International Journal of Research in Engineering, Science and Management
Volume 6, Issue 11, November 2023
https://www.ijresm.com | ISSN (Online): 2581-5792

Impacts of Alternative Renewable Sources and Technologies on Forest Conservation at Lumbuji Village in Kilosa District and Imalamakoye Village in Urambo District

Stephen Samwel Mokare[1*], Joseph Perfect[2], Catherine Masao[3], Latifa Litwe[4]
[1]*Graduate, University of Dar es Salaam, Tanzania*
[2]*Lecturer, University of Dar es Salaam, Tanzania*
[3]*Senior Lecturer, University of Dar es Salaam, Tanzania*
[4]*Assistant Lecturer, University of Dar es Salaam, Tanzania*

***Abstract*: The study examined the impacts of alternative renewable sources and technologies on forest conservation at Lumbuji Villlage in Kilosa District and Imalamakoye Village in Urambo District. Consequently, for this objective to be fulfilled the study had to examine the land cover change and distribution of land cover change at Lumbuji villlage in Kilosa District and Imalamakoye Village in Urambo District. The research used cross sectional design by involving both qualitative and quantitative information where data were gathered through questionnaire and key informant interviews, observation and FGD from stakeholders participated in the study. The study employed purposive and random sampling techniques to choose 135 respondents from the population. Descriptive analysis and unsupervised classification technique employed for analysing the qualitative and quantitative data in the study. Finally, the study revealed that, perceptions of local community were guided by level of knowledge, accessibility, usefulness and benefits of the AREST. Moreover, despite the existence of alternative renewable energy sources and technologies at the study areas, the extent of adoption of AREST was low because some of the local communities were still using fire wood and charcoal as the source of energy in the household. The study recommends reinforcement of training and education to commuters on potential alternative renewable energy sources and technologies in their respective areas and ensuring the accessibility and affordability by commuters to renewable energy inputs and other additives/agricultural residues with ensuring their quality that suits the climatic situation of the area in generating renewable energy sources and technologies.**

***Keywords*: alternative, renewable, sources, technologies, forest conservation.**

1. Introduction

Renewable Energy is one of the principle parts in the improvement of any nation (Sarakikya *et al.,* 2015). The world vitality request is relied upon the energy sector in order to develop at the normal yearly rate of 1.8% between the year 2005 and 2030. Basing on the fore mentioned importance of energy, the energy sector has raised an essential attention all around the world where several initiatives have been taken to transform from relying on non-renewable energy sources and technologies to renewables (Kichonge 2016; Msololo *et al.*, 2016; Bishoge et al, 2018).

For instance, currently the world has embarked into major energy sector transformations from growing electrifications to the expansion of renewable energy sources and technologies (World Energy Outlook, 2018). The demand for renewable energy sources has raised enough all around the world as China emerges giant consumer. Moreover, in power markets renewable energy sources and technologies have become the item of priority, making up almost two third of the global capacity additions by the year 2040. This transformation estimated the raise of the world share of renewable energy sources to over 40% by 2040 from 25% today (World Energy Outlook, 2018).

In Africa the demand for renewable energy sources and technologies has been increasing from time to time as it is estimated to be over 30% of all energy that will be available in the continent (Karekezi, 2002). The major increase of renewable energy sources and technologies in Africa has been linked to the initiatives featured on the agenda of the Johannesburg World Summit on Sustainable Development (WSSD) in 2002 (Karekezi 2002). Some of renewable energy sources that have been deployed in Africa include potential electricity generation from bagasse produced by sugar factories (WEHAB Working Group 2002).

WEHAB, (2002) extended that, it is estimated that up to 16 sub-Saharan African countries can meet significant proportions of their current power energy from bagasse-based cogeneration in the sugar industry. Those countries include Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Sudan, Uganda, Zimbabwe and Tanzania. Moreover, Africa has numerous energy assets projects, for example, hydropower, sun based, wind and geothermal, biomass i.e animal manure,

*Corresponding author: smokare.sm@gmail.com

charcoal and firewood, agro-ranger service remaining i.e maize cob and rice corn, forestry processing waste etc. (Sarakikya *et al.,* 2015).

In Tanzania several projects in renewable energy including local biogas in Tanzania was first presented by Small Industries Development Organization (SIDO) in 1975. But also various other Non-Governmental Organizations (NGOs), participated in the advancement of this innovation all around the nation whereby the inclusion of CAMARTEC, later in collaboration with Government of Tanzania quickened mindfulness and dispersal, especially in the northern areas of the nation. CAMARTEC and Government conveyed the work forward during the 1980s-1990s by creating, advancing and giving preparation in the biogas division, where amid those years, invested individuals worked around 6,000 biogas digesters (Mwirigi, *et al,* 2014; Hewitt, *et al,* 2022).

Other initiatives are the revision of the 1992 the National Energy Policy to include renewable energy matters in the newly established policy of 2003 (URT, 2003). Also, more than 7,133 residential biogas plants have been assembled by SIDO countrywide including Arusha and Moshi in Eastern Tanzania for household and business applications since 2009 (Kichonge, 2016).

Moreover, TaTEDO in collaboration with TFCG and MJUMITA trained more than 52 charcoal producers in Kilosa, Morogoro on the best way to advocate on the commercially viable alternative sources of renewable energy and sustainable sourcing of charcoal by using improved methods of charcoal productions and sustainable forest harvesting (TaTEDO, 2018). One among the technologies introduced in Kilosa was the use of crop residue (i.e corn and cob from maize and rice respectively) and cogeneration of electricity using bagasse from Kilombero sugar estates and industries as the source of energy in replacement of fire wood, charcoal and timber.

In connection to that, several studies done in Tanzania including, (Sarakikya *et al.,* 2015; Kichonge 2016; Msololo *et al*., 2016; Bishoge *et al*, 2018); and some specific projects done by national and international organizations such as TFCG, FAO, TaTEDO and UNDP have identified a number of bio-fuel production scenarios using different feedstock crops and different types of downstream processing plants (use of improved tobacco curing burner). Likewise, several projects on solar energy resources as one among good energy sources and technology in the central portions of Tanzania i.e Dodoma and Singida region has been adopted.

The increase in the price of fossil fuels, unsustainable supply of charcoal and firewood and a global concern on the effects of greenhouse gasses emissions on the environment have attracted the interest on the use of alternative and sustainable sources of energy and technologies (Adepoju & Akinwale, 2019; Bishonge *et al*, 2018). Despite a number of achievements in the renewable energy in some parts of the country namely use of biogas plants in Moshi Tanzania, cogeneration of electricity from bagasse in sugar industries including Kagera Sugar in Kagera, Mtibwa Sugar in Mvomero and TPC in Moshi the Tanzania and the existence of various programme and projects concerning renewable energy sources and technologies in Tanzania.

Majority of the studies and projects have only documented the number of existing renewable energy sources and technologies i.e solar power, wind, geothermal, biomass and hydropower energy as well as the role/importance of such sources of renewable energy in reducing spread of greenhouse gases emissions. Also, have mainly concentrating in providing education to societies on the way to implement the alternative sources of energy so as to ensure forest conservations as well as enhancement of their livelihood (Bishonge *et al*, 2018).

Yet there are missing useful insight on the attitudes and the adoption of the community towards such renewable energy sources and projects. Likewise, the impacts of such renewable energy sources and technology in livelihood and forest conservations in Tanzania have not yet been identified. Therefore, this study focused on addressing such gap.

Technology acceptance model (TAM) was an offshoot of TRA, and was first developed by Davis in 1986. TAM explains how users acquire, learn, accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it. TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. The two main factors influencing the intentions to use a particular technology are *perceived usefulness,* which is a degree to which a person believes that using a particular system will improve his job's output; and *perceived ease of use* is the degree to which a person believes that using a particular system would be free from effort.

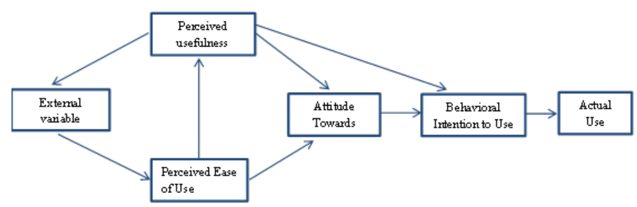

Fig. 1. Davis model on technological acceptance model

2. Methods

The study was conducted at the at Lumbuji Villlage in Kilosa District and Imalamakoye Village in Urambo District. Study employed sample size consisted of 135. In that regard, this sample gave equally reliable representative information. The researcher inspired to use this sample because it looked for representatives that generate different views and suggestions which enabled to generate concrete evidence and intended findings at the end of this study.

The study applied purposive and randoms sampling techniques to get members of sample size of 135 respondents. The manner of using purposive made easy to get respondents. On the other hand, respondents based in approach were able required information that related to the study. In order to attain this, a researcher requested them either by visiting them or making calls to get concern about time and day that were available to respond on that study.

Additionally, respondents were distributed with questionnaires with guidelines needed to answer by supervision of researcher. The questionnaires consisted of closed and open ended. The closed one had a role of getting particulars, simple and short answers while open ended is for answers with more details as per respondents wish and generated views without pre-emptive. Also, researcher conducted interview, observation and FGD to the some of respondents. Data were analyzed using descriptive analysis.

3. Results

A. Land Cover Changes at the Selected Villages of Study

1) Accuracy Assessment

In this study, accuracy assessment was done by using the error matrix created on ArcGIS software. The findings presented in figure 1 revealed that the overall accuracy for the classified image of 2000 was 89%. The overall accuracy was obtained by taking the average of the identified classes of images which were forest (90%), Agriculture (88%), built-up area (86%) and grasslands (92%). This result implies that the accuracy of the studied images was in an acceptable range. According to Rawat & Kumar, (2015) the overall accuracy is acceptable if it is greater than 80%.

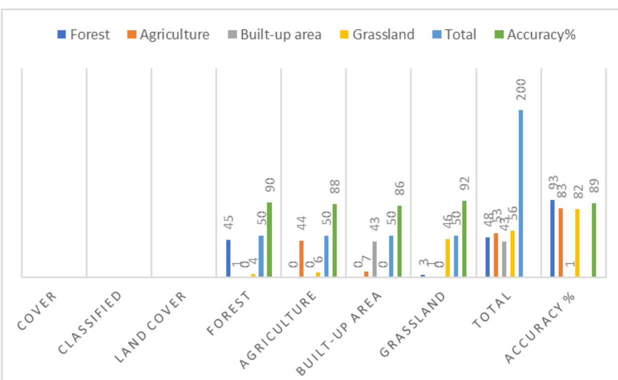

Fig. 2. Error matrix for supervised classification of 2000 satellite image
Source: Author's construct

Moreover, the overall accuracy for the classified image of 2020 was 83%. The overall accuracy comprised of Forest (84%), agriculture (80%), built-up areas (82%) and grasslands (86%). The result implies that the accuracy of the studied images was in an acceptable range because the overall accuracy is acceptable if it is greater than 80% (Rawat & Kumar, 2015).

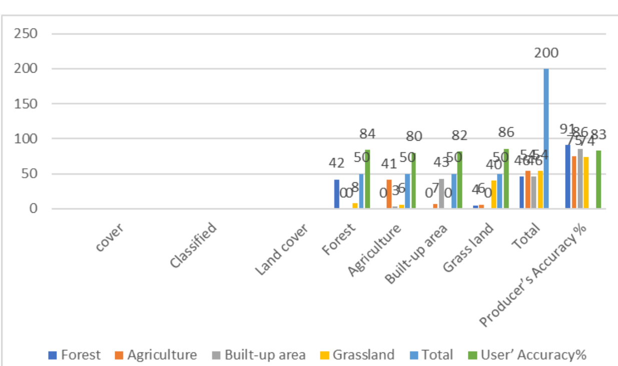

Fig. 3. Error matrix for supervised classification of 2020
Source: Author's construct

2) Distribution of the land cover changes at Lumbuji village in 2000, 2010 and 2020

The distribution of the land cover changes in Lumbuji village entails the percentage and area covered by various land cover patterns as per studied satellite image sub-scene at different years namely 2000, 2010 and 2020 presented in figure 4.5 as (a), (b) and (c) respectively. The years were considered with reference to the three years project started in 2000 conducted by Tanzania Traditional Energy Development Organisation (TaTEDO) in kilosa district. The main land covers identified in the village were forest; agriculture; grassland; incorporating of open grassland, bush grassland and wooded grassland. Other major land cover patterns at the village were shrubland and build up/rock. These woodlands are made up of open woodland and closed woodland.

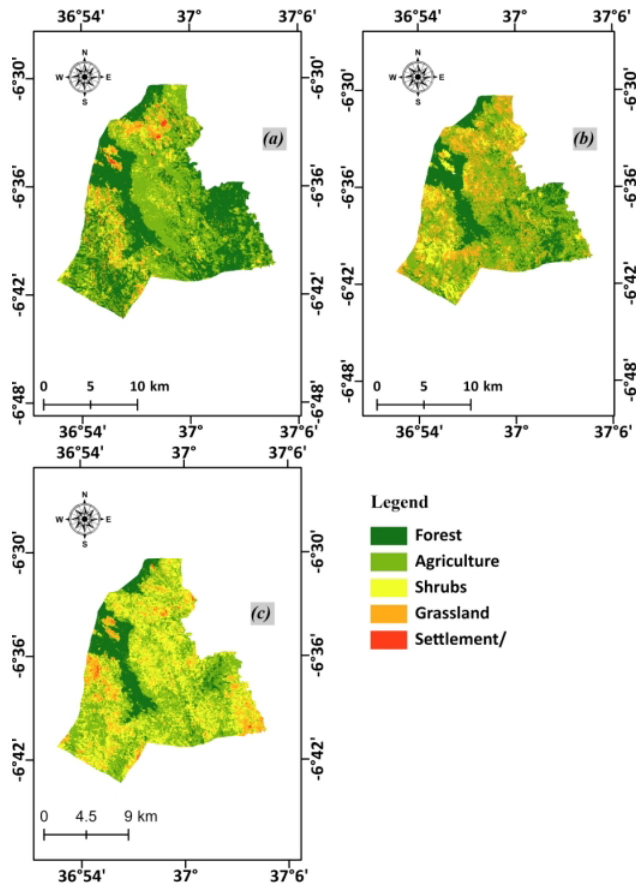

Fig. 4. Distribution of land cover of Lumbiji village in (a) 2000, (b) 2010 and (c) 2020

3) Distribution of the land cover changes at Lumbuji village in 2000

The forest constituted 10,450 Ha which translates to 37% of the total land in Lumbiji village. Agricultural land covered an area of 12,320 Ha which translates to 44% of the total land in the area. The built-up areas which include residential areas and road networks, constituted about 150 Ha which translates to 1% of the total area of the study while grassland and shrubs constitutes to 2830 Ha and 2150 Ha which translates to 10% and 8% respectively.

4) Distribution of the land cover changes at Lumbuji village in 2010

The forest cover was 6140 Ha which is equivalent to 22% of the total land. Agricultural land covered an area of 13,250 Ha which is higher compared to 12,320 Ha in 2000. This translates to 47% of the total area. The built-up area constituted 180 Ha equal to 1% of the total land. Grassland covered an area of 2780 Ha of land which translates to 10% of the total land in the area while shrubland constituted of 5580 Ha which translates to 20% of the total land in Lumbiji village. The distribution of land use and land cover is shown in figure 4.5(b).

5) Distribution of the land cover changes at Lumbuji village in 2020

The forest constituted an area of 3560 Ha. The agricultural land declined by 8% from 13250 Ha in 2010 to 10,800 Ha in 2020. On the other hand, shrubland coverage increased from 5580 Ha in 2010 to 10,700 Ha in 2020 which translates to 38%. The built-up area covered 160 Ha while grassland coverage declined by 1% from 2780 Ha in 2010 to 2620 Ha in 2020.

6) Distribution of the land cover changes at Imalamakoye village in 2000, 2010 and 2020

The distribution of the land cover changes in Lumbuji village entails the percentage and area covered by various land cover patterns as per studied satellite image sub-scene at different years namely 2000, 2010 and 2020 as identified in figure 4. The main land covers identified in the village were forest; agriculture; grassland; incorporating of open grassland, bush grassland and wooded grassland. Other major land cover patterns at the village were shrubland and build up/rock. These woodlands are made up of open woodland and closed woodland.

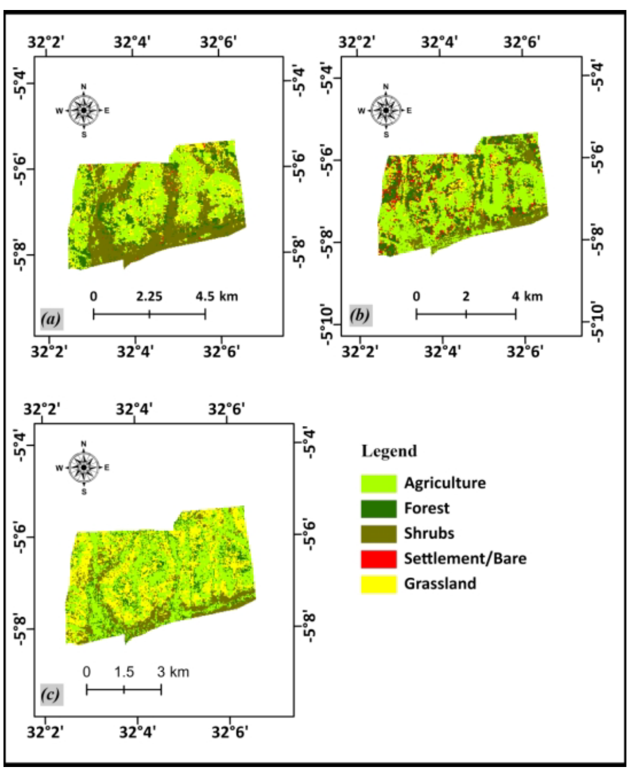

Fig. 5. Distribution of land cover of Imalamakoye village in (a) 2000, (b) 2010 and (c) 2020

7) Distribution of the land cover changes at Imalamakoye village in 2000

The forest constituted 570 Ha which translates to 19% of the total land in Imalamakoye village. Agricultural land covered an area of 720 Ha which translates to 24% of the total land in the area. The built-up areas which include residential areas and road networks, constituted about 15 Ha which translates to 1% of the total area of the study while grassland and shrubs constitutes to 823 Ha and 920 Ha which translates to 27% and 30% respectively.

8) Distribution of the land cover changes at Imalamakoye village in 2010

The forest cover was 200 Ha which is equivalent to 7% of the total land. Agricultural land covered an area of 780Ha which is higher compared to 720 Ha in 2000. This translates to 26% of the total area. The built-up area constituted 18 Ha equal to 1% of the total land. Grassland covered an area of 960 Ha of land which translates to 31% of the total land in the area while shrubland constituted of 1090 Ha which translates to 36% of the total land in Imalamakoye village.

9) Distribution of the land cover changes at Imalamakoye village in 2020

The forest constituted an area of 32 Ha. The agricultural land increased by 4% from 780 Ha in 2010 to 800 Ha in 2020. On the other hand, shrubland coverage increased from 1090 Ha in 2010 to 1104 Ha in 2020 which translates to 36%. The built-up area covered 28 Ha while grassland coverage increased by 4% from 960 Ha in 2010 to 1080 Ha in 2020.

4. Discussion

A. Land Cover Changes at the Selected Villages of Study

1) Accuracy Assessment

In this study, accuracy assessment was done by using the error matrix created on ArcGIS software. The findings presented in figure 1 revealed that the overall accuracy for the classified image of 2000 was 89%. The overall accuracy was obtained by taking the average of the identified classes of images which were forest (90%), Agriculture (88%), built-up area (86%) and grasslands (92%). This result implies that the accuracy of the studied images was in an acceptable range. According to Rawat & Kumar, (2015) the overall accuracy is acceptable if it is greater than 80%.

The views presented above concur with those of Jager et al. (2021) who conducted study on renewable energy and biological conservation in a changing world. The findings indicated that adoption of AREST was low because some of the local communities were still using fire wood and charcoal as the source of energy in the household.

2) Distribution of the Land cover changes at Lumbuji village in 2000, 2010 and 2020

The distribution of the land cover changes in Lumbuji village entails the percentage and area covered by various land cover patterns as per studied satellite image sub-scene at different years namely 2000, 2010 and 2020 presented in figure 4.5 as (a), (b) and (c) respectively. The years were considered with reference to the three years project started in 2000 conducted by Tanzania Traditional Energy Development Organisation

(TaTEDO) in kilosa district. The main land covers identified in the village were forest; agriculture; grassland; incorporating of open grassland, bush grassland and wooded grassland. Other major land cover patterns at the village were shrubland and build up/rock. These woodlands are made up of open woodland and closed woodland.

These findings resemble of Raihan et al. (2023) who studied on the likely adverse environmental impacts of renewable energy sources. Their findings found that adoption of AREST was low because some of the local communities were still using fire wood and charcoal as the source of energy in the household, then suggested policies that will emphasize a low-carbon economy, promoting renewable energy use, financing technical advancement, and the ecological viability of Indonesia's fores

Contrary, finding of Abbasi & Abbasi (2000) comes up with the broad conclusion that renewable energy sources are not the panacea they are popularly perceived to be; indeed, in some cases their adverse environmental impacts can be as strongly negative as the impacts of conventional energy sources.

3) Distribution of the land cover changes at Lumbuji village in 2000

The forest constituted 10,450 Ha which translates to 37% of the total land in Lumbiji village. Agricultural land covered an area of 12,320 Ha which translates to 44% of the total land in the area. The built-up areas which include residential areas and road networks, constituted about 150 Ha which translates to 1% of the total area of the study while grassland and shrubs constitutes to 2830 Ha and 2150 Ha which translates to 10% and 8% respectively.

The findings look similar to those of Raihan et al. (2023) who studied on the likely adverse environmental impacts of renewable energy sources. Their findings found that adoption of AREST was low because some of the local communities were still using fire wood and charcoal as the source of energy in the household.

4) Distribution of the land cover changes at Lumbuji village in 2010

The forest cover was 6140 Ha which is equivalent to 22% of the total land. Agricultural land covered an area of 13,250 Ha which is higher compared to 12,320 Ha in 2000. This translates to 47% of the total area. The built-up area constituted 180 Ha equal to 1% of the total land. Grassland covered an area of 2780 Ha of land which translates to 10% of the total land in the area while shrubland constituted of 5580 Ha which translates to 20% of the total land in Lumbiji village.

In supporting the findings, Hastik et al. (2015) conducted the study on Renewable energies and ecosystem service impacts, results highlighted the strong need for interdisciplinary research on RE and environmental conflicts because some of the local communities were still using fire wood and charcoal as the source of energy in the household.

5) Distribution of the land cover changes at Lumbuji village in 2020

The forest constituted an area of 3560 Ha. The agricultural land declined by 8% from 13250 Ha in 2010 to 10,800 Ha in 2020. On the other hand, shrubland coverage increased from 5580 Ha in 2010 to 10,700 Ha in 2020 which translates to 38%. The built-up area covered 160 Ha while grassland coverage declined by 1% from 2780 Ha in 2010 to 2620 Ha in 2020.

The views conform with those of Shan et al. (2021) which show that green technology innovation, renewable energy, energy consumption, population, income per capital, and carbon dioxide emissions are co-integrated for the long-term association hence its integration can reduce level of local communities in using fire wood and charcoal as the source of energy in the household.

6) Distribution of the land cover changes at Imalamakoye village in 2000, 2010 and 2020

The distribution of the land cover changes in Lumbuji village entails the percentage and area covered by various land cover patterns as per studied satellite image sub-scene at different years namely 2000, 2010 and 2020 presented in figure 4.6 as (a), (b) and (c) respectively. The main land covers identified in the village were forest; agriculture; grassland; incorporating of open grassland, bush grassland and wooded grassland. Other major land cover patterns at the village were shrubland and build up/rock. These woodlands are made up of open woodland and closed woodland.

The findings resemble to those of Pratiwi & Juerges (2020) which reported negative impact of renewable energy development comes from hydro power, biofuel production, and geothermal power plants. Solar and wind power might also have a negative impact, albeit one less reported on than that of the other types of renewable energy. The impact was manifested in environmental pollution, biodiversity loss, habitat fragmentation, and wildlife extinction.

7) Distribution of the land cover changes at Imalamakoye village in 2000

The forest constituted 570 Ha which translates to 19% of the total land in Imalamakoye village. Agricultural land covered an area of 720 Ha which translates to 24% of the total land in the area. The built-up areas which include residential areas and road networks, constituted about 15 Ha which translates to 1% of the total area of the study while grassland and shrubs constitutes to 823 Ha and 920 Ha which translates to 27% and 30% respectively.

The findings supported with those of Lippke et al. (2011) which found the robust and where uncertainties may be large enough to question key assumptions that impact carbon in the forest and its many uses which associated with some of the local communities were still using fire wood and charcoal as the source of energy in the household.

8) Distribution of the land cover changes at Imalamakoye village in 2010

The forest cover was 200 Ha which is equivalent to 7% of the total land. Agricultural land covered an area of 780Ha which is higher compared to 720 Ha in 2000. This translates to 26% of the total area. The built-up area constituted 18 Ha equal to 1% of the total land. Grassland covered an area of 960 Ha of land which translates to 31% of the total land in the area while shrubland constituted of 1090 Ha which translates to 36% of the total land in Imalamakoye village.

In supporting the findings, Hastik et al. (2015) conducted the study on Renewable energies and ecosystem service impacts, results highlighted the strong need for interdisciplinary research on RE and environmental conflicts because some of the local communities were still using fire wood and charcoal as the source of energy in the household.

9) Distribution of the land cover changes at Imalamakoye village in 2020

The forest constituted an area of 32 Ha. The agricultural land increased by 4% from 780 Ha in 2010 to 800 Ha in 2020. On the other hand, shrubland coverage increased from 1090 Ha in 2010 to 1104 Ha in 2020 which translates to 36%. The built-up area covered 28 Ha while grassland coverage increased by 4% from 960 Ha in 2010 to 1080 Ha in 2020.

The findings supported with those of Wassie & Adaramo (2019) who suggested that building on the household level positive results for scale and lasting impact at national and regional levels hence requires addressing key policy, technical, financial and sectoral integration barriers.

Generally, despite slightly improvement in land cover changes at the study villages, yet there are deforestations at both Lumbuji and Imalamakoye villages. This are happening due to different level of understanding in the societies found within these villages. Some of them found easy and cheap to use charcoal and firewood in their domestic consumption than using maize corns and rice cobs or other alternative renewable energy sources that are founding in both study villages.

The study found that alternative renewable energy sources and technologies was not only a factor for the improved land cover changes and forest cover but there were a number of reasons including; that of year 2002 where the government of Tanzania passed a new national forest policy with intention to transfer power over forest resources back to the community level so as citizens are directly involved in forest conservation. This being the case, a number of trees are planted at both the study villages however these efforts are confronted by the rapid increase in population that demand land for settlements and agriculture activities i.e., farming and livestock keeping.

The role of governance from the authorized experts i.e., Tanzania Forest Services (TFS) in line with NGO's i.e., TFCG, TaTEDO and CARMTEC addressing the issue of land cover changes and forest conservations by providing people with cheap alternative energy sources, improved charcoal stoves so as to alleviate the demand for charcoal and firewood that would have highly accelerated environmental degradation.

Moreover, study villages have benefited from the participation of Tanzania in various UN projects including program for reducing Emissions from deforestation and forest degradation (REDD) and conservation of forest stocks, sustainable management of forests and enhancement of forest carbon stocks (REDD+). As the result of the above-mentioned program, in 2016 Tanzania managed to establish a National Carbon monitoring center which allow the country to benefit from future international carbon trading mechanisms. This has resulted to improved forest and land cover change at Lumbuji and Imalamakoye villages and Tanzania in particular.

As a linkage to Technological Adoption Model (TAM) focuses how users acquire, learn, accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it. TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. The two main factors influencing the intentions to use a particular technology are perceived usefulness, which is a degree to which a person believes that using a particular system will improve his job's output; and perceived ease of use is the degree to which a person believes that using a particular system would be free from effort.

Moreover, basing on TAM, the findings found out that perceptions of local community were guided by level of knowledge, accessibility, usefulness and benefits of the AREST. Moreover, despite the existence of alternative renewable energy sources and technologies at the study areas, the extent of adoption of AREST was low because some of the local communities were still using fire wood and charcoal as the source of energy in the household. The views presented above concur with those of Shan et al. (2021) who conducted study on role of green technology innovation and renewable energy in carbon neutrality, where empirical findings show that green technology innovation, renewable energy, energy consumption, population, income per capital, and carbon dioxide emissions are co-integrated for the long-term association. Additionally, green technology innovation and renewable energy decline carbon dioxide emissions, whereas energy consumption, population, and per capital enhance carbon emissions.

5. Concluding Remarks

A. Conclusion

The perception of local community toward alternative renewable energy sources and technology has vital importance in improving the forest conservation and community livelihood at large. Several factors as such, better knowledge tends to have positive perception towards alternative renewable energy sources and technology. Thus, providing more knowledge to a larger group is essential. Teaching alternative energy sources and technology as a compulsory part of secondary school education might be relevant in a self-assessment system to increase positive perception of local community toward alternative renewable energy sources and technology.

Another contributing factor affecting the perception of the person is the usefulness. This study identified that use of tobacco flue curing in Imalamakoye village was alternative renewable energy source because, most respondent practices tobacco plantations as the source of financial income hence improvement of social wellbeing and livelihood.

On other side, at Lumbuji village were aware and skilled on the role of agricultural residues i.e., maize corns and rice cobs in contributions to alternative renewable energy sources. Mostly, the societies tend to use this type of renewable energy due to its attributes of being cheap to use as well as less cost. Such kind of renewable energy was mostly applicable at Lumbuji village in Kilosa due to fact there were most people with maize and rice plantations as compared to Imalamakoye village in Urambo district.

The aspect of extent of adoption of the alternative renewable energy source and technology is highly dependent on the accessibility of source, application and benefits. The findings from the study areas dictates Imalamakoye village have highly adopted to use maize corns and rice cobs while the respondents from Lumbiji village have highly adopted to use flue curing technology for treatment of tobacco because it is cheap to use and the availability of corn and cobs from maize and rice respectively is easy simply that most of the respondents are the crop farmers.

B. Implications of the Study

Study will provide the basis for the country to incorporate alternative renewable energy resources in its policies, acts and laws as the way to reinforce their applicability all around the country depending on the available resource in each location. Likewise, information from this research will serve as the basis for further research study on renewable resources and governance.

C. Limitation

As for the future studies, the investigator recommends more investigations to be conducted as it is earliest of its type in Tanzania, therefore similar study can be done involving extensive geographical coverage.

Furthermore, the research should be done with extensive scope by including more causing factors and indirect effects of the variables or causes that will shows impacts of alternative renewable sources and technologies on forest conservation at Lumbuji Villlage in Kilosa District and Imalamakoye Village in Urambo District.

References

[1] Abbasi, S. A., & Abbasi, N. (2000). The likely adverse environmental impacts of renewable energy sources. Applied energy, 65(1-4), 121-144.

[2] Abiodun, O. (2012). Review of Renewable Energy Sources in Nigeria-Security and Challenges. International Journal of Advanced Renewable Research. vol. 1, no. 1, 71-77, 2012.

[3] Achterberg P, Houtman D, van Bohemen S, Manevska K. (2010). Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in the Netherlands, International Journal of Hydrogen Energy, 35, pp. 6075–6083.

[4] ADBG. (2015). Renewable Energy in Africa: Tanzania Country Profile. African Development Bank Group, Available online: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/

[5] Adepoju, A. O., & Akinwale, Y. O. (2019). Factors influencing willingness to adopt renewable energy technologies among micro and small enterprises in Lagos State Nigeria. International Journal of Sustainable Energy Planning and Management, 19, 69-82.

[6] Ajzen, I., & Fishein, M. (1969). The prediction of behavioral intentions in a choice situation, Journal of Experimental Social Psychology, 5 (1969) pages 400-416.

[7] Ajzen, I., & Fishein, M. (1980). Understanding attitudes and predicting social behaviour, Prentice-Hall.

[8] Amjad (2015). Wind energy development policies in Developing Countries and their effects: Turkey, Egypt and prospects for Pakistan. American Journal of Energy and Power Engineering. vol. 2, no. 5, 2015.

[9] Annala S, Viljainen S, Tuunanen J, Honkapuro S. (2014). Does knowledge contribute to the acceptance of demand response? Journal of Sustainable Development of Energy, Water and Environment Systems, 2(1), pp. 51-60.

[10] Azjen I, & Madden, T. (1989). Prediction of goal-directed behavior: attitudes, intentions, and perceived behavioral control, Journal of Experimental Social Psychology, 22(5), pp. 453-474.

[11] Benjaminsen, T.A., Maganga, F. and Abdallah, J.M. (2009). The Kilosa Killings: Political Ecology of a Farmer–Herder Conflict in Tanzania. Development and Change.

[12] Bishoge, O. K., Kombe, G. G., & Mvile, B. N. (2020). Community participation in the renewable energy sector in Tanzania: Community participation in the renewable energy sector. International Journal of Sustainable Energy Planning and Management, 28, 121–134.

[13] Bishoge, O.K., Lingling, Z., and Mushi, W. G (2018). The Potential Renewable Energy for Sustainable Development in Tanzania: A Review.

[14] Cesena, E. M. (2012). Real Options Theory Applied to Renewable Energy Generation Projects Planning, University of Manchester: UK, 2012.

[15] Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, MIS Quarterly, 13(3), pp. 318–340.

[16] FAO. 2020. State of the World's Forests 2020. Forests and agriculture: land-use challenge and opportunities. Rome.

[17] Feng, H. (2012). Key factors influencing users' intentions of adopting renewable energy technologies, Academic Research International, 2(2), pp. 156-168, 2012.

[18] Fichera, C. R., Modica, G., & Pollino, M. (2012). Land Cover classification and change-detection analysis using multitemporal remote sensed imagery and landscape metrics. European Journal of Remote Sensing, 45(1), 1–18.

[19] Giacomo F., David E.H.J. Gernaat, J.H, & Sebastian S. (2019). Hydropower dependency and climate change in sub-Saharan Africa: A nexus framework and evidence-based review. Journal of Cleaner Production, Volume 231, pp. 1399-1417.

[20] Graziano M. (2014). Adoption of Diffused Renewable Energy Technologies: Patterns and drivers of Residential Photovoltaic (PV) Systems in Connecticut, 2005-2013. Doctoral Dissertations.

[21] Hall, J., Burgess, N.D., Lovett, J., Mbilinyi, B. and Gereau, R.E. (2009). 'Conservation implications of deforestation across an elevation gradient in the Eastern Arc Mountains, Tanzania.' Biological Conservation.

[22] Hastik, R., Basso, S., Geitner, C., Haida, C., Poljanec, A., Portaccio, A., ... & Walzer, C. (2015). Renewable energies and ecosystem service impacts. Renewable and Sustainable Energy Reviews, 48, 608-623.

[23] Heaslip E, Costello GJ, Lohan J, (2016). Assessing good-practice frameworks for the development of sustainable energy communities in Europe: lessons from Denmark and Ireland, Journal of Sustainable Development of Energy, Water and Environment Systems, 4(3), pp. 307–319.

[24] Hewitt, J., Holden, M., Robinson, B.L., Jewitt, S., Clifford, M.J. (2022). Not quite cooking on gas: Understanding biogas plant failure and abandonment in Northern Tanzania, Renewable and Sustainable Energy Reviews, Volume 165, 112600.

[25] Imakulate, T. (2016). Impacts of biofuel plantation on land use cover changes and livelihood of communities in Tanzania, UDSM, Dar es Salaam.

[26] Jager, H. I., Efroymson, R. A., & McManamay, R. A. (2021). Renewable energy and biological conservation in a changing world. Biological Conservation, 263, 109354.

[27] Karekezi, S. and W. Kithyoma, (2002). Renewable Energy Strategies for Africa. Oxford: Elsevier Science Limited.

[28] Kichonge, B., Mkilaha, I., Geoffrey, J., Sameer, H (2016). The Economics of Renewable Energy Sources into Electricity Generation in Tanzania. Journal of Energy, Volume 2016.

[29] Kilosa District Council (2010). Kilosa District Profile. District Council, Kilosa, Morogoro Tanzania.

[30] Kisoza, L.J.A., Kajembe, G.C. and Monela, G.C. (2004). Natural resource use conflicts in Kilosa district, Morogoro region, Tanzania. In: Proceedings of the IFRI East African Regional Conference. (Edited by Shemwetta, D.T.K., Luoga, E.J., Kajembe, G.C. and Madoffe, S.S.). Moshi, Tanzania.

[31] Kothari, C. (2004). Research Methodology, Methods and Techniques. Second revised Edition. New international publisher, India.

[32] Lippke, B., Oneil, E., Harrison, R., Skog, K., Gustavsson, L., & Sathre, R. (2011). Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns. Carbon Management, 2(3), 303-333.

[33] Maganga, F., Odegaard R. Derman, B. Odegaard R. and Sjaastad, E., (2007). Contested identities and resource conflicts in Morogoro Region, Tanzania – who is indigenous? Conflicts Over Land and Water in Africa. James Currey, Oxford, pp. 202–14.

[34] Merton, R. C., (1997). Theory of rational option pricing," Bell Journal of Economics and Management Science, vol. 4, no. 1, pp. 141-183, 1973.

[35] Michael, G and Msafiri, J (2007). Integrated Sustainable Energy Services for Poverty Reduction and Environmental Conservation Program ISES-PRECP. NORAD Collected Reviews.

[36] Msololo (2016), 100% Renewable energy and poverty reduction in Tanzania, workshop paper on Climate Action Network, Tanzania.

[37] Mwirigi, J., Balana, B., Mugisha, J., Walekhwa, P., Melamu, R., Nakami, S. (2014). Socio-economic hurdles to widespread adoption of small-scale biogas digesters in Sub-Saharan Africa: A review.

[38] Park, S. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning, Educational Technology and Society, 12(3), pp. 150–162.

[39] Pierce J, Steel B, Warner R. (2009). Knowledge, culture and public support for renewable-energy policy, Comparative Technology Transfer and Society, 7(4), pp. 270-286.

[40] Pratiwi, S., & Juerges, N. (2020). Review of the impact of renewable energy development on the environment and nature conservation in Southeast Asia. Energy, Ecology and Environment, 5(4), 221-239.

[41] Raihan, A., Pavel, M. I., Muhtasim, D. A., Farhana, S., Faruk, O., & Paul, A. (2023). The role of renewable energy use, technological innovation, and forest cover toward green development: Evidence from Indonesia. Innovation and Green Development, 2(1), 100035.

[42] Rawat, J. S., & Kumar, M. (2015). Monitoring land use/cover change using remote sensing and GIS techniques: a case study of Hawalbagh block, district Almora, Uttarakhand, India. The Egyptian Journal of Remote Sensing and Space Science, 18(1), 77–84.

[43] Sarakikya, H. Renewable energy policies and practice in Tanzania: Their contribution to Tanzania economy and poverty alleviation. Int. J. Energy Power Eng. 2015, 4, 333.

[44] Shan, S., Genç, S. Y., Kamran, H. W., & Dinca, G. (2021). Role of green technology innovation and renewable energy in carbon neutrality: A sustainable investigation from Turkey. Journal of Environmental Management, 294, 113004.

[45] Shishira, E. K. & Yanda P. Z. (1997). Kilosa District: Land Use and Natural Resource Assessment. Report Prepared for Kilosa District Council/Irish Aid. Institute of Resource Assessment Dar es Salaam.

[46] Southey, G. (2011). The theories of reasoned action and planned behaviour applied to business decisions: a selective annotated bibliography, Journal of New Business Ideas & Trends, 9 (1) pages 43-50.

[47] Sunderlin W.D., (2005), Livelihoods, Forest and Conservation in Developing countries: An overview, CIFOR, World Development 33 (9): 1383-1402.

[48] Tate G, Mbzibain A, Ali S, (2012). A comparison of the drivers influencing farmers' adoption of enterprises associated with renewable energy, Energy Policy, 49, pp. 400-409, 2012.

[49] TaTEDO (2018). Sustainable energy development programme, Center for sustainable Energy services, Dar es Salaam.

[50] The International Hydropower Association, IHA, (2018). The International Hydropower Association annual status report.

[51] URT, (2003). National sample census for Agriculture in 2002/2003, Volume Vf, 2003.

[52] Wassie, Y. T., & Adaramola, M. S. (2019). Potential environmental impacts of small-scale renewable energy technologies in East Africa: A systematic review of the evidence. Renewable and Sustainable Energy Reviews, 111, 377-391.

[53] WEHAB working Group, (2002). A framework for Actions on Energy – World Summit on Sustainable Development, Johannesburg 2002.

[54] World Bank, (2020). The status of the global renewable energy sources. Annual report.

[55] World Energy Outlook, (2018). International Renewable Energy and Technology. International Energy Agency.