

The Role of Rural Women's Occupations on Electrification and Use of Electric Stoves for Households in Busega District, Tanzania

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Abstract: The paper addressed occupations as socio-economic qualities that determine rural women's capabilities to install and use electric stoves in their households. The study applied the cross-sectional design through conducting a household survey. The study sample size included 210 rural women and seventeen key informants. Qualitative data was analysed through content analysis while the quantitative data was analysed by computing descriptive statistics, cross tabulation and chi-square test. The study established that majority of rural women were interested in installing electricity and using electric cookers in their households. However, households without electricity lacked income for paying the required charges to get services. Men controlled installation and usage of electric cookers in households as they were the main bread winners while women lacked income to meet the required charges. As a result, rural women were negatively affected by the burden of firewood collection and cooking that led into deforestation in the area. The study recommends that sensitization on the installation and use of electric cookers should be done to rural women to increase their awareness on the benefits of adopting them. In addition, development stakeholders should support rural women by increasing their capacity for conducting income generation activities to get higher profits.

Keywords: Electrification; electric stoves; household; rural women; occupation

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Introduction

This study is about rural women's occupations with installation of electricity and the use of electric stoves for cooking in households in Busega District, Tanzania. The paper focused on electrification and electric stoves because they consume the highest costs than other sources of cleaner energy like gas, solar and biofuels. Electric power is a resourceful energy to quicken the process of cooking food. In addition, the use of electricity in cooking facilitates environmental conservation (Kabeyi and Olanrewaju, 2020). Sustainable electricity supplies reduce deforestation caused by cutting trees for firewood and air pollution through smokes. In developing countries, successful electrification in households depends on availability of incomes to

ensure sustainable supplies (Namaganda-Kiyimba and Mutale, 2020; Zebra, van der Windt, Nhumai & Faaij, 2021). Typically, in Kenya, electric micro-grids contributed significantly to boost the household income through increased agricultural productivity for rural communities (Mugisha, Ratemo, Keza & Kahveci, 2021).

Installation of electricity in households increases chances for using cleaner cooking technologies. Tanzania Electric Supply Company (TANESCO) supplies electric power in urban and rural areas. However, in 2018 statistics show that in rural Tanzania, only 2.1% used electricity while 29% used charcoal and 61% used firewood for cooking. In addition, "only 29% of households were connected to grid electricity in 2018" (NBS, 2019). Scholars

attach the demand of electricity consumption in households with the economic affluent that plays a significant role on decision-making for installation and purchasing the devices (Rogers *et al.*, 2021; Wang, Wang & Ahn, 2021). However, for the majority of rural women, their occupations have contributed significantly to enable or limit them to install and use electricity for cooking in their households (Taale and Kyeremeh, 2019). The issue of rural women's occupations as one of the determinants for installing and utilizing electricity for cooking in rural households has not been well addressed in development interventions.

This study adopted the theory of change through adopting electricity to development for discussing electrification in households and adopting cleaner cooking stoves. The theory of change can be used in explaining interventions undertaken to promote development in various sectors for instance, agriculture (Douthwaite, Ahmad & Shah, 2020). The theory of change through adopting electricity to development has been adopted in this study as a basis for discussing the usefulness of electric power in households. The theory emphasizes on changing from using traditional methods for conducting various activities to adopting modern technologies. For this study, the use of modern technologies refers to adoption of electricity to save time that could be utilized in conducting livelihood strategies to foster development in households. The use of electricity provides outcomes when its inputs are implemented in various consumptions. According to Gebremeskel, Ahlgren & Beyene (2021), electrification in households is likely to increase effectiveness of executing development programmes.

Different electricity access options promote alternatives and opportunities to create valued lives of people in households (Bhattacharyya and Palit, 2021). The theory of change through adopting electricity to development put forward the desired outcomes as outputs delivered through the processes of managing electric installation charges as well as the consumptions. According to Thomas, Sandwell, Williamson & Harper (2021) "electricity access situation for households" provide a "greater range and quality" of various appliances that reduce the workload of cooking in households and save time for other activities. The paper proposes that electrification and the use of electric stoves in households reduce the burden of firewood collection and cooking to save rural women's time that could be dedicated on livelihood strategies to improve their lives.

However, Cravioto *et al.* (2020) observed that there are no changes in the time dedicated for performing a particular activity in household when electricity is used. In addition, other scholars regard "electrification by creating an additional strain on households' finances..." (Gupta and Pelli, 2020, p. 1). Despite the negative arguments on electrification in households, the theory of change through adopting electricity to development outputs is based on how electricity is distributed by key players/actors and the ability of clients to afford the expenses throughout their usage. The theory assumption is used to generate the argument of the study, that installation of electricity and the use of electric stoves can save time used by rural women for firewood collection and cooking in households. As a result, they will be able to save time and use it for livelihood strategies to improve households' incomes.

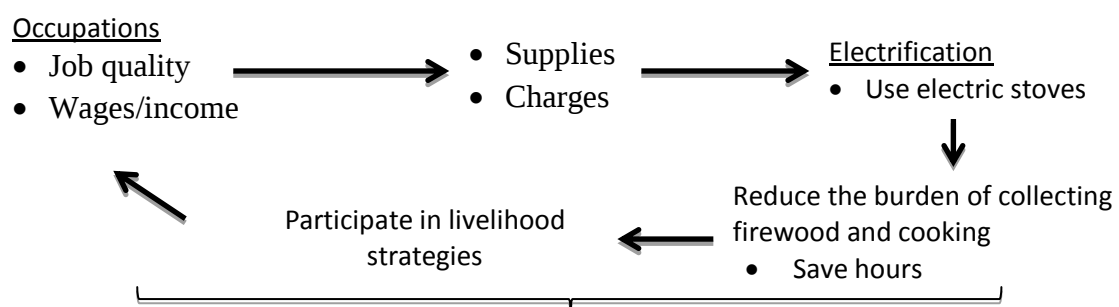


Figure 1: Theoretical Framework of the study

The theory emphasizes on the importance of adopting the steps required to obtain electricity. The presence of an electricity supplier agent does

not mean that everyone will be able to access it without personal efforts. In this study, figure 1 represents the concept of theory of change through

adopting electricity to development that is supported by rural women's occupations. Rural women's occupations with high and medium wages or income are likely to contribute in paying charges for installing and using electric stoves in their households. As such, the use of electricity for cooking is capable to reduce the workload of fetching firewood and cooking to save time for livelihood strategies to generate income.

The paper analysed the question: How do rural women's occupations contribute into affording the expenses of installing electricity and use of electric stoves for households in Busega District, Tanzania? This question has been answered by examining the number of households with electricity and the ones that use electric stoves in relation to rural women's occupations in the study area. Rural women who did not have electricity in their households were also examined to determine whether incomes generated from their occupations were not enough to afford payments of charges for receiving services. The study was therefore worth undertaking to encourage rural women to increase productivity in order to improve household incomes and afford the expenses of installing electricity and using electric stoves for cooking.

IFAD Sampling Formula:

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

Description:

n = required sample size

t = confidence level at 95% (standard value of 1.96)

p = estimated percentage for occurrence of the problem (16.3%)

m = margin of error at 5% (standard value of 0.05)

Calculations:

$$n = \frac{1.96^2 \times 0.163(1-0.163)}{0.05^2}$$

$$n = \frac{3.8416 \times 0.026569}{0.0025}$$

$$n = \frac{0.52411333}{0.0025}$$

$$= 209.645332 \sim 210$$

The process started by assessing the exposure of rural women to the situation of installing electricity and use of electric stoves in their households. Respondents were visited once in their households for interviews and observations. Cross-sectional design was used because it allows collecting data and observing features at a particular moment.

Methodology

The study was carried out in Busega District in the Simiyu Region of Tanzania. The region has five districts namely; Busega, Meatu, Itilima, Bariadi and Maswa. Busega District is located in the north western part of the region bordering with Magu District in the west, Bariadi District in the South and Bunda District and Serengeti game reserve in the south eastern part. The geographical location of the district is between latitude 2° 10' and 2° 50' South with longitude 33° and 34° East. The headquarters of this district is Nyashimo town. Busega District was selected as among the areas in the country that has been deforested due to the use of firewood (Hailemariam and Mekonen, 2021; Rugeiyamu, Shayo, Kashonda & Mohamed, 2021). Rural women are struggling to fetch firewood for cooking despite the availability of modern appliances capable to reduce the workload in their households.

Research Design

The research design adopted for the study is the cross-sectional as a strategy for integrating components that were required to address the problem in the study area. The design was adopted to conduct a household survey to rural women at a single point in time.

Population and Sampling

The targeted population was 98,700 women based on the Tanzania National Census of 2012 in Busega District (United Republic of Tanzania, 2012). The sampling population in these villages were rural women as entities eligible to contribute their income for paying electric installation and usage of

electric cookers in households. International Fund for Agriculture Development formula was applied to calculate the sample size (International Fund for Agricultural Development, 2011). The formula was employed because it has the percentage option for estimating the problem under investigation.

The calculated sample size was 210 respondents. These respondents were selected from six villages that included Yitwimila A and Yitwimila B in Kiloleli Ward; Bulima and Bukabile villages in Nyashimo Ward, and Kabita and Nyamikoma villages in Kabita Ward. As villages in Busega District have similar demographic characteristics, the selection of the six villages was guided by the presence of TANESCO services within the area. The sample size of 210 was divided by six to get equal number from each village. As such, rural women's selection included the ones who were involved in the workload of collecting firewood and cooking in their households.

Key informants and participants for focus group discussions were selected through purposive sampling. The selection was done by considering and selecting entities that were likely to provide the needed information. The rationale for adopting purposive sampling is that the technique provides an opportunity to select individuals who are equipped with suitable information required for answering the research question.

Data Collection

In this study, both primary and secondary data were collected to obtain qualitative and quantitative facts. The sources of data were interview schedules, observations and discussions. For primary data collection, household survey, non-participant observations and focus group discussions were conducted. For primary data collection, household survey, non-participant observations and focus group discussions were conducted. Each method was administered to eligible respondents in different sessions. Household survey was conducted to interview respondents by administering a questionnaire to collect quantitative data. The survey was conducted because it was a suitable approach to request information from respondents to answer the research question. More information was collected through non-participant observations by using a guide prepared to capture qualitative data on the status of electrification in households and the surroundings in the study area.

Observations included the kind of fuels used for cooking food in households, locations of TANESCO

electricity poles and availability of forests in the surroundings. Furthermore, six focus group discussions with ten rural women as participants in each totaling 60 were conducted in the district. In this paper, the number of participants in each group was selected based on the suggestion given by Yayeh (2021) that "A focus group typically consists of around 6 to 12 target participants engaged in a discussion with a research moderator." Only ten members for each group were preferred to ensure that they get a chance to participate effectively in the discussion. These focus group discussions were conducted by gathering qualitative information from similar respondents by using a guide or checklist as the baseline for dialogues. Respondents were guided to provide information that originates from their real-life patterns. The rationale for using focus group discussions was to collect information from rural women with similar backgrounds to review the situation of installing and using electric stoves in households.

Semi-structured interview guides were also used as instruments to conduct interviews to collect qualitative, in-depth information from seventeen key informants who were selected direct from their respective working places. Key informants included the district commissioner for getting information about the status of electrification in rural households in the district. Two TANESCO personnel were interviewed as key players/actors for providing electricity in the study area. A social worker, the community development officer and three development stakeholders from Social Network Venture (SNV) and private sectors explained their observations about the existing condition of electrification in rural households. Three ward and six village executive officers were also interviewed to explain the status of electrification in their areas. Key informants were interviewed in this study because they are knowledgeable people who work and provide services to the community and they understand the statuses of rural women livelihoods.

Secondary data were collected through documentary reviews by analysing the pricing system from TANESCO fliers to get quantitative figures for calculating the expenses. The fliers consisted information about the installation charges and LUKU (*Lipa Umeme Kadiri Unavyotumia*) meaning that prepay for electricity for future consumptions. Secondary data were important in this study because they provided accurate

information about utilization and charges of electricity within the district and country wise.

Treatment of Data

The mixed approach such as qualitative and quantitative techniques was adopted to analyse data from different scenarios of the study. The mixed approach was applied because it allowed studying, analysing and reporting responses in terms of quality and magnitude features.

Qualitative Technique

Content analysis was applied to analyse qualitative data. Contents captured were extracted from rural women's explanations about the statuses of installing electricity and adoption of electric stoves for cooking food in their households. Content analysis was done by developing codes into meaningful patterns to report social phenomena obtained from the field. This technique was applied to define the population and texts were used to answer a research question in a comprehensive approach. This analysis was done systematically by recording in-depth explanations given by respondents during data collection. The methods applied for analysis include converting collected information into codes, summarizing and interpreting contents into meaningful text descriptions and organizing. Content analysis was adopted because it delivered a tool for determining detailed words, themes and concepts from respondents.

Quantitative Technique

Descriptive statistics was used to calculate frequencies and percentages of rural women on the options regarding installations of electrical power whether needed or not in their households. The same method was used to compute the number of

households that owned electric stoves. A Five Point Likert Scale was applied to determine perceptions on the technical support delivered by key players/actors as 1 for constantly, 2 for often, 3 for sometimes, 4 for rarely and 5 for never provided. Cross tabulation was used to compute perceptions of rural women by considering the existed situation. Chi square test was done to analyse the relationship that existed between the installation of electricity and the use of electric stoves in households with rural women's occupations.

Findings and Discussion

This section presents and discusses results of the study. The study was guided by the following research question: How do rural women's occupations contribute into affording the expenses of electrification and using electric stoves for households in Busega District, Tanzania?

Household Electricity Supply Requirement

Rural women were asked whether they required electricity supplies in their households. Respondents declared the need for the reliable electrical power supply for household consumptions. The majority of rural women in the study area (82.3%) testified that they needed installation of electrical power in their households but a few of them (17.7%) did realize the requirement as seen in Table 1.

Rural women interviewed during the household survey stated that there was a huge demand of electrical power supply for conducting several activities such as for lighting electronic devices like cookers, refrigerators, fans, televisions, radios, irons and bulbs/tube lights. Despite the requirements identified by rural women, electricity supply was available in few households.

Table 1: Electricity Supply Requirement in Households

Electricity requirement	Frequency	Percentage
Required	37	17.7
Not required	173	82.3
	210	100.0

Table 2: Ownership of Electric Stoves in Households

Status	Frequency	Percentage
Own and use electric cooker	14	6.7
Not owning an electric cooker	196	93.3
	210	100.0

The TANESCO key players/actors declared that their services were available in rural and urban areas and customers were supported to pay required

expenses for installation and usage in their households. However, the usage of electricity for cooking in households was minimum. Statistics show

that 6.7% of rural women in the study area owned and used electric stoves including substitutions with charcoal and 93.3% did not own (Table 2). The key player/actor from TANESCO declared:

In places where electricity is available within the district, women didn't use it for cooking; they rather used it for lighting bulbs/tube lights with appliances such as refrigerators, computers, printers and televisions. Rural women needed a strong support for expediting the switch from biomass cooking to cleaner energy" (Busega District, 14/08/2017).

Rural women explained that installing electricity and using electric cookers in their households is expensive such that very few people can afford the expenses. Likewise, Njenga *et al.* (2019) revealed that high costs of electricity limited the majority of rural women to use electric stoves for cooking to reduce the workload of firewood collection. In Busega District, electric energy was not frequently used for cooking because people were not able to meet the costs.

Electricity Installation in Households

The study sought to establish possibilities for installing electricity in households of selected respondents. Electricity key players/actors explained that the absence of electricity in many households was due to their priorities and lack of income to pay

for installation charges. Installation charges were proportional to the distances from households to the poles excavated in the particular area. Through observations, it was revealed that most of the rural households were located far approximately 500 metres from electric poles within their villages. As such, 42.86% of rural households in the study area managed to install electricity while the majority 57.14% was not supplied with electricity (Table 3).

The Bulima Village Executive Officer also reported this: "Despite the government's initiatives in extending supply of electric power in rural areas, low incomes in most of the households remain a major obstacle to meet the desired targets" (Busega District, 25/08/2017).

Energy, poverty and gender create an inter-relation in development, which is known as the "energy-poverty-gender nexus" (Skutsch and Clancy, 2006). The TANESCO key players/actors reported that, the gender dimension of energy originates from households for both adult men and women. During the focus group discussions, it was reported that the pattern of division of labour in households puts several responsibilities to women that increase the demand for energy supplies. The community development officer also reported that when the workloads overwhelm rural women, they dropped out from schools young boys and girls to assist them.

Table 3: Installation of Electricity in Households of Busega District

Status	Frequency	Percentage
Households with electricity	90	42.86
Household without electricity	120	57.14
	210	100.0

Furthermore, the study revealed that the pricing system of electric power was expensive; thus, hindered rural women to use such energy for cooking. The study discovered that the prices were more expensive to extend electricity in rural households than urban because communities had low incomes. Thus, an alternative for reducing the demand of firewood by adopting electric stoves to rural women has not been successful. Rural women also testified this during the focus group discussions that they continued to struggle in fetch of firewood for cooking by walking long distances. Observations also showed that the area was deforested due to heavy dependency on trees for firewood cutting.

Rural Women's Perceptions on Electric Supplier Key Players/Actors

Rural women were asked to declare how they perceived electric supplier key players/actors on responding to their problems related to power supplies. Respondents who had electricity in their households were consulted to assess the frequency of technical support provided by key players/actors in their community. Five Likert scale points were used to determine their perceptions on the following statement "Electric suppliers respond on time when they are requested to deliver technical supports to their customers." Results were distributed as follows: 23% said that they responded constantly; 19% said that their support was offered often and 24% reported that sometimes key

players/actors responded to their calls for support. In addition, 24% said that they were rarely provided with technical support while 10% said that they were never given any kind of support (Figure 2). According to the statistics, minority were provided with constant support by the key players/actors even though access to electricity is generally deemed to facilitate improvement in livelihood (Tonini, Sanvito, Colombelli & Colombo, 2022).

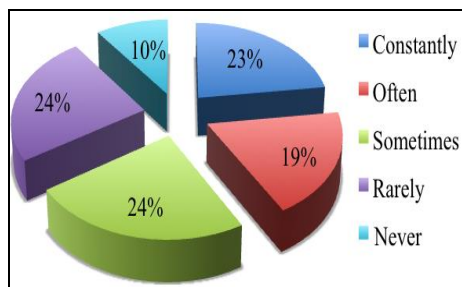


Figure 2: Perceptions on Electric Service Providers

Observations also showed that there was a problem of power outages frequently which was among the limitations of using electric stoves in rural households. Technical support from TANESCO key players/actors to rural households was therefore not sufficient to meet the demands of customers. Similarly Chigbu and Nekhwevha (2021) reported that electrical technical support was not fully offered for solving problems in rural areas. As a result, TANESCO key players/actors in Tanzania were incapable to meet the increasing demands. This has resulted into “planned and unplanned power outages” that affect negatively the performance on various activities that depend on this source of power (Carlsson, Kataria, Lampi & Martinsson, 2021). The efforts of solving electricity technical problems offered by key players/actors were not sufficient in Busega District.

Control of Electric Energy Utilization

Rural women were asked whether they had freedom to install or use electricity in their households. The results show that, in households with electricity, there was a problem for married

women as their husbands controlled utilization of electricity. Rural women testified that since men were the ones responsible to pay for the households’ living expenses, they often prohibited rural women to use the energy to retain the pre-paid charges. In Busega District, like other places in the country, clients use LUKU (*Lipa Umeme Kadiri Unavyotumia* ‘pay for electricity as you consume’) that “allows a customer to receive tokens to recharge digital electricity meters” (Ilonga and Mapunda, 2022). All the surveyed households used the LUKU payment system.

Rural women also explained the situation when they used electric stoves in their households. The LUKU payments made were consumed at a short time. One of the respondents in Bukabile village had this to say:

Often in our households, husbands prohibit us from using electricity. When the consumption expenses increase, it normally becomes difficult to afford. Most of our households struggle with low incomes not possible to meet the costs of using even other cleaner cook-stoves. As a result, we use charcoal and firewood for cooking, which is time consuming” (Busega District, 30/08/2017).

The most alternative used by the majority in the area included gas cookers, charcoal and firewood. The majority of households, however, used firewood for cooking because they did not afford the expenses of using cleaner cook-stoves.

Electric Stoves Uses Vs Occupations

As indicated in table 4, rural women’s occupations were examined in relation to installation of electricity in their households. Statistics indicate that 1.43% small-scale farmers, 2.38% business persons, 16.19% those who combined farming and business, 20% civil servants, 5.71% NGO employees, 0.48% who conducted other activities managed to install electricity in their households.

Table 4: Status of Electric Installation by Occupations

Status	Occupation													
	Farmers		Business Persons		Farmers/ Business Persons		Civil Servants		NGO Employees		Other Activities		Total	
	f	%	f	%	f	%	F	%	F	%	f	%	f	%
Installed	3	1.43	5	2.38	34	16.9	42	20	12	5.71	1	0.48	97	46.19
Not installed	37	17.62	18	8.57	50	28.81	0	0	0	0	8	3.81	113	53.81
Total	40	19.05	23	10.95	84	40	42	20	12	5.71	9	4.29	210	100

Table 5: Chi-Square Tests

	Value	Degree of Freedom	P - Value
Pearson Chi-Square	99.794 ^a	10	0.00***
Likelihood Ratio	126.486	10	0.00***
Linear-by-Linear Association	17.748	1	0.00***
Number of Valid Cases	210		

Significant at 0.05

This study revealed that all rural women who were employed, such as teachers, nurses, guardians of students in schools and civil servants, lived in houses with electricity. This implies that the majority of rural women who were employed managed to install electricity in their households with some portion of those who combined farming and trading. This demonstrates that, affordability of the costs for installing electricity in rural households depends on the daily and monthly incomes. Households with rural women who had sustainable incomes managed to install electricity. This is due to the fact that rural women contribute for paying installation charges by compensating with their husbands incomes.

The chi-square results show that there is a strong association between rural women's occupations and installation of electricity in households at a p-value 0.00, significant at 0.05 (Table 5). This shows that rural women's occupations contributed significantly to affording the expenses of installing electricity and utilization of electric stoves in households.

The study discovered that the majority of rural women who failed to diversify livelihood strategies by conducting a single small-scale income generating activity such as farming or trading had no electricity in their households. In this case, women who generated middle and higher incomes were likely to support their households to afford the expenses of installing and utilizing electricity for cooking. Since in rural areas women were limited to access the sources of income generation for household consumptions, they failed to establish reliable sources which has contributed significantly to escalate income poverty and inability to afford the expenses of electric power supplies.

Conclusions and Recommendations

Conclusions

It is evident that majority of rural women were interested in installing electricity and using electric cookers in their households. However, households

without electricity lacked income for paying the required charges to receive the services. Some rural women who had electricity in their households were not offered with sufficient support by key players/actors whenever they needed services. It was also evident that men controlled installation and usage of electric cookers in households as they were the main bread winners while women lacked income to meet the required charges. As a result, rural women were negatively affected by the burden of firewood collection and cooking that led into deforestation in the area. The study conforms with the theory of change through adopting electricity to development in the context of adopting and using energy in households. The minority of rural women whose occupations enabled them to earn higher and medium incomes such as those who combined farming and trading, civil servants and NGOs employees contributed to pay for the expenses of installing electricity in their households. The study concludes that there is a relationship between installation of electricity and usage of electric cookers in households and with rural women's occupations.

Recommendation

The study recommends that sensitization on the installation and use of electric cookers should be done to rural women to increase their awareness on the benefits of adopting them. Development stakeholders should support rural women by increasing their capacity for conducting income generation activities to get higher profits. The support should include provision of equal opportunities such as employment and access to credits so that they can generate medium and high incomes for household expenditures and support to pay the expenses of installing electricity and using electric stoves in households. TANESCO personnel should pay attention on the calls from customers to improve services in households. Finally, men should consider the need of installing electricity and

purchasing electric cookers to reduce the burden of firewood collection and cooking to rural women.

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