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Project Planning and Welfare of Households: A Case of Biogas Project in Huye District, Rwanda

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Abstract

The purpose of this study was to assess the role of project planning on the welfare of the household with a biogas project case in Huye District. This research was guided by three objectives including assessing the role of biogas project budgetary planning on welfare of households in Huye District, to examine the effect of biogas project planning activities on welfare of households in Huye District, and to establish the relationship between biogas project Standard cost and welfare of households in Huye District. This research will be significant to policy makers, future researchers, students and lecturers who will use the results of the study as point of reference in formulating new policies and doing further research in this field of the study. The research was also tracked by project management theory and Becker's new household economic theory. The study involved descriptive research design, 184 people of whom 105 respondents were drawn by using purposive and simple random sampling techniques as the primary informants of the study. The study findings were collected using questionnaire and interview guide but before actual time of collecting data, these data collection instruments were pre-tested during a pilot study to prove its validity and reliability. The findings of the first objective have shown that the general perception tends to 1.8806 indicating stronger tendency which implies that biogas project budgetary planning affects welfare of households. While the results of the second objective demonstrated that the overall mean is 1.770 which implies that biogas project planning activities affects welfare of households to a very great extent. Lastly, the results of the third object show that there is a strong relationship between project budgetary planning and income generating activities (r=.637 and sig=.000), between project budgetary planning and livelihood diversification (r=.526 and sig=.000), between project budgetary planning and improved standards of living (r=.600 and sig=.000), between project planning activities and livelihood diversification (r=.723 and sig=.000), between project planning activities and improved standards of living (r=.872 and sig=.000), between income generating activities and project planning activities (r=.789 and sig=.000), between standard cost and livelihood diversification (r=.728 and sig=.000), and between standard cost and improved standards of living (r=.904 and sig=.000). This implies that there is a relationship between biogas project

planning and the welfare of household in Huye District, Rwanda. Thus, basing on the results, the researcher recommends to rural households to adopt biogas project in order to save time that they spent cooking, to adopt biogas generation for health and sanitation purposes because it helps to ensure better health that is free of diseases related to smoke; and also recommends to the local government to encourage rural households to ensure that those at least with vast land should have biogas generation in their households so that the number of people who own biogas should be increase to ensure welfare of the households in rural areas.

Keywords: *Construction delays, cost overrun, regional cybercrime center, Rwanda*

1. Introduction

Most of the literatures have affirmed that attainment of households' welfare in less developed countries is still a myth due to poor development project planning and insufficient resources (Odoom, 2021). Development projects have been applied as a way of improving the welfare of households. This could be achieved by reducing their expenses spent in their daily life by introducing other new methodologies which can replace their traditional way of living. For example, when cooking, most of households use firewood and fuel for lighting but to improve the welfare of household a modern way of cooking replaces traditional to increase both households welfare in terms of livelihood diversification, decent work and Improved standards of living as well as activities that generate income for the household (Fregue, et al., 2021).

Use of biogas serves time for the households and that time might spared for other activities such as hustling for food, generating income and getting improved standards of living. However, a number of governments have failed to ensure effective planning for development project that favors welfare of households in rural areas of Africa (Biogas and Engines, 2011). The Government of Rwanda promotes biogas project which is a source of renewable energy. The efforts focus on inspiring homes to possess sources of energy and quit the common types of energy like firewood which have devastated the health of the people and polluting the nearby environment (GoR, 2013).

Therefore, the local government encourages the utilization of renewable sources of energy like biogas which is generated on the local levels in the households (MININFRA, 2014). However, despite the presence of biogas generation and production at household level, the researchers in this field are required to put a lot of efforts and do research in this field of development planning and welfare households project which proves adoption of biogas as the feedback to the implemented project as few areas of the adoption of biogas risk which is very low at rate of 6.8% in the whole of Huye households when the common countrywide danger of biogas project stands at 9.3% of Rwanda's full households (GoR, 2013). However, if even the statistics show that the use of biogas is still low in Rwanda, there is no empirical research done on biogas planning and household welfare. Thus, it is in this context the researcher conducted this research to examine the role of biogas project planning to the welfare of households in Huye District.

1.1 Objectives of the study

1.1.1 General objective

The general objective of this study is to determine the role of biogas project planning to the welfare of households in Huye District, Rwanda.

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1.1.2 Specific Objectives

This study was guided by the following objectives of the study:

(i) To assess the role of biogas project budgetary planning on welfare of households in Huye District, Rwanda;
(ii) To examine the effect of biogas project planning activities on welfare of households in Huye District, Rwanda;
(iii) To establish the relationship between biogas project standard cost and welfare of households in Huye District, Rwanda.

2.1 Empirical Literature Review

2.1.1 Biogas project budgetary planning and welfare of households

The research conducted by Arjun, *et al.,* (2017) on the impact of a household biogas programme on energy use and expenditure in East Java using explanatory research design and empirical approach. The statistics showed that the biogas supply from digesters has almost completely replaced the use of liquefied petroleum gas and greatly reduced the use of firewood for cooking. The availability of biogas has reduced average household energy expenditure by about 45%, or about 3.5% of total household expenditure. In addition, time spent collecting firewood falls by about 85%. The results also displayed a negative relationship between owning a biogas digester and expenditure on fertilizer, as well as a positive association with farm revenues, however, these effects were not statistically significant. Hence, basing on the results the researcher recommend that economic benefits of a by-product such as bio-slurry to materialize, its application needs to be sufficiently expanded and customized to local conditions.

The empirical research of Nyang, *et al.,* (2020) showed that households get acceptable production rather than optimal production from the invested capital in the project of biogas if the project were effective. However, poor maintenance was due to poor planning and as a great challenge to digest materials that produce biogas and stopping maintenance destroys the gas container. The results proved that utilization of biogas at house reduces respiratory diseases that affect the welfare the whole household members. The results revealed that 34.3% of households with biogas digester still use other sources of energy for cooking besides biogas. Among the benefits of using biogas instead of unclean energy sources like charcoal and firewood, less emission were ranked highest for environment (71.4), household savings as important economic benefit (74.3%) and convenience of cooking using biogas as a leading social benefit (77.1%). In contrast, large initial capital (82.9%) stood out as the biggest challenge to biogas adoption in Kampala.

The same study of Nyang, *et al.,* (2020) concluded that it was unlikely for the very poor in informal settlements to invest in biogas due to a lack of financial savings required for the installation. Energy sector should create a platform which can allow credit access for biogas digester installation, payable on small daily savings for a period sufficient enough to facilitate repayments. Otherwise alternative methods of financing are necessary for slum dwellers in order for the majority of Kampala residents without livestock to gain access to biogas technology.

2.1.2 Biogas project planning activities and welfare of households

The research of Sampa and Sichone (2015) has shown that the initiatives of renewable energies were driven by the crises of oil in 1970s. The increase of renewable energy has substituted the traditional use of energy resources such as firewood in the households. One of the variables of this study is biogas project as a new application to enhance welfare of households. Since, attitudes are learnt to generate an attitude based on biogas generation to include the positive or negative attitude developed by an individual's direct experience or learning about the performance ability of the generation after use.

The study of Arifin, *et al.,* (2020) concentrated on the community attitudes towards biogas as an alternative energy and environmental quality improvement. The predictors of adoption of generation or innovations have found performance expectations. The attitudes towards the use of biogas is also associated to social theory, the individual complies with the opinion of the referees. Thus, developing a positive attitude towards generation of biogas which acquire personal experience to resist changes and funding the major role is to ensure welfare of households. By using quantitative descriptive research methods and Likert scale for data analysis on 50 respondents, resulting that as many as 46% of respondents agreed that biogas as an alternative energy and want to have it as much as 54%. However, in the statement that they will build biogas, most of them answered doubtfully, which is 70% as results.

Studies have proven that one of the predominant boundaries to the implementation of renewable energy project is not generally the technical feasibility of these initiatives, however the absence of low cost, long-term funding, and inefficient mission planning (News & Seven, 2014). This problem is worked out by opposing the money restrained through restricted money and will turn out to be imperative if one becomes concerned with biogas project it works below detrimental macroeconomic conditions. Economically, the evaluation of biogas technological know-how can be addressed as a macroeconomic hassle that consists of investment in the broader context of the economy's overall fuel development policies.

It can also be handled as a microeconomic problem in which the returns to a safe financing are examined in a specific region and inside particular economic prerequisites. In discovering out whether to boost a new biogas generation, entrepreneurs have play a role with budget plans in calculating predicted advantages and estimated prices for themselves and if the former is in all likelihood to exceed the latter, they undertake biogas assignment (Linovski, 2021). Another financial consideration is that of selections the place the contrast of the have an effect on of a funding is in precept the comparison of the investment with the subsequent least pricey investment alternative. Land tenure and time horizon also have an impact on biogas energy adoption. One instance is technologies that are intrinsically long-term and require protection, such as land tenure, for high-quality adoption. Many farmers are poor in terms of sources and can also lack safety on land and therefore might also not be able to invest in these biogas technologies.

2.1.3 Biogas project standard cost and welfare of households

Hafner (2018) point out that experience in Africa suggests that the introduction and success of any renewable energy is generally set to those installed by using the authorities in the policies and mission planning of contemporary authorities. Government insurance plan insurance policies are a key element in terms of their ability to create an enabling environment for the dissemination and mobilization of RET resources, as properly as encouraging non-public adoption of biogas initiatives amongst households. The findings of this research have shown that there is a correlation between government policies of effective

project planning with achievement of biogas project for the well - being of households in Africa.

Ndahimana (2010) in his study he wrote that the Biogas Project objective was to enhance a commercial home biogas sector with the two objectives of contributing to the welfare of rural families, while decreasing pressure on natural resources and fostering the welfare of household members. Most preceding research such as Govender (2019) who conducted studies which are related to biogas project planning and welfare of households have revealed that planning project activities, management, attitudes and capacity of rural famers as well as improved standards of living and income generating capacity have an effect on both biogas project planning and households welfare.

2.2 Research gap

Previous studies in this field of development planning in biogas project and welfare of households have given less attention the role of development planning in biogas project towards welfare of households. For instance, the study conducted by Nyang, *et al.,* (2020) concentrated on factors determining use of biogas project in increasing welfare of households in terms of cooking, lighting, generating income, environmental conservation, Improved standards of living creation, reduction of workload fertilizers, particularly for women and children; improving sanitation and health conditions, for the benefit of women and children. However, they have not considered the welfare of the households in terms of increasing livelihood diversification, creating more improved standards of living and income generation to increase the welfare of households.

Ndahimana (2010) focused on the benefits of use of biogas in cooking, lighting and using fertilizer in agriculture; thus, shows that there was a still a gap to address the role of development planning of biogas project on households' welfare in terms of livelihood diversification, improved standards of living and income generation. The same related study by Loïc (2013), focused on benefits achieved by households but he stated only four benefits as achieved among the eight stated by Arifin, *et al.,* (2020) said about ownership as a determinant of value of the asset to the household. Asset in this case is a biogas plant. As they said, asset can be productive as it can be used as an input in a productive process. The ownership for the case of biogas, farmers at the beginning should have a certain amount or earn profits to enter financial institutions on reasonable terms and have the possibility to invest, as even with the use of subsidies, farmers have to make a large funding as investment.

The previous studies like the study of Arifin, *et al.,* (2020) concentrated on the community attitudes towards biogas as an alternative energy and environmental quality improvement. By using quantitative descriptive research methods and Likert scale for data analysis on 50 respondents. However, this study has ignored the role of project planning in enhancing household welfare in terms of budgetary planning, project planning activities and standard cost in order to promote the livelihood diversification, improved standards of living and income generating activities. Thus, this is the justification and significance showing why this study was conducted in this field of project planning and household welfare in Huye District, Rwanda.

In this study, researchers did not say anything about how biogas as a development project can generate income; increase improved standards of living and livelihood diversification through enhancing agriculture. Thus, the gap meant for the study to fill. The benefits of biogas are not limited on cooking, lighting and using bio-slurry as a fertilizer unless the users are not instructed as (Anaclet, 2010) stated. Hence, the researcher filled the gap by studying the role of project planning in biogas project to welfare of households in Huye, whereby

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project planning were measured in terms of planning input factor, project planning activities and Standard cost to ensure that biogas project is conducted effectively.

2.3 Conceptual Framework

The conceptual framework consists of variables, such as dependent and independent variable and intervening variables to have a cause-effect relationship. The essence of conceptual framework is to establish the cause and effect relationship of independent and dependent variables (Jensen & Toates, 2013). Basing on this study the identified dependent variable was the welfare of household such as livelihood diversification, improved standards of living, and Income Generating Activities; to achieve the welfare of households, benefits of biogas project planning (measured in terms of planning input factor, project planning activities and Standard cost) as independent variables, some other factors which are known as moderating or intervening variables including project management and government policies.

In case of this study, the government policies are regarded as policies that the government put to make development projects viable and affordable to all citizens like energy policies and strategies of 2010 and government to put some subsidy policy examples reducing high costs of a biogas plant (Anaclet, 2010). Dependent variable represented by welfare of households that is measured by livelihood diversification, improved standards of living and IGAs.

Figure 1 makes clear what has been explained above:

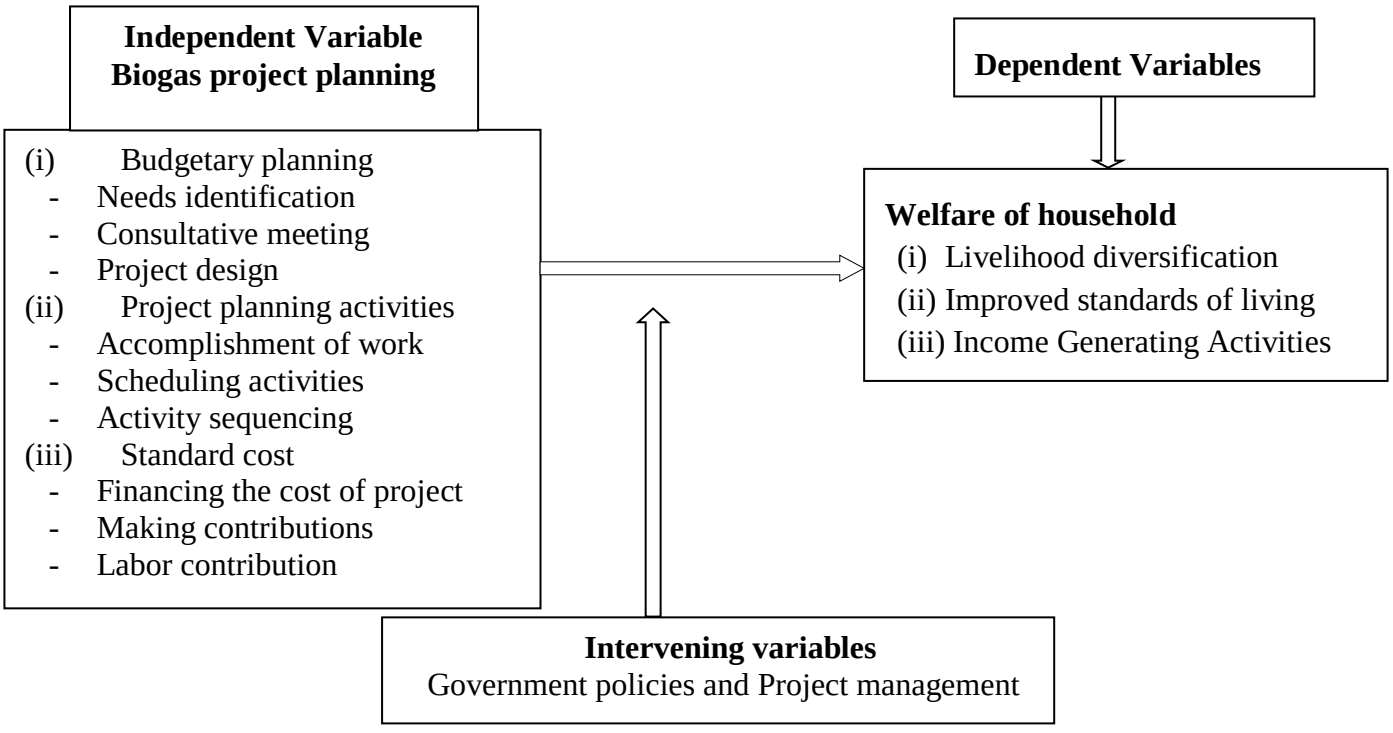

Figure 1 demonstrates relationship between variables represented as biogas project planning and measured by its predictors such as budgetary planning, project planning activities, Standard cost; dependent variables represented as welfare of household which is measured in terms of livelihood diversification, improved standards of living and IGAs; and the intervening variables which is another factor such as project management that can cause change in the dependent variable.

3. Materials and Methods

In the context of the current study, descriptive research design was used to assess and describe the characteristics of the variables of the study to collect qualitative and quantitative information connected to primary and secondary information from the foremost respondents of the study and review of annual reports, documents that are relate to biogas project planning and welfare of households. Thus, descriptive research design refers to the type of research design that aims at obtaining the information which systematically describes the situation and phenomenon in its detail (Eyesi, 2016). The target population is drawn from the farmers benefiting from biogas project in Huye District as an area of study who are 142 farmers that have biogas plants at their homes and 42 staffs that are involved in biogas project to increase the target population to 184 people targeted in this study. Therefore, the researcher chose the sample size determined using Krejcie and Morgan (1970) on target population of 184 from biogas project, the researcher used purposive and simple random sampling techniques were involved to select the 105 respondents.

The research used questionnaire and interview guide to collect data. The questionnaire was developed in survey form and distributed to the targeted population. There was a support to the respondent when they were filling the questionnaire to avoid bias which could lead to wrong information and loss of time. The questions were in English but they were translated in Kinyarwanda to avoid language barrier and save time. The interview guide was addressed to 2 managers of Biogas Project staff in Huye District. Different questions related to the relationship existing between biogas project development planning and welfare of households was face to face asked to them. Descriptive statistics was used to describe the fundamental features of data about information. They provided summaries and measures. In fact, the descriptive analysis allowed for the simply description of what the data showed. In addition to this the analysis of data was done through SPSS software version 21.0. The inferential statistics were also analysis to deduct the relationship between the variables of the study. Thus the Pearson correlation was used to find the relationship between biogas project planning and welfare of households. The multiple linear regression was also used where the regression model was $Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3$ where Y is welfare of households, β_0 is constant coefficient of determination, β_1, β_2, β_3 are coefficients of determination on the predictors of project planning which are budgetary planning, project planning activities and standard cost which are presented in the model by X_1, X_2 and X_3 and these results are presented in model summaries, ANOVAs and regression coefficient Tables.

4. Research Findings and discussion

4.2.1 Role of biogas project budgetary planning on welfare of households in Huye District

The views and perceptions presented here as the role of biogas project budgetary planning on welfare of households in Huye District are dignified in terms of involvement in consultative meeting for the biogas project, involvement in project design of biogas project, involvement in needs identification for biogas project, and households have clear roles and responsibilities in biogas project planning to mention but few.

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Table 1: Statement regarding biogas project budgetary planning on welfare of Household in Huye District

Role of biogas project budgetary planning	Mean	Std.
I was involved in consultative meeting for this biogas project	1.742	1.330
I was involved in project design of biogas project planning	1.800	.954
I was involved in needs identification for the biogas project planning	2.781	1.224
Households have clear roles and responsibilities in this biogas project planning	2.057	1.239
I am involved in management of biogas project planning	1.733	1.128
I participate in financing biogas project planning	1.952	1.204
I am aware of the goals and objectives of this biogas project planning	1.923	1.149
The project team considers the ideas of women as members of household	1.742	1.135
I greatly supported the project to proceed	2.047	1.163
I was satisfied with the level of consultation and participation	2.304	.889
Biogas project improve standards of living	1.647	1.037
Biogas project contribute in generating income	1.409	.947
Biogas increases agricultural production	1.552	1.065
Biogas reduces workload for women and children	1.561	1.082
Biogas contributes to environmental conservation	1.952	.859
Total Mean	1.880	

Source: Primary data, 2021

Table 1 represent the Likert Scale data presenting the views and perceptions of respondents in a scale of 1-5 range in which biogas project budgetary planning affects welfare of households in Huye District, the 1 is for to a very great extent, 2 for is for a great extent, the 3 is for to small extent, the 4 is for to no extent, the 5 is for not sure. The results indicate that there is stronger tendency of 1.409 mean and SD is .947 at 85 (81.0%) of respondents stipulated that biogas project contributes in generating income to very great extent.

There is stronger tendency of 1.552 mean and SD is 1.065 at 79 (75.2%) of respondents stipulated that biogas increases agricultural production to very great extent. There is stronger tendency of 1.561 mean and SD is 1.082 at 79 (75.2%) of respondents asserted that biogas reduces workload for women and children to very great extent. There is stronger tendency of 1.742 mean and SD is 1.330 at 76 (72.4%) of respondents asserted that they were involved in consultative meeting for the biogas project conducted to a very great extent. There is stronger tendency of 2.304 mean and SD is .889 at 70 (66.7%) of respondents stipulated that they were satisfied with the level of consultation and participation during project planning input is concerned towards the biogas project success to great extent.

There is stronger tendency of 1.647 mean and SD is 1.037 at 67 (63.8%) of respondents stipulated that biogas project improve standards of living through agricultural production business to very great extent, that there is stronger tendency of 1.733 mean and SD is 1.128 at 64 (61.0%) of respondents asserted that they are involved in management of biogas project planning to a very great extent, that there is stronger tendency of 1.742 mean and SD is 1.135 at 64 (61.0%) of respondents asserted that the project team considers the ideas of women as members of household to a very great extent.

There is stronger tendency of 2.781 mean and SD is 1.224 at 62 (59.0%) of respondents asserted that they were involved in needs identification for the biogas project planning to a great extent, that there is stronger tendency of 1.952 mean and SD is 1.204 at 57 (54.2%) of respondents stipulated that they participated in financing biogas project planning to a very great extent, that there is stronger tendency of 1.923 mean and SD is 1.149 at 57 (54.3%) of the respondents asserted that they were aware of the goals and objectives of the biogas project planning to a very great extent, that there is stronger tendency of 1.952 mean and SD is .859 at 56 (53.3%) of respondents asserted that biogas contributes to environmental conservation to great extent.

There is stronger tendency of 1.800 mean and SD is .954 at 50 (47.6%) of respondents asserted that they were involved in project design of biogas project planning to a great extent, that there is stronger tendency of 2.047 mean and SD is 1.163 at 50 (47.6%) of respondents stipulated that the greatly supported project to proceed with household welfare to a very great extent, that there is stronger tendency of 2.057 mean and SD is 1.239 at 49 (46.7%) of respondents asserted that households have clear roles and responsibilities in the biogas project planning to a very great extent. Results also show that the general perception tends to 1.8806 indicate stronger tendency which implies that biogas project budgetary planning affects welfare of households in Huye District, Rwanda.

In an interview with one of the biogas project managers, he stated that before starting the project they have budgeted for enough money to be employed in the implementation of the project, he also added that they have planned that the project beneficiaries would participate in implementation of the project through provision of labor force. He stated that in his own word: "*As we planned before starting the project, most of the beneficiaries of this project in Huye have participated in the implementation of this project by providing the labor force. This have been the project to be successful because the budgeted cost of this project has been covered as planned before they start of the project. Due to this commitment of the beneficiaries in participating in this project I am sure the project will have a significant impact on the welfare of households in Huye District*".
The results of the study of Linovski (2021) are supportive to the findings of this current study which found that biogas project budgetary planning affects welfare of the households in Huye District while the findings of Linovski (2021) revealed that to develop a new biogas generation, the budgetary plans is applied in calculation of expected benefits and expected cost which is very crucial for the sake of household welfare so that the former exceeds the household biogas.

Table 2: Descriptive statistics of predictors of biogas project planning that affect welfare of households in Huye District, Rwanda

biogas project planning	Mean	Std.
Project budgetary planning	1.742	1.330
Project planning activities	1.800	.954
Standard cost	2.057	1.239
Overall mean	1.866	

Source: Primary Data, 2021

Table 2 revealed that the likert scale results of 5 points (1 to 5 where 1 is strongly agree whereas 5 is strongly disagree was used) and the results demonstrated that mean of 1.742 and SD of 1.330 with 76 (72.4%) of respondents strongly agreed that project budgetary planning affects welfare of household. The mean of 1.800 and SD of 0.954 with 50 (47.6%) of respondents strongly agreed that project planning activities affects welfare of household. The

mean of 2.057 and SD of 1.239 with 49 (46.7%) of respondents strongly agreed that standard cost affects welfare of household. Thus, since the overall mean is 1.866 it implies that predictors of biogas project planning affects household welfare in Huye District, Rwanda.

Table 3: Descriptive statistics of indicators of households' welfare in Huye District

Welfare of households	Mean	Std.
Livelihood diversification	1.952	.949
Improved standard of living	1.438	.780
Income generating activities	2.333	.871
Overall mean	1.907	

Source: Primary Data, 2021

The Table 3 revealed that the likert scale results of 5 points (1 to 5 where 1 is strongly agree whereas 5 is strongly disagree was used) and the results demonstrated that mean of 1.952 and SD of 0.949 with 83 (79.0%) of respondents strongly agreed that livelihood diversification is an indicator that helps to attain welfare of household. The mean of 1.438 and SD of 0.780 with 58 (47.6%) of respondents agreed that improved standard of living is an indicator that helps to attain welfare of household. The mean of 2.333 and SD of 0.871 with 52 (49.5%) of respondents strongly agreed that income generating activities is an indicator that helps to attain welfare of household. Thus, since the overall mean is 1.907 it implies that there is household welfare due to biogas project in Huye District, Rwanda.

Table 4: Model Summary of Biogas project planning and livelihood diversification as an indicator of household welfare in Huye District, Rwanda

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.749[a]	.560	.547	.67786

a. Predictors: (Constant), Standard cost, Budgetary planning, Project planning activities
Source: Primary Data, 2021

Findings in Table 4 prove that R coefficient .749 reveals that biogas project planning has a positive relationship with livelihood diversification as an indicator of household welfare. The coefficient of determination .560 R square also indicates that biogas project planning explains 56.0% of progress variability of livelihood diversification that influences welfare of households in Huye District. Thus, it implies that predictors of biogas project planning such as Standard cost, budgetary planning, and project planning activities affect the progress in livelihood diversification for welfare of households by 56.0% in Huye District.

Table 5: Analysis of Variance (ANOVA) of Biogas project planning and livelihood diversification as an indicator of household welfare in Huye District, Rwanda

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	59.154	3	19.718	42.913	.000
Residual	46.408	101	.459		
Total	105.562	104			

a. Dependent Variable: Livelihood diversification
b. Predictors: (Constant), Standard cost , Budgetary planning , Project planning activities
Source: Primary Data, 2021

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Table 5 proved a positively significant relationship between biogas project planning and livelihood diversification as an indicator of household welfare due to the fact the calculated sig. level 0.00 is less than 0.05 sig. level (0.00 the calculated significance level is less than 0.05 levels of significance). Therefore, the statistical model that predicts the relationship between biogas project planning and livelihood diversification for household welfare in Huye District is significant.

Table 6: Coefficients of Biogas project planning and livelihood diversification as an indicator of household welfare in Huye District, Rwanda

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.176	.141		1.246	.216
Budgetary planning	.213	.107	.229	1.988	.050
Project planning activities	.539	.229	.473	2.351	.021
Standard cost	.527	.217	.465	2.428	.017

a. Dependent Variable: Livelihood diversification

Source: Primary data, 2021

Findings in Table 6 prove that predictors of biogas project planning have positive coefficients that enhance the increase of livelihood diversification of household welfare in Huye Districts. The regression analysis shows that there is a relationship between biogas project planning and livelihood diversification for household welfare, because all calculated p values are less than to 0.05. Therefore, the coefficients provide a regression model, $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta$. Therefore, the model turns into $Y = .176 - .213X1 + .539X2 + .527X3$, this regression equation suggests that there is a relationship between the predictors of biogas planning and the diversification of livelihoods for welfare of household in Huye district.

The first objective of organizing the relationship between project budget planning and livelihood diversification for household welfare has a positive and significant relationship ($b = .213$ and $p = .050$). The second objective of establishing the relationship between project planning and livelihood diversification for household welfare has a relationship ($b = .539$ and $p = .021$). The third objective is to organize the relationship between standard cost and livelihood diversification for household welfare in Huye District ($b = .527$ and $p = .017$). Hence, it implies that there is a positively significant relationship between biogas project planning and livelihood diversification for household welfare in Huye District.

4.2.2 Effect of biogas project planning activities on welfare of households in Huye District

The findings presented in this subsection are generally based on the effect of biogas project planning activities on welfare of households in Huye District; and these views and perceptions are presented in terms of willingness to work overtime to accomplish unfinished biogas project activities, biogas project enhances welfare of households to mention but few.

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Table 7: Statements regarding the effect of biogas project planning activities on welfare of households in Huye District

biogas project planning activities on welfare of households	Mean	Std.
I am willing to work overtime to accomplish unfinished biogas project activities	1.952	.949
As a beneficiary, thinking about biogas project activities need to be done	1.438	.780
I feel this biogas project planning don't regarding welfare of households	2.333	.871
I am interested in project that improves welfare of household	1.676	.899
Biogas project planning activities increase Improved standards of living opportunities	2.466	.829
Biogas project planning activities affect livelihood diversification	1.819	.889
Biogas project planning activities affect IGAs	1.504	1.007
I do extra work for biogas project on behalf of household welfare	1.419	.871
Biogas project contributes to poverty reduction	1.323	.871
Overall mean	1.770	

Source: Primary data, 2021

Table 7 represent Likert Scale data presents the views and perceptions of respondents in a scale of 1-5 range in which biogas project planning activities affects welfare of households in Huye District whereby 1 stands for to a very great extent, 2 for to a very great, 3 for to a small extent, 4 for to no extent and 5 for not sure. Thus, there is stronger tendency of 1.4190 mean and SD is .87151 at 89 (84.8%) of respondents asserted that they do extra work for biogas project on behalf of household welfare to a very great extent, there is stronger tendency of 1.3238 mean and SD is .87151 at 89 (84.8%) of respondents stated that they are not sure whether biogas project contributes to poverty reduction, there is stronger tendency of 1.5048 mean and SD is 1.00748 at 86 (81.9%) of respondents stipulated that biogas project planning activities affect IGAs to a very great extent.

There is stronger tendency of 1.9524 mean and SD is .94994 at 83 (79.0%) of respondents asserted that they are inclined to work longer to get an unfinished job biogas project activities to a very great extent, there is stronger tendency of 1.8190 mean and SD is .88929 at 70 (66.7%) of respondents asserted that biogas project planning activities affect livelihood diversification through agricultural production to a very great extent, there is stronger tendency of 1.4381 mean and SD is .78037 at 58 (55.2%) of the respondents stipulated that they think always about biogas need to conducted to a great extent, there is stronger tendency of 2.4667 mean and SD is .82952 at 58 (55.2%) of respondents stated that biogas project planning activities increase improved standards of living opportunities to a great extent.

There is stronger tendency of 2.3333 mean and SD is .87151 at 52 (49.5%) of respondents asserted that biogas project planning enhances welfare of households to a very great extent, there is stronger tendency of 1.6762 mean and SD is .89943 at 41 (39.0%) of respondents asserted that they are interested in biogas project that improves welfare of households to a great extent. The results also show that the overall mean is 1.770 which implies that biogas project planning activities affects welfare of households to a very great extent in Huye District, Rwanda.

The results of this study are supported by the results of Drechsel *et al.*, (2005) and Barnet *et al.*, (2008) who conducted studies in related fields to biogas project planning and welfare of

households and revealed that planning project activities, management, attitudes and capacity of rural famers, improved standards of living and income generating capacity have an effect on both biogas project planning and households welfare.

Table 8: Model Summary of Biogas Project Planning and Improved standards of living as an indicator of household welfare in Huye District, Rwanda.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.935[a]	.875	.871	.31292

a. Predictors: (Constant), Standard cost , Budgetary planning , Project planning activities
Source: Primary data, 2021

The Table 8 proves that R coefficient .935 reveals that biogas project planning has a positive relationship with improved standards of living for household welfare in Huye District. The coefficient of determination .875 R square also indicates that biogas project planning explains 87.5% of progress variability of improved standards of living opportunities that influence welfare of households in Huye District. Thus, it implies that predictors of biogas project planning such as standard cost, budgetary planning, and project planning activities affect the progress in improved standards of living for household welfare by 87.5% in Huye District.

Table 4. 9: Analysis of Variance (ANOVA) of Biogas Project Planning and Improved standards of living as an indicator of household welfare in Huye District, Rwanda

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	69.101	3	23.034	235.233	.000
Residual	9.890	101	.098		
Total	78.990	104			

a. Dep. Variable: Improved standards of living
b. Predictors (constant), Standard cost , Budgetary planning , Project planning activities
Source: Primary Data, 2021

The Table 9 indicate that there is a relationship between biogas project planning and the improved standards of living due to the fact that the calculated p-value of 0.00 is less than 0.05 level of sig. (the calculated significance level of 0.00 is less than 0.05 value level). Therefore, the statistical model that predicts the relationship between biogas project planning and improved standards of living for household welfare in Huye District is significant.

Table 10: Coefficients of Biogas Project Planning and Improved standards of living as an indicator of household welfare in Huye District, Rwanda.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.058	.065		.890	.376
Budgetary planning	.323	.049	.402	6.543	.000
Project planning activities	.436	.106	.443	4.120	.000
Standard cost	.791	.100	.807	7.897	.000

a. Dependent Variable: Improved standards of living
Source: Primary Data, 2021

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The findings in Table 10 prove that predictors of biogas project planning have positive coefficients that enhance the increase of improved standards of living for household welfare in Huye District. The regression analysis demonstrates that there is a remarkable relationship between biogas project planning and improved living standards due to the fact all calculated p values are less than 0.05 each. Thus, the coefficients provide the regression model, $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta$. Therefore, the model becomes $Y = .058 + .323X1 + .436X2 + .791X3$, this regression equation suggests that there is a between the predictors of biogas project planning and improved standards of living for the welfare of the household in the Huye district.

The second objective of establishing the relationship between project planning activities and improving standards of living for household welfare has remarkable relationship (b = .436 and p = .000). The first purpose of setting up the relationship between budgetary planning and improved standards of living for household welfare has a considerable relationship (b = .323 and p = .000). The third objective was to establish the relationship between standard cost and improved standards of living for household welfare (b = .791 and p = .000). Therefore, it implies that there is a relationship between biogas planning and the improved standards of living for household welfare in Huye District. Therefore, it implies that there is a remarkable relationship between biogas project planning and IGAs for household welfare in Huye District.

4.2.3. Relationship between biogas project standard cost and welfare of households in Huye District

The relationship between biogas project Standard cost and welfare of households in Huye District is found in relating biogas project Standard cost with indicators of household's welfare which are livelihood diversification, Improved standards of living and IGAs through households activities. Thus, for clarification the researcher also measured relationship in terms of involvement in financing the budget of the biogas project by project stakeholders including beneficiaries to own the project, and involvement in different levels of project such as design and consultative meeting.

Table 11: Statements regarding biogas project standard cost and welfare of households in Huye District

Standard cost and welfare of households	Mean	Std. D
I was involved in financing the budget of this biogas project	1.3238	1.06501
I was involved in the meeting for designing the budget of this biogas project	1.5524	1.08241
I decided on the labor of each households contribution in this biogas project	1.5619	.93537
I decided on the wages to be paid for households labor in this biogas project	1.6762	.94994
I decided on the compensation for non-labor households resources in this project	1.4381	.95857
I decided on the sanctions to be imposed on households that do not participate in maintenance of this biogas project	1.8190	.87151

Source: Primary Data, 2021

The Table 11 presents the Likert Scale data presents the views and perceptions of respondents in a scale of 1-5 range in which biogas project standard cost promote welfare of households in Huye District. Whereby 1 stands for to a very great extent, 2 is to a great extent, 1 for a

small extent, 4 for to no extent, and 5 for not sure). The results show that stronger tendency of 1.6762 mean and SD is .94994 at 83 (79.0%) of respondents stipulated that they decided the ages to be paid for households' labor in this biogas project to a very great extent, there is stronger tendency of 1.3238 mean and SD is 1.06501 at 79 (75.2%) of respondents asserted that they were involved in financing the budget of biogas project to a very great extent, there is stronger tendency of 1.5524 mean and SD is 1.08241 at 79 (75.2%) of respondents stipulated that they were involved in the meeting for designing the budget of biogas project to a very great extent, there is stronger tendency of 1.5619 mean and SD is .93537 at 58 (55.2%) of respondents stated that they decided on the labor of each households' contribution in biogas project to a very great extent, there is stronger tendency of 1.8190 mean and SD is .87151 at 52 (49.5%) of respondents affirmed that they decided on the sanctions to be imposed on households that do not participate in maintenance of this biogas project to a very great extent there is stronger tendency of 1.4381 mean and SD is .95857 at 49 (46.7%) of respondents asserted that they decided on the compensation for non-labor households' resources in biogas project planning to a very great extent. The findings of the research demonstrate a mean of 1.8190, while the lowest suggests 1.3238, implying that biogas project standard cost promotes welfare of households in Huye District, Rwanda.

The findings are supported by the findings of Ndahimana (2010) in his study he stated that the Biogas Project objective was drive a commercially viable household biogas sector with each goals of contributing to the welfare of rural households whilst reducing pressure on natural resources and promoting the welfare of household members.

Table 12: Statement regarding biogas project planning and welfare of household in Huye District

Statements	Mean	Std. D
Project budgetary planning affects household welfare	1.9143	1.08410
Project planning activities promotes household welfare	1.5905	.88465
Standard cost enhances the household welfare	1.5048	.88929
Livelihood diversification promotes the welfare of households	1.4190	1.00748
Improved standards of living is result of household welfare	1.3238	.87151
IGAs promote household welfare	1.4667	1.04759

Source: Primary data, 2021

The table 12 represents the Likert Scale data presents the views and perceptions of respondents in a scale of 1-5 range in which biogas project planning is related to welfare of households in Huye District, whereby 1 is to a very great extent, 2 is to a great extent, 3 is to a small extent, 4 is to no extent and 5 is not sure). The results show that there is stronger tendency of 1.3238 mean and SD is .87151 at 89 (84.8%) of respondents stipulated that improved standards of living is result of household welfare to a very great extent, there is stronger tendency of 1.4190 mean and SD is 1.00748 at 86 (81.9%) of respondents stipulated that livelihood diversification promotes the welfare of households to a very great extent, there is stronger tendency of 1.4667 mean and SD is 1.04759 at 84 (80.0%) of respondents stipulated that IGAs promote household welfare to a very great extent, there is stronger tendency of 1.5048 mean and SD is .88929 at 70(66.7%) of respondents stipulated that standard cost enhances the household welfare to a very great extent, there is stronger tendency of 1.5905 mean and SD is .88465 at 61(58.1%) of respondents asserted that project planning activities promotes household welfare to a very great extent, there is stronger tendency of 1.9143 mean and SD is 1.08410 at 51(48.6%) of respondents asserted that

project budgetary planning affects household welfare to a very great extent. The results have also show the highest mean as 1.08410 while the lowest is .87151 showing that biogas project planning have an effect on household welfare in Huye District, Rwanda.
The study findings of Karekezi and Kithyoma (2003) which revealed that there is correlation between government policies of effective project planning with achievement of biogas project for the well - being of households in Africa supports the results of this study.

Table 13: Correlation analysis between project planning and households welfare

		Livelihood diversification	Improved standards of living	IGAs
Budgetary planning	P Correlation	.526**	.600**	.637**
	Sig. (2-tailed)	.000	.000	.000
	N	105	105	105
Project planning activities	P Correlation	.723**	.872**	.789**
	Sig. (2-tailed)	.000	.000	.000
	N	105	105	105
Standard cost	P Correlation	.728**	.904**	.828**
	Sig. (2-tailed)	.000	.000	.000
	N	105	105	105

**. Correlation is sig. at 0.01 level (2-tailed)
Source: Primary data, 2021

The Table 13 proved that budgetary planning and livelihood diversification has a positive and significant relationship (r=.526 and sig=.000), between budgetary planning and Improved standards of living (r=.600 and sig=.000), between budgetary planning and IGAs (r=.637 and sig=.000), between project planning activities and livelihood diversification (r=.723 and sig=.000), between project planning activities and Improved standards of living (r=.872 and sig=.000), between project planning activities and IGAs (r=.789 and sig=.000), between Standard cost and livelihood diversification (r=.728 and sig=.000), and between Standard cost and Improved standards of living (r=.904 and sig=.000), between Standard cost and IGAs (r=.828 and sig=.000). Thus, these findings prove that biogas project planning and household welfare has a positive and significant relationship in Huye District.

The study of Nyang, *et al.*, (2020) supports the findings of his study, renewable biogas generation and mobilization of responses has a positively significant relationship which demonstrated that there is correlation between effective project planning and biogas project achievement for the well – being of households.

Table 14: Model Summary of Biogas Project Planning and IGAs

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.831[a]	.690	.681	.59186

a. Predictors: (Constant), Standard cost , Budgetary planning , Project planning activities
Source: Primary Data, 2021

Table 14 indicates that R coefficient .831 reveals that biogas project planning has a positive relationship with IGAs for household welfare in Huye District. The coefficient of

determination .690 R square also indicates that biogas project planning explains 69.0% of progress variability of IGAs that influences welfare of households in Huye District. Thus, it implies that predictors of biogas project planning such as standard cost, budgetary planning, and project planning activities affect the progress in IGAs by 69.0% in Huye District.

Table 15: Analysis of Variance (ANOVA) of Biogas Project Planning and IGAs

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	78.754	3	26.251	74.940	.000
Residual	35.380	101	.350		
Total	114.133	104			

a. Dependent Variable: IGAs
b. Predictors: (Constant), Standard cost , Budgetary planning , Project planning activities
Source: Primary Data, 2021

The findings in Table 15 point out that there is a positive relationship between biogas project planning and IGAs, due to the fact that the 0.00 sig. value of the calculated significance is less than 0.05 p-values (level of 0.00 of calculated sig. is less than 0.05). Therefore, the statistical model that predicts the relationship between biogas project planning and IGAs of household welfare in Huye District is significant. Thus, it implies that the statistical model predicts the relationship between biogas project planning and IGAs of household welfare in Huye District.

Table 16: Coefficients of Biogas Project Planning and IGAs

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.002	.123		.015	.988
Budgetary planning	.082	.093	.085	.881	.031
Project planning activities	.182	.200	.154	.910	.035
Standard cost	.886	.190	.752	4.672	.000

a. Dependent Variable: IGAs
Source: Primary Data, 2021

The findings in Table 16 show that predictors of biogas project planning have positive coefficients that enlarge the increase of household welfare livelihood diversification in Huye District. Regression analysis shows that there is a relationship between biogas project planning and livelihood diversification due to the fact that all calculated p values are less than 0.05 each. Thus, the coefficients provide the regression model, $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta$. Therefore, the model will become $Y = .002 + .082X1 + .182X2 + .886X3$, this regression equation suggests that there is a massive fantastic between the predictors of biogas project planning and livelihood diversification of household welfare in Huye district.

The first objective of organizing the relationship between project budgetary planning and IGAs for household welfare in Huye District with positive relationship (b = .082 and p = .031). The second objective of setting up the relationship between project planning activties and income generation has a relationship (b = .182 and p = .035). The third objective is to set

up the relationship between standard cost and IGAs for household welfare in Huye District (b = .886 and p = .000). Therefore, it implies that there is a suitable relationship between biogas project planning and IGAs for household welfare in Huye District.

5.1 Conclusion

In conclusion, the results of the first objective showed the total mean 1.8806 indicate stronger tendency which implies that biogas project budgetary planning affects welfare of households in Huye District which is supported by the inferential statistics results which showed that budgetary planning and livelihood diversification has a positive and significant relationship (r=.526 and sig=.000), between budgetary planning and Improved standards of living (r=.600 and sig=.000), between budgetary planning and IGAs (r=.637 and sig=.000) which implies that budgetary planning has a positive and significant relationship with welfare of hoiseholds in Huye District, Rwanda.

The results of the second objective showed the highest average is 2.4667 while the lowest average is 1.3238 meaning that biogas project planning activities affects welfare of households in Huye District. This descriptive statistics results are supported by the inferential statistics results which showed that there is a positive and significant relationship between project planning activities and livelihood diversification (r=.723 and sig=.000), between project planning activities and improved standards of living (r=.872 and sig=.000), between project planning activities and IGAs (r=.789 and sig=.000), between Standard cost and livelihood diversification (r=.728 and sig=.000) which implies that project planning activities has a positive and significant relationship with welfare of households in Huye District, Rwanda.

The results of the third objective showed the highest mean is 1.8190 whereas the lowest mean is 1.3238 implying that biogas project standard cost promotes welfare of households in Huye District. The results are supported by inferential statistics results which showed that standard cost and improved standards of living (r=.904 and sig=.000), between standard cost and IGAs (r=.828 and sig=.000). Thus, these findings prove that biogas project planning and household welfare has a positive and significant relationship in Huye District which also implies that biogas project plays a big role in enhancing the betterment of households' welfare in Huye District, Rwanda.

5.2 Recommendations

The researcher would like to highlight the following recommendations basing on the findings of the study:

Basing on the results of this study, the researcher recommends to rural households to adopt biogas project in order to save time that they spent cooking, to adopt biogas generation for health and sanitation purposes because it helps to ensure better health that is free of diseases related to smoke. I would also like to recommend them to effective apply development planning skills while planting biogas project that can also increase livelihood diversification due to use of organic fertilizer in agriculture to mention but few.

The researcher would like to recommend to the local government to encourage rural households to ensure that those at least with vast land should have biogas generation in their households so that the number of people who own biogas should be increase to ensure welfare of the households in rural areas.

The researcher would like to recommend to stakeholder in rural development agencies both government, NGOs and private sector to investment and sponsor local communities to own biogas technologies to tackle issues of climate change and global warm as well to ensure effective development planning for rural communities to ensure their welfare.

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