and Street leaders, District community Development Officer, District Environmental Officer, and District Planner as well as 3 community members in each ward. While the selection of key informants and brick makers was done purposefully, the community members were selected randomly basing on their willingness to participate in the study. The sample size was 81 respondents among them (9) were key informants, 9 were community members and 63 were mud brick makers and owners of the land. The sample size was determined based on reaching a saturation point, where data collection was stopped as no further new data were obtained to provide meaningful insight.

Both primary and secondary data were collected. The study used conversational interviews in the form of FDG and KIIs, and documentary reviews like government documents, scholarly books, recent dissertations, journal article, magazines, and newspapers relevant to the topic under study. Multiple information sources used in the current study are meant to complement the sources, check the information against each other, and increase the validity and reliability of the study's findings.

Data were analysed quantitatively and qualitatively. Quantitative data were analysed using IBM SPSS Statistical computer programme to generate descriptive statistics such as frequencies and percentages. Qualitative data were put into small themes and summarized into short texts. Whereas analysis was done using content analysis procedure to supplement information obtained from quantitative data.

V. RESULTS & DISCUSSIONS

5.1 The Process of Mud Brick Making and Its Effects on the Surrounding Communities

The process of mud brick making has been observed as livelihood practices among certain communities residing in the outskirt of Morogoro Municipality. This practice is usually carried out during the dry season which involves several steps. Firstly, the process begins with excavating soil and kneading it to create a mixture, which is then left overnight. The second step involves mixing into bricks using timber mould. The next step is to arrange the raw bricks in a line within a kiln for drying between 3- 7 days depending on the soil type and availability of sunlight. Once dried the bricks are covered with materials such as soil and then fired. After firing, the bricks are transported to

storage for future sale and use. These process align with the findings of the study conducted by (Aniyikaiye et al., 2021) which identified stages in the brick production process, such as soil selection, mixing brick formation and brick drying. The specific methods employed in each stage may vary based on factors such as location, climate, soil composition, economic condition, and the availability of resources and tools.

In examining the impacts of mud brick-making activities on the surrounding community, the study identified three primary perspectives through which these effects become apparent: they include; socioeconomic, environmental, and political. It is important to note that these effects, though discussed individually, are interconnected and influence one another. Each perspective is discussed here under for understanding of its effects:

5.1.1. Social-Economic Effects of Mud-Brick Making Activities on the Community

Mud brick-making activities have social implications for the community. These activities often create employment opportunities for residents, contributing to the local economy. Additionally, the brick-making process fostered a sense of community cooperation and involvement because some individuals in the communities were engaged directly or indirectly in this seasonal practice. The study through in-depth interviews with respondents revealed that in the period starting from June to December, the community surrounding mud-brick making sites faced a massive influx of young men from different regions of the country for casual labour in the mud-brick-making sites thus increasing the number of people in the host community and its surroundings.

The increased number of people resulted into more demand for energy consumption, food items, shelter, health services, and increased interaction with the community. It also increased markets for the available local goods such as houses for rent and food staff. This result coincides with the study conducted by (Chen et al., 2016) that population increases in an area increased food and energy consumption. It was reported by (Sumari et al., 2019) that Morogoro municipality is growing fast in terms of its population and housing hence more demand for settlement.

Employment creation was reported as another socio-economic impact of mud brick making activities in the community and its surroundings where youth around brick-making sites got employment as casual labourers. The production and sale of bricks by brick makers also generate income for the brick makers and brick owners. The community members including women and youth on the other hand were reported to benefit by selling food items to the labourers thus increasing their income. Overall, the employment benefits generated by mud-brick-making activities have the potential to improve the economic conditions of the communities involved, providing income and livelihood opportunities for individuals and contributing to local economic growth. These findings align with study by (Hashemi & Cruickshank, 2015) that brick making process incorporates a range of activities, starting from initial stage of soil excavation to the final stage of brick sales. All these activities play a significant role in short term employment opportunities particularly for the youth and other members of the community.

This idea was supported by one street leader in Kihonda Maghorofani site that;

> "*Mud-brick making activity has had a positive impact on our community's economy. It has provided jobs for many individuals, both men and women. People in our community, including those with limited education or skills especially youth and women, can find employment in the brick-making industry. There are approximately over 300 young individuals engaged in this brick-making industry participating in diverse tasks such as food vending, soil excavation, water fetching, brick production, and preparation of the kilns for firing the mud bricks. This has improved their livelihoods and allowed them to support their families." The employment opportunities created by mud-brick making can have a ripple effect on the local economy. As more people find work in the industry, they have increased purchasing power, which can stimulate local businesses and contribute to economic growth. Additionally, the income generated from mud-brick making activities can be reinvested within the community, further supporting economic development"* (Street Leader- Kihonda Maghorofani).

Another notable socio-economic impact of the mud bricks industry is the availability of locally produced bricks, which helps the community to improve the standards of their houses, and reduces construction costs which in turn stimulates economic development. This is because mud bricks are less expensive and available nearby to a larger portion of the middle-income population. The results concur with findings from Joglekar et al. (2018) which highlights that it is noteworthy to consider the cost of building materials in the construction of better quality housing. Therefore the affordability of mud bricks in the communities contributes to the increasing demand for better housing. The argument was supported by a key informant in Kasanga during KIIs interview session that mud bricks activities supported to improve their income and their standard of housing.

The informant who had this to say;

> "*The need for the mud bricks is highly increasing due to increase demand of people who preferred using mud brick to build their houses especially people of middle class. This in turn resulted into demand for more masons to build peoples residences here youth are mainly involved. The need for the mud bricks is highly growing due to increase demand of people who preferred using mud brick to build their houses majority of them being people of middle class. The industry has employed many youths for sometimes now"* (Key informant)."

Additional social -economic impact of brick making activities mentioned by community member participants was health related problems among the brick makers and surrounding communities. This is because the activity takes place during dry season in the dust environment leading to respiratory problems, such as asthma, coughing and lung diseases. The abandoned holes on the other hand became enduring breeding sites for mosquitos which cause malaria and related diseases which easily spread to the communities; endangering the entire society and other waterborne diseases. This finding concurs with study by Jerin, et al., (2016) and Ismail, et al., (2017) that brick makers faced health effects due to dusty condition of the sites and that the society around the brick making sites also lacked clean and safe water since the nearby water streams were polluted by ash and dust hence leading to poor quality of portable water.

The idea is further supported and explained by Community Development Officer that;

> *Brick makers and community along mud bricks sites are infected with diseases such as malaria due to inbreeding of mosquitos in the holes left after bricks making. Such holes are filled with stagnant water throughout the year thus became a source of malaria parasites. Likewise, during dry season such water are used by the mud bricks makers for bricks making activities hence imperilling their health. The quality of water in the nearby streams is equally polluted by ashes and dusts originated from burning of bricks. Consequently the users are infected with related diseases such as skin diseases, eye irritation, respiratory system complications and the like"* (Community Development officer).

In the KIIs interview with District Environmental Officer, it was testified that, though the practices of brick making was found to be economically significant, yet the burning process during bricks making distorted the soil texture, drains fertility and hence subdue the portion of land into inability to support growth. In addition, economically the place where brick making takes place becomes dependent due to land distortion hence poor agricultural practices. He has the argument that Most of the host communities remain without land or with a very small piece of land for agriculture because they sell their land to wealthy people sometimes from outside their communities. This makes the host communities to work in the mudbricks sites as labourers with unsafe working condition.

This findings concurs with that of Bhattachary (2018) that in places where mud brick is practiced there is high demand for the land demand for the land by foreigners, People from outside area) which in turn increased price of land to make dwellers in such areas fail to purchase land for agriculture and settlement establishment Moreover, the officer The officer has the opinion that Local government leaders are supposed to supervise the industry because it is their role to maintain safety of the citizen within their areas. Occupational health and safety measures should be implemented to protect the well-being of the workers and mitigate any potential negative effects on their health.

The environmental officer had this to say;

> *"Although the mud brick making industry has employed more youths but in reality those who came from outside the community seasonally from different regions of the country are financially good than youth in the host community, because they came with their capital which enabled them to buy big land at the cost of making the host youth to sell their labour to them. This has kind of exploitation because the youth in such areas are mainly the owners of the land but they are not benefiting much from their land".* (Environmental officer)

5.2 Environmental Effects of Brick Making on the Surrounding Communities

The process of making mud bricks involves the diggings of soil from specific areas of land. In order to obtain the required mud consistency, a significant amount of water is used. However, these activities have adverse effects on the environment, leading to soil erosion, land degradation and disruption of ecosystem. On the other hand individuals excavated soil for making bricks either within their residential areas or in their nearby farms within their localities. Unfortunately, due to the challenging of refilling the excavated holes, these areas were often left bare and exposed. This practice continued in the municipality for a long period time until 2017 when heavy rainfall resulted in flooding in many households. Following this experience local government authority recognized the need for intervention in land management, particularly addressing the issues associated with abandoned holes and degraded land. Efforts were initiated to mitigate the negative impacts of soil erosion and land degradation caused by mud brick production

activities. These interventions aimed to restore and rehabilitate the affected areas, preventing further flooding incidents and promoting sustainable land use practices.

The environmental officer further explained that excessive cutting of trees for burning the bricks has adverse effect on the land because the land is left bare thus loose its fertility. All major soil nutrients such as nitrogen, potassium, phosphorous and calcium and essential trace element like zinc, cobalt, molybdenum among others get lost. This makes the land to be prone to soil erosion and flooding, leading to poor agricultural yield hence food in security in the communities. This finding concurs with (Biswas, et al., 2018) that brick production contributes to soil loss and that soil degradation caused by brick making activities is central threat to sustainable agriculture.

5.3 Political Effects of Brick Making on the Surrounding Community

Mud brick-making activities also have political implications. The study found that local government officials have generally been in active in implementing regulations and guidelines to govern the brick- making industry and promote safe and responsible practices. Their presence at the sites is minimal, except when conflicts or misunderstandings arise. There is a lack of routine monitoring and supervision, with visits to the sites mainly focused on tax collection. This lack of regulatory misunderstanding contributes to various unresolved problems, such as the poor condition of roads leading to and from the sites, particularly during the rainy season. Good political decisions and policies related to land use, resource management, and occupational safety can have a significant impact on the brick-making community. However, politicians, such as councillors, and District Commissioner, only engage with the community when there are specific issues that need resolution.

In the focus group discussion at Konga brick making sites participants have the opinion that to address challenges facing the mud brick industry and the community at large, stake holder need to reorganize the multifaceted impacts of mud brick- making activities and collaborate to promote sustainable practices. According to participants such collaboration should involve the community, government authorities, environmental organizations, and other relevant stake holders. By working together, they can develop and implement policies and measures that benefit the community, economy, environment, and political landscape. This may include establishing regulations, improving infrastructure, enhancing resources management practices, and ensuring occupational safety standards are met.

5.4 Alternative Use of Abandoned Holes along Brick-Making Sites

The study was also interested in understanding the use of abandoned holes and whether the local government authorities played a significant role in addressing the issue. In a focus group discussion, at Kasanga the respondents had the opinion that the abandoned holes are of different sizes resulting from the long history of brick-making activities. Some of these holes are too big to be utilized due to water accumulation and the growth of certain types of trees around them. Despite the challenges posed by these abandoned holes, the residents living in proximity to them have found ways to make use of the land. During the interviews conducted at Kasanga and Konga sites, respondents mentioned that some of the holes were filled with dust and ashes and then used for cultivating various crops such as vegetables, banana plants, sugar cane, yams, and trees.

This productive activity was mainly carried out by women and youth few of them were reported to export the surplus vegetables to nearby regions such as Dar es Salaam. In so doing they expand their business opportunities. Men on the other hand are using the abandoned holes for small scale fishing just for family consumption and sometimes additional income is accrued from selling the surplus fish. However, fishing is conducted in a very rudimentary way thus hardly generate profit. This is an indication that the degraded land can be reclaimed and be reused for other economic activities.

5.5 Involvement of local government leaders in mud-brick making sites

The study assessed the commitment of local government officials in the management of the mud brick sites at all levels of governance. It was established that the local government leaders mainly intervene in sites for setting land demarcation, provision of environmental education and resolving disputes in relation to mud bricks industry

5.5.1 Setting Land Demarcations and Ownership Description

At the municipal level, the local government authority plays a crucial role in planning and designating specific areas for mud brick-making activities. The purpose of this designation is to prevent random practices of brick-making in individual homesteads or public open spaces. The study revealed that, the municipal council designated Mindu, Kauzeni and Kihonda Maghorofani wards for mud brick-making activities due to their geographical location and the availability of extensive land. At ward and village/street, leaders have the role of supervisory.

However, it is important to note that the ownership of the land remains in the hands of private individuals. The local government leaders are involved in administering the land lease procedures. According to Tanzania customary law, the land is privately possessed and owned, and individuals are free to sell or rent it to any time they need to do so. This gives them the room to sell and rent their land to brick makers or anyone interested in that land. This argument was supported during the focus group discussions, where participants emphasized that land ownership belongs to individuals, who have the right to rent or sell their land as long as they follow the proper procedures. While the full ownership lies with the individuals, the government does intervene in certain aspects, such as setting the demarcation of the designated areas and resolving disputes if they arise. This indicates a shared responsibility between individuals and the government in regulating and managing the mud brick-making industry. It is worth noting that the information provided relates specifically to the studied area, and practices may vary in different locations.

5.5.2 Provision of Environmental Education

The study found that the local government authority at the ward level, in collaboration with the district environmental officer organizes visits to mud brick-making sites. The aim is to create awareness about environmental conservation and reclamation strategies among brick makers, landowners and the community at large. In such awareness creation sessions, different approaches to reclaiming land holes and reusing abandoned holes are emphasized. For example, activities like keeping fish in the holes and using the water for growing vegetables are encouraged. These initiatives not only contribute to environmental sustainability but also provide additional benefits such as improved family consumption and a potential source of income. The findings of the study align with the Environmental Statistics Report of 2017 by the government (Plan, 2018), which states that LGAs are responsible for implementing environmental regulations related to solid waste management and overall environmental management. The existence of such laws and regulations helps raise awareness about land management and resolve environmental-related issues.

5.5.3 Settlement of Disputes among Land Owners and Brick Makers

The study through in-depth interviews revealed that the land where mud brick-making activities are taking place is privately owned by some people who either have a customary title deed or have bought it directly from the municipality. It was found that the land owners normally can either lend/hire the piece of land to brick makers in agreement of paying back rents. Because of the mud brick activities, the value of land has increased and it became marketable due to increased demand which rarely happened to land possession conflicts. It is under such context that local leaders at the streets and wards levels were involved in selling and buying the land and settlement of any land misunderstanding between the parts once happened. These findings coincide with the study by Lombard and Rakodi (2016) that Government checks and balances play a crucial role in overseeing and regulating the management of land, particularly to prevent conflicts arising from land ownership and settlement issues.

By implementing effective governance mechanisms, the government can ensure fair and equitable distribution of land resources, resolve disputes, and maintain social harmony, by establishing robust systems for recording and documenting land transactions, governments can enhance transparency, safeguard property rights, and enable efficient land administration processes. This, in turn, promotes economic development, encourages investment, and fosters social stability within communities.

The argument is supported by the Village executive officer in Kongwa –Kauzeni ward who had this to say;

> *The land used in brickmaking is predominantly owned by individuals who have inherited it from their grandparents, while some have acquired it through direct purchase from individuals or the government. However, in case of any disorder between the users the local government interfere to bring the harmony. If disagreement continued after the local government local government directives, then individuals concerned are free to take their different to the court to get their rights. This shows the role of the local government in intermediating land related quarrels and providing a mechanism to solve. While the local government can offer guidance and directives, the ultimate resolution of disputes may require legal intervention through the court system* (Village Executive Officer, Kongwa –Kauzeni Ward).

The quotation provided aligns with the study conducted by Lombard and Rakodi (2016). Their research emphasizes the importance of maintaining accurate and comprehensive records of land transactions at the local level, particularly due to the prevalence of informal transactions. These records are crucial for effective land and housing delivery systems. Moreover, the study through focus group discussion revealed that even though local government authority is in charge of land management and control, land owners are considered responsible for all matters

concerning brick makers including their security and welfare. Most of the labourers are hired from different parts of the country and work under land owners by short contracts.

5.6 Knowledge Required to Reuse Abandon Holes and Degraded Land Sustainably

There was a need to ascertain from the community as to what kind of knowledge was necessary for the community and brick makers to use the land sustainably. It was revealed that although the communities are aware of the negative consequences of land degradation resulting from brick making, their knowledge of effective protective measures is limited. For instance, during the rainy season, the area's sloping terrain and land degradation contribute to water flooding in their farms and residential areas. Unfortunately, the community lacks the necessary skills and knowledge in environmental safety measures to effectively mitigate such situations. Thus, they indicated the need to be trained on means to control soil degradation and control erosion to protect their land and be used in a sustainable way.

Participants in the focus group discussion also mentioned having desired knowledge on agribusiness through irrigation. This need arose from the fact that the abandoned holes in the area were filled with water throughout the year, presenting an opportunity for cultivating crops and vegetables to meet their needs and generate income. Community members need to be trained on how to use the coincidental to increase their income.

Land owners on the other hand mentioned to need for knowledge on refraining from digging deep holes that could potentially degrade the land. They expressed a desire to acquire a better understanding of sustainable land management practices, as they face limitations in terms of available land area and lack the financial resources to purchase additional land. However, during KIIs it was asserted that “some of the land owners have a persuaded knowledge to protect their land by not digging deep holes to preserve the land for other uses, but yet they insisted to have more understanding on how better they can sustainably manage their land.

The discussion with Municipal environmental officer established that the knowledge on practice of irrigation farming goes hand in hand with the ability to reclaim the land. He shared the success story of the former brick maker in Kasanga- Kauzeni wards who saved as a model for others. In this story, a farmer took two years to reclaim his land by refilling it with ashes and soil. Afterward, he planted various crops and fruit trees such as lemon, pawpaw, and banana trees. He has made his project large enough thus successfully earn income alternatively to the extent that he became the best district farmer of the year 2021 during farmer’s exhibition. This results align with a study by Roy et al., (2023) that the importance of meeting the necessary critical and employing scientific practices for soil management, as well as the sustainable use of natural resources,

VI. CONCLUSIONS & RECOMMENDATIONS

6.1 Conclusions

Mud brick making industry was a seasonal intensive practice associated with both positive and negative impact to surrounding communities. On one hand the activity has far reaching effects in the provision of economic benefits such as income generation and improving living standard of the individuals. On the other hand the practices lead to land degradation including soil erosion and loss of habitat due to land extraction. Moreover, the abandoned holes from land diggings pose safety risk and disrupt ecosystems.

6.2 Recommendations

The study recommends that the local government to enact appropriate by laws governing the practice of brick making to develop a sustainable employment opportunity with less environmental hazards. This is because bricks have positive impact to the community. It may not be wise to prohibit the practice but to provide education on how use the land in an appropriate way. Environmental stake holders including the community affected by bricks making activity should collaborate with the government to find means that can facilitate the ruse of abandoned holes in an alternative way of use. The government need to recognise the sustainable land practices and take some measures to raise awareness among communities. For example it would be useful for the municipal council to turn big abandoned holes into dumping sites until they are filled up and able to be reclaimed for the useful purposes.

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