

Fuel-Wood Energy Sector-Livelihood Nexus: Evidence from South Africa

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ABSTRACT Many transactions associated with fuel-wood value chain fall within the informal sector, and are undertaken illegally, hence, not recorded or captured in the economic analysis of developing countries including South Africa. This scenario increases the difficulty of examining the contribution of fuel-wood energy sector in the economic growth of South Africa. The non-existence of formal markets for fuel-wood energy services has reduced the visibility of the sector. This paper highlights the value addition the fuel-wood energy sector on the livelihood of South African fuel-wood traders. A two stage stratified random sampling technique was utilized to collect data from 200 fuel-wood traders using the demarcated enumeration areas (EAs) in Western Cape Province during the 2011 census. The findings show that fuel-wood traders in South Africa relied on the business to sustain livelihoods. The findings have implications for long-term development planning in energy and small business development planning by the government.

INTRODUCTION

It is generally agreed, that in the developing countries, forest resources contribute to rural livelihood by facilitating present modern-day expenditure and offering households a type of 'natural insurance' against adversities (Pouliet et al. 2012). According to Shackleton et al. (2007) forest income contributes 20% of the mean total income of the households in the dry forests of South Africa. In Kenya, Langat et al. (2016) studied role of forest resources to local livelihood using IBM and SPSS, the result shows that fuel-wood contributed higher income (50%) to the households amongst other forest resources. Also, in Pakistan, Hussain et al. (2019) conducted a study on dependence of rural livelihood on forest resources on Naltar valley, a dry temperate mountainous region of the country and showed that the income derived from fuelwood was highest (52%) among other forest resources namely, timber (46%), honey (1%), fodder (1%), medicine (0.41%) and vegetables (0.47%). In reviewing the impact of the fuel-wood energy sector on livelihood. Jamal and Anthony's (2016) study on fuel-wood commercialization and household welfare in the Northern region of

Ghana provided insights to improvement of rural living. The study employed a simple random sampling structured questionnaire in six districts to examine the major factor, which motivates the household's decisions to engage in the commercialization of fuel-wood. The result shows that fuel-wood commercialization has reduced the income inequality from district to district. Additionally, the study adds to the debate on the decrease in poverty, welfare development and security provision for entrepreneurs on fuel-wood commercialization

Researches are pointing to the fact that production of wood for energy in the forest creates more jobs than are generated by other domestic energy such as kerosene, gas and electricity (World Bank 2011). The dependence of people on forest is viewed as a form of livelihood diversification mechanism. This sustains or revamps income generation through harvesting and selling of wood. Shackleton and Shackleton (2004) observed that non-timber forest products (fuel-wood inclusive) in South Africa provide livelihood benefits at two levels. Firstly, it provides households with coping strategy in times of adversity manifested in form of death or retrenchment of the head of the household or breadwinner, droughts, floods, frosts or disease leading to crop failure or death of domestic animals, foremost economic and structural elemen-

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tal alterations, or unimagined and huge rises in prices of key foods and goods. Secondly, it also permits the utilization of limited cash resources in order to have more money to buy other household necessities and to attempt to amass an essential asset base for a more protected living. For instance, child-education, investing in tools used for farming, or funds for actions that make income available, everyday energy-building needs, shelter, food and medicine are considered as assets. Furthermore, World Bank (2011) argues that increased job prospects in the biomass (fuel-wood) sector can generate poverty relief to several households, assist in the realization of poverty reduction targets as well as an increased purchasing power, allowing both households and individuals to surpass all limits of their existing economic circumstances.

In reviewing the impact of fuel-wood energy sector on livelihood, Arnold and Persson (2003) asserted that, globally fuel-wood is a major source of income for the poor. In practice, huge numbers of people continue to rely on fuel-wood as a source of energy or income, which translate into their livelihood and will continue to do so. In the Democratic Republic of Congo (DRC), fuel-wood contributes about 12 percent to the household income of its producers; it supports 65 percent of basic needs of fuel-wood producers living around Kisangani, thereby helping to reduce poverty (USAID/ Ghana, SFMPB 2015). Jamal and Anthony (2016) in their study on fuel-wood commercialization and household welfare in Northern region of Ghana an implication for rural livelihood improvement. The study employed simple random sampling structured questionnaire in six districts to examine the major factor, which motivate household's decisions to engage in commercialization of fuel-wood. The result shows that fuel-wood commercialization has reduced the income inequality from district to district. A major significant contributing factor towards poverty decline, welfare improvement and a safe net amongst entrepreneurs is fuel-wood profitability in the study areas. In the Masvingo city in Zimbabwe with the use of mixed methods, Bernard et al. (2013) made an effort to analyze ways in which urban poverty could be reduced via fuel-wood business. Their fuel-wood business debate has created good opportunities for poor persons living in the urban areas

and doing business in transportation, paid to fetch fuel-wood from the forest. This has also resulted in creating entrepreneurial activities for urban areas, which had nothing in common with the role of fuel-wood in rural areas and its ecological maintenance.

In the Democratic Republic of Congo (DRC), fuel-wood contributes 12 percent to producers' household income, it supports 65 percent of the basic needs of fuel-wood producers living around Kisangani, thereby helping to reduce poverty (USAID/ Ghana, SFMPB 2015:1). Bernard et al. (2013) tried to analyze how to reduce urban poverty through the fuel-wood business in Masvingo city, Zimbabwe using qualitative and quantitative research methodology. Their contention was that fuel-wood business has created sound opportunities for the urban poor who are in the transport business, hired to fetch fuel-wood from the bush. It has also created entrepreneurial activities for urbanites that had nothing to do. Concerning the contribution of fuel-wood to the rural livelihood and its environmental sustainability, an investigation was conducted in Swaziland by Manyatsi and Hlope (2010) using Land set Mapper of 1994 and 2006. There results illustrated that most harvested was monitored; whilst sale of fuel-wood to the livelihood of the sellers was about \$67 and \$133 per month. In Kenya, Geoffrey (2010) reports that vendors seem to make the highest profit per stere of wood sold compared to transporters. The vendors interviewed said they sell about two steres of wood per week, translating to a profit of KSh. 11,600 per month. Similarly, Geoffrey (2010) reports in Rwanda shows most of the wood is traded informally with only a small proportion consumed. The analysis of the supply chain was based on the fuel-wood that moves regularly along the chain which might be a way forward if the sector is to be sustainable and economically beneficial to the stakeholders especially the farmers. Nosiru et al. (2013) used descriptive statistics and gross margin analysis to evaluate the economic contribution of fuel-wood to the livelihood of rural households in Oyo State, Nigeria. The findings indicated that the fuelwood business is a very lucrative job in the study area. The rate of profit is high due to the active involvement of family labour in the business, which drastically reduces the cost that might have been incurred

if such labour is hired. In Forest and Savannah zones of Nigeria.

Hence, the impact of fuel-wood at household level depends on the extent; the household consumes fuel-wood which is a function of their initial resource endowment. These endowments are in terms of its physical, human, financial, and natural capital and other factors such as prices, socio-economic factors, government policies and institution. This paper therefore examines the contribution of fuel-wood energy sector on the livelihood of South African fuel-wood traders.

Theoretical Perspectives

Household Economic Portfolio Model

Livelihood is viewed as people's capability to create and preserve their means of livelihood, improve their well-being and that of future generations. Household Economic Portfolio Model (HEPM) is the model that explains household living standards and a method that places the household members at the focus of the livelihood analysis. The approach views household members as a unit of analysis in appraising the importance of a observable fact. Additionally, HEPM considers household's natural resources (forest) and human resources (family labour and skills) can be combined to achieve optimum livelihood outcomes. The HEPM is a vibrant theoretical model that clarifies the interfaces among a variety of resources, economic actions' including the round flows between them. The resources do comprise of individual, normal, physical and financial resources, and economic behaviors, which are linked to manufacturing, expenditure and investment activities all, carried out by the household. Resources are allotted to economic activities whilst the returns from such undertakings do go towards resource amassing constituting the circular flow. The model illustrates a set of links in resources do have an impact on economic activities and each effect becoming a cause in its own right and thus additional effects (Habte 2016). Based on the model, there were five types of household resources (or assets), these household resources means a set of human, natural, physical, financial and social resources or assets available

for use by the household in a given period of time. The human resources are the labor, skills, time and labour of the household members while the natural resources included forest, land and everything on it and water.

It is pertinent to note that forest resources proved to be a very important variable in the fuel-wood energy sector because it is the main source of raw material. The physical resources are tangible items that are at the disposal of household members for example, buildings, equipment, machinery, livestock and personal items. Financial resources may include cash and other forms of liquid savings. Social assets included kinship networks and social and political groups. Household activities are the set of consumption, production, marketing and investment activities that households undertake in a given period. Consumption activities in the model means satisfaction of material wants and needs of the fuel-wood traders through the provision of items such as food, education and medical services. Production activities include income generating activities of the households and Investment activities can either be tangible or intangible because it is an enhancement of resource and asset base of the household such as farm land, woodlot etc. Investment actions comprises of the utilization of household resources in order to generate the potential for extra income in the future. Income generating activities within the model are all actions contributing towards the creative industrious enterprises, which do produce a good (marketable), or service, which give households income. For example, market group of actors, the role of specific market roles, in fuel-wood value chain, manufactured goods, the consumers and flow of money; these were recognized. In addition, household maintenance activities include things like daily meal preparation for the family, washing of clothes, repairing clothes and finally upholding and improvement of the house and water.

The model is relevant to fuel-wood energy sector as it emphasizes the household as a unit of analysis in production and consumption. Also, it looks at resource mobilization and allocation decision making processes because the model assumes that household fuel-wood traders as a unit of consumption wished to maximize their utility namely, food security, health securi-

ty and children education while as a unit of production, the household traders wished to maximize income/profit and assets from the fuel-wood trading.

Fuel-wood Value Chain and Commercial Fuel-wood Vending

Fuel-wood Value Chain is an instrument used to understand the chain of fuel-wood business activities starting from production, to trading and finally consumption. In addition, fuel-wood value chain undoubtedly spells out the functions of all the workers and followers within the chain. It also contributes, towards the identification of those capacities and motivations for actors in which interventions can eradicate bottlenecks. However, proper value chain analysis actually allows policy actors to construct positive framework conditions, which support income for local people, competitive enterprises and sustainable jobs. The engagement in fuel-wood value chain involves stages that allows for evaluation of the level of each of the operator. It involves production where by trees are cut down, chopped to a practical size or requested size, dried, parked and transported to the market for sale. On the other hand, commercial fuel-wood vending entails the labour involved in the procurement of fuel-wood in order to satisfy the domestic needs of the households. According to Geoffrey (2010), the process is characterized by a marked fragmentation of operators (producers, operators and retailers) who tend to work in isolation on an individual or family basis. On the contrary, Naibbi (2013) described the process as highly organized, having a strong association that if any member of the association commits infraction in the procurement process, fuel-wood vendors association intervene to save the member from prosecution.

The participants in fuel-wood production and trading are broken down below:

a. Professional Fuel-Wood Producers/Traders: These stakeholders are almost exclusively individuals or small informal enterprises. The wood producers are sometimes referred as wood harvester they play the main role in wood production and they are the entrepreneurs that cut down the trees for sale.

- b. Forest Cutters:* In the fuel-wood procurement process, the forest cutters play significant role because they are the group that enter the forest and cut down trees. They are always in a group, normally hired by producer.
- c. Drivers and Their Assistants:* These are the people who drive the vehicles in to the forest and convey wood to the market. Wood is brought to either a middle man or retailers or markets where it is then sold directly to the consumers.
- d. Labourers /Assistants:* These groups performs two roles in the fuel-wood procurement process. They help in loading and unloading the wood in both forest and market, that is to say they work both in the forest and in the market.
- e. Splitters:* These are the labourers that are hired to split the logs of wood when it reaches market from the forest so that it can be neatly packed into separate bundles for consumers to buy.
- f. Borrowers:* These are the category of people that are directly linked with the dealer as distributors. They take wood in credit from the vendors and return the money after sales. The vendors normally give wood to these categories of people at a discounted price based on personal trust.
- g. Distributors:* These are the category of people that sell wood locally either in a wheelbarrow or smaller trucks.
- h. Household Sellers:* These are group of wood sellers, they sell the wood in their homes, they are mostly old men and women who cannot go to market or have market stand.
- i. Wheelbarrow Pushers:* Generally, when customers buy wood from the market, wheelbarrow pushers conveys the goods from the market to the home at a certain price.
- j. Middlemen:* Middlemen provide the services of linking the producers to consumers, they also provide the services of distribution. Middlemen are business men in this activity of the Fuel-Wood supply chain.

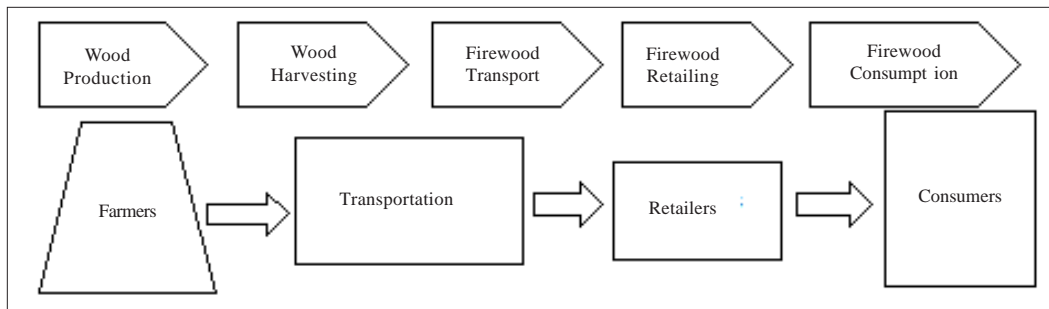


Fig.1. Fuel-wood value chain
Source Author(s)

METHODOLOGY

The Western Cape Province has a land area of 12,938,600 hectares making it the 4th largest province in South Africa. The physical resources of the province are distinctive from other provinces within South Africa. Five district municipalities within the Western Cape include; Overberg, Central Karoo, West Coast, Cape Metro pole (City of Cape Town - the singular metro pole which is situated in the Province), Cape Winelands and Eden. Winelands with its winter rainfall and the Southern Cape's continuous rainfall supports a diversity of crop mix and manufacturing possibilities. The agricultural segment of the Western Cape Province is famous for its manufacturing stability, as well as having an established framework (Western Cape Government, Provincial Profile 2014).

Two stage stratified random sampling technique was used in this study. Initially 608 enumeration areas (EAs) demarcated to Western Cape Province during the 2011 census in South Africa was considered, then in each three (3) EAs, one (1) fuel-wood traders was randomly selected and given a questionnaire to fill. Meaning that the enumerators randomly selected 200 fuel-wood traders from the 608 EAs. It is pertinent to note that fuel-wood is sold in an open market places, at shopping centers, in residential areas and along the roads and road corners. Selection of the respondents was done randomly in depots and selling points in the EAs. South Africa has experienced three census exercises since the first democratic elections of 1996, 2001 and 2011. During the 2011, there were quite a few

household dynamics and distinctiveness which were measured

RESULTS AND DISCUSSION

Fuel-wood trading remains one of the non-farming activities that contribute to the livelihood of many households. Table 1 on trader's dynamic about weekly turnover on fuel-wood business and household size showed 68 participants in a household of 3 to 5 persons have a weekly turnover less than R666 while 53 of the participants have a weekly turnover between R1222 to R2000. The household with the highest weekly turnover is the household with 3 to 5 persons and the household with less weekly turnover is the household with 11 persons above. Out of 200 participants, 100 participants said their weekly turnover is less than R666 and 100 participants said their weekly turnover is between R1222 and R2000. The result shows that fuel-wood generate turnover to the traders in South Africa even though it is less when compared to what was obtained in other African countries. Geoffrey (2010) revealed that the annual turnover from fuelwood in Rwanda was estimated at about US\$122 million in 2007.

On trader's dynamic about weekly profit and household size, the result in Table 2 showed 56 participants. This indicates that a household of 3 to 5 persons, have a weekly profit less than R166, 32. 18 participants have weekly profit between R333 to R499 and 15 of the participants have weekly profit between R499 to R666. The household with the highest weekly profit is the household with 3 to 5 persons and the house-

Table 1: Household size and weekly turnover

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
Weekly turnover SA						
Less than R666	19	68	6	5	2	100
Between R1222 to R2000	30	53	13	3	1	100
Total	49	121	19	8	3	200

Table 2: Household size and weekly profit

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
Weekly profit SA						
Less than R166	25	56	9	4	2	96
Between R166 to R333	18	32	5	2	1	58
Between R333 to R499	2	18	3	0	0	23
Between R499 to R666	4	15	2	2	0	23
Total	49	121	19	8	3	200

hold with less weekly profit is the household with 11 persons above. Out of 200 participants, 96 participants said their weekly profit is less than R166. The result indicated that fuelwood business is profitable venture even though the profit is small. Small profit in fuelwood business is not only found in South Africa. In Nigeria, Olugbire et al. (2016) showed fuelwood traders in Nigeria earns only N6558 (R218.5) per month. Sufficient evidences have also established that fuelwood is a poor man's energy, meaning that the entire activities in the value chain are conducted informally with low capital base. This finding may also confirm the conclusions of Angelsen and Wunder (2003), Wunder (2001)

that the role forests play in expanding livelihood options and accumulation of wealth and assets is seemingly very little.

Table 3 showed traders' dynamic about profit use and household size. The result shows that 68 participants in a household of 3 to 5 persons use their profit for food for the household members while 53 of the participants use their profit for health and medicals. Out of 200 participants, 100 participants said they use their profit for food for the household members and 100 participants said they use their profit for health and medicals. Although fuelwood may be pursued as a source of secondary income by traders, the fuelwood enterprise provides a vital source of

Table 3: Household size and profit use

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
Profit use SA						
Food for the household members	19	68	6	5	2	100
Health and medical	30	53	13	3	1	100
Total	49	121	19	8	3	200

income and livelihood option. The result indicated that the profit from fuelwood is used to solve some of the household problems as corroborated in a study conducted by the USAID Ghana (2015) showing that fuelwood trade has provided the traders a livelihood and income options. Traders earn the highest (49%) in the value chain, and 50 percent of the actors were of middle age and have had basic formal education.

Smith and Subandoro (2007) described the food as one of the most basic needs for human survival. Access to food is a basic human right. Access to sufficient food by households enables them to live a healthy and active life. Respondents were asked how often they sleep hungry. Result in Table 4 on trader's dynamic about household sleeping hungry and household size showed 68 participants in a household of 3 to 5 persons never sleep hungry while 53 of the participants sometimes sleep hungry. Out of 200 participants, 100 participants said they never sleep hungry and 100 participants said they sometimes sleep hungry. This shows that households utilize earnings from fuelwood business to provide food.

According to World Bank (2011), fuelwood markets provide a critical source of support to the rural people through income and employ-

ment. This means that fuelwood proceeds can be used to take care of non-food consumption needs like health care. Table 5 showed traders dynamics about household health in 1 year and household size. The result indicated that 64 participants in a household of 3 to 5 persons said they adequately take care of their health while 57 of the participants said they do not take care of their health. Out of 200 participants, 99 participants said they adequately take care of their health and 101 participants said they do not take care of their health. The result to some extent does not totally conform with the World Bank assertion, and this could be explained in the context of the low returns from fuelwood energy profit which may not be able to adequately take care of the health needs of the households. Sundelin et al. (2005) and Neumann and Hirsch (2000) attempts to corroborate this outcome by explaining that the role of forest resources especially to the poorer households rarely leads to poverty alleviation but it will prevent the intensification of poverty.

Non-food activities like children schooling is one of the livelihood outcomes. Respondents were asked to state whether they take care of their children education or not. Fuelwood energy sector provide the benefit to the household

Table 4: Household sleeping hungry

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
HH sleeping hungry SA						
Never	19	68	6	5	2	100
Sometimes	30	53	13	3	1	100
Total	49	121	19	8	3	200

Table 5: Household size and health care in the last in 1 year

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
HH health in 1YrSA						
Adequate taking care of	22	64	7	5	1	99
Not taking care of	27	57	12	3	2	101
Total	49	121	19	8	3	200

to access money on a frequent and regular basis which may be deploy towards the household needs such as education. Respondents were asked to state whether or not they take care of their children’s education using fuelwood trade. Result in table 6 on trader’s dynamic about children schooling and household size shows that 53 participants in a household of 3 to 5 persons said their children schooling has been adequately taken care of, 43 participants said their children schooling has been less adequate, and 25 of the participants said their children schooling has been more than adequate. Out of 200 participants, 93 participants said their children’s schooling has been adequately taken care of. Therefore, the result suggested that to some extent fuelwood trade contribute to the household funding of education. This means that fuelwood play the role of providing education to children, a service government is supposed to incur at the rural areas. Geoffrey (2010) found similar situation in Kenya, where households used profit from fuelwood trade to pay for their children’s school fees.

Despite the significance of fuel-wood energy sector on livelihood people highlighted above, it is only in the recent time that non-timber products sector have received support and acknowledgment by South African government or rural development agencies due of the growing recognition of the importance of the informal sector in poverty alleviation and job creation. According to Jolie et al. (2014) fuelwood energy value chain or sector is generally characterized by many actors, informal practices and often-unequal benefits, leading to a situation where the sector has little incentives to attract for growth. To this end, three types of financial constrains hindering the growth of small

businesses were identified Bolton report (1971) which can be applicable to fuel-wood energy sector in South Africa. Firstly, lack of access to finance has been identified as critical to the growth of fuel-wood energy sector. Sepp and Mann (2009) argued that fuel-wood market is generally weak with under-valuated and under-priced products, despite growing scarcity of wood. The findings of Fatoki and David (2010) in South Africa that showed 75 percent of South African small firms fail as a result of lack of access to finance and even those that applied for financing, 75 percent of their application are rejected. Secondly, informality of fuel-wood energy sector made many people to consider it as poor man’s business or poor man’s trade. This means that both policy makers and financial institutions ignore the sector leaving it in the hands of semi- illiterate members of the society who have no technical expertise, hence limiting technological adoption and investment (Geoffrey 2010). Furthermore, the criminalization of fuel-wood energy sector by the government officials in many countries including South Africa has made many key players in the sector to operate underground, so much so that the issue of getting knowledge and innovations from government or financial institutions becomes very difficult. Even the prices of fuel-wood in the market is determine by the fuel-wood traders themselves, and the traders at their will, showing a huge gap between the traders and the larger conventional markets, can alter the prices. Thirdly, because the sector usually operated underground, it has becomes almost impossible to engage the major stakeholders of the sector. For these reasons, the sector lacks formal recognition to warrant professional advice from either public or private sector. Following the above

Table 6: Household size and children schooling

	<i>HH size</i>					<i>Total</i>
	<i>2 persons</i>	<i>3 to 5 persons</i>	<i>6 to 10 persons</i>	<i>11 persons and</i>	<i>Others</i>	
Children schooling						
Adequately taking care of	25	53	8	5	2	93
Less adequate	18	43	8	2	1	72
More than adequate	6	25	3	1	0	35
Total	49	121	19	8	3	200

named complex and multifaceted obstacles confronting fuel-wood energy segment, there is a necessity for encouraging partnerships, involvement of the private sector, developmental actors, NGOs and other interested parties to partner with the government, in order to generate a supportive structure towards attaining an essential policy modifications. Short of such a combined will make policy restructurings inadequate, and fall short below the required scope to realize a long-lasting effect.

CONCLUSION

This paper intends to find appraises the link between fuel-wood energy sector and livelihood of South African fuel-wood energy traders as per income, food security, health care and children education. The article showed that, in contrast to fossil fuels based energy sources that are frequently introduced and adversely influence countries balance sheets, wood-based biomass (fuel-wood) possibly will create value-added, complementing economic growth and poverty mitigation, which re-affirms previous studies. The researchers' findings indicates that fuel-wood traders in South Africa used fuel-wood business as a means of livelihood as per food security, health security, children education and income. Furthermore, the researchers' results is in line with the assertion that harvesting of fuel-wood to supply markets is linked to the greater contribution of both customers and dealers within the market economy. They all operate as economic representatives, with costumers aiming towards the maximization of utility from the consumption of energy whilst traders seek to get the most out of profit by selling fuel-wood. The result of this interaction leads to livelihood outcomes.

RECOMMENDATIONS

Empirical evidence from the developing countries, particularly Sub-Saharan African countries believed that poverty has been a major challenge. The researchers' findings imply that the fuel-wood energy sector may create diverse opportunities that can enable the rural poor to make the best use of their available natural and human resources to initiate self-employment activities and develop a sense of self-reliance. There-

fore, the paper posits that fuelwood energy sector can be enhanced to provide livelihood options with good policies. In addition, natural resource management can be achieved through the development of small-scale plantations and woodlots that can increase fuel-wood production and trigger economic opportunities and land-use planning. Although natural forests are expected to continue supplying much of the fuel-wood. However, in the long run, they will be unable to meet demand sustainably since the demand is expected to increase substantially due to population growth. Thus, the researchers recommend the development of private or group-based woodlots/plantations that will in the long term, complement fuel-wood supplies. The researchers also recommend that government should encourage local-level investments in establishing planted woodlots. The recently acquired green bond can substantially assist in this manner. South Africa can learn from Senegal where World Bank's PROGEDE enterprise acknowledged sustainable community-based forest management structures over an area of 378,161 hectares with a capacity to deliver yearly more than 370,596 tons of sustainable fuel-wood. It was established that the results surpassed the aims at the time of (with an average 215 accomplishment index figure compared to the appraisal report)

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