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Mphila, T, Z., Sakwa, M., & Mati, B.

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[1] Mphila, T, Z., [2] Sakwa, M., & [2] Mati, B.

[1] Msc. Candidate, School Of Communication and Development Studies, Jomo Kenyatta University of Agriculture [JKUAT], Kenya
[2] Professor, Jomo Kenyatta University of Agriculture [JKUAT], Kenya

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ABSTRACT

Women and men play an important role in the sustainable management of water and water resources. Both their roles are crucial for the sustainable management of water for household wellbeing and well as other benefits for their families. The main objective of this study was to compare gender perceptions on socio-economic effects of sustainable water management practices on household wellbeing in Ndakaini sub-watershed. The study examined the various perceptions and the effects they have on the men and women's practice of sustainable water management in Ndakaini sub-watershed. Furthermore, the study examined the income benefits, health benefits as well as food security benefits that the respondents get from practicing sustainable water management in their households. For data collection, a comparative study was adopted. Primary data was collected through the use of questionnaires which targeted household which practice sustainable water management in the study area. The data was then transcribed verbatim and coded for analysis. The study found that men and women have different perceptions on the socio-economic effects of sustainable water management on household wellbeing in the sub-water. The study recommended that both men and women be educated about sustainable water management and its benefits and also have existing Water Resource User Associations that will ensure that they continue to practice sustainable water management in their households in order to be able to see the benefits and make a clear comparison of their household wellbeing from when they did not practice sustainable water management.

Key Words: *Sustainability, Water Management, health effects, income, Production, socio-economic*

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INTRODUCTION

Water is an important natural resource to all forms of life and their existence; for mankind, it is the backbone of growth and prosperity (Ministry of Water and Irrigation (MWI), 2006-2008). However, it has become a scarce resource in most parts of the world. The population of the world has been increasing at a higher rate with the world population projected to hit 9 billion by 2050. This has transpired to an increased water demand (Joseph, 2016). According to Grant (2017) population growth, growing middle classes, and ever-increasing demand for food, energy, and construction are putting a major stress on water resources.

At a global level, demand for water is increasing steadily, with a general trend toward diversification of use away from agricultural activities (Rathgeber, 1997). Currently, about 70% of world freshwater are used for agricultural purposes. Moreover, with increasing populations and improved living standards, domestic demand for water has grown significantly in all parts of the world, including Africa (Biswas, 1993). In the context, the past decade has seen massive expansion of water projects in Africa. Although the Africa continent is still the least-irrigated and least-industrialized region of the world, sustained efforts continue to be made to provide safe and reliable water sources in rural and urban areas throughout the region, both for domestic consumption and for agricultural purposes (Rathgeber, 1997).

Kenya as a country is facing a number of serious challenges related to water resources management (Kenya National Water Development Report, 2006). The report also states that a number of these challenges are as a result of factors both within and outside the water sector. Climate variability and increasing demand for water as a result of development and population pressure are factors that the sector may not be able to control but can initiate mitigation measures to ensure sustainable water resource development. According to the KNWD report, Kenya is also faced with the challenge of catchment degradation which results in increased runoff, flash flooding, reduced infiltration, erosion and siltation. Catchment degradation is a major problem, which is undermining the limited sustainable water resources base in the country. The main causes of catchment degradation are poor farming methods, population pressure and deforestation. For example, the Upper Tana watershed is currently facing a serious problem of water scarcity as a result of several factors such as poor management, loss of forest cover, climatic variability, population increase, and limited endowment of the resource. Water being an economic good and a cost attached to its development, distribution, operation and maintenance there has been gender disparity in its management (TNC, 2015).

Gender refers to the different roles, rights, and responsibilities of men and women and the relationship between them. Gender does not simply refer to women or men, but to the way their qualities, behaviors, and identities are determined through the process of socialization. Gender is generally associated with unequal power and access to choices and resources (Status of Women, Canada, 1996).

The different roles of women and men are influenced by historical, religious, economic and cultural realities. These roles and responsibilities can and do change over time. Gender also recognizes the intersection of women's experience of discrimination and violations of human rights not only on the basis of their gender but also from other power relations that result from race, ethnicity, caste, class, age, ability/disability, religion, and a multiplicity of other factors including whether they are indigenous. Looking at how water management tasks are divided across the sexes and age groups shows for example on which aspects water projects need to work with women or with men, as within families, different categories of women, and men, tend to have different tasks, decision-making power and knowledge (van Wijk, 1998).

The Upper Tana River ecosystem provides hydrologic services which are of key importance for the Kenyan economy and environment (TNC, 2010). It is the most productive basin for agriculture in Kenya, provides water to key national parks, generates half of the total hydropower production of the country, and supplies 95% of Nairobi's water. Rain-fed smallholder agriculture uses 36% of the water budget, mostly through transpiration from crops. Another major water user at 33% is hydropower; although this use is non-consumptive (meaning the flow is returned to the river after being used for power generation). Irrigated agriculture utilizes about 4% of the water budget, while around 2% is abstracted for Nairobi's water supply. The Upper Tana basin supplies Nairobi city water through the Sasumua and Ndakaini dams drawing water from the Chania and Thika rivers respectively. The challenges facing the Upper Tana watershed are that the demand for irrigation water has increased, particularly to support horticulture production. Encroachment on natural wetlands that once stored runoff water and recharged aquifers has reduced dry-season flows. Agricultural expansion along with soil erosion and landslides has increased sediments in local rivers. The combination of these factors means that in the Tana River there are lower water yields during dry periods and increased sediment in streams (TNC, 2010).

It is these factors according to TNC (2010) that have prompted TNC and others to come together to assess the likely impact of implementing a water fund to preserve the Upper Tana. This then resulted to the establishment of the Upper Tana-Nairobi Water Fund (UTNWF). The stakeholders working together in the watershed include major utilities, NCWSC and KenGen; government agencies, Water Resources Management Authority (WRMA) and Tana and Athi Rivers Development Authority (TARDA); as well as prominent corporations in Kenya, East African Breweries, Coca-Cola, Frigoken Horticulture, the water technology company Pentair, the International Centre for Tropical Agriculture (CIAT) and TNC. Additional support comes from other stakeholders including Swedish International Development Agency (SIDA), Global Environment Facility (GEF), United Nations Environment Program (UNEP) and International Fund for Agricultural Development (IFAD).

The growing challenge faced by the Upper Tana watershed requires something innovative to protect the Tana river, increase downstream water quality and quantity and provide benefits for tens of thousands of farmers in the watershed (TNC, 2010). The ways in which the upper Tana watershed and the Tana river can be protected at household level is through the practice of rainwater harvesting, runoff water management, vegetation cover and soil and water conservation. This study seeks to determine how these practices benefit the farmers within the watershed.

Problem Statement

The Upper Tana watershed is of critical importance to the Kenyan economy. It supplies 95% of Nairobi's drinking water, sustains important aquatic biodiversity, drives agricultural activities that feed millions of Kenyans and provides half of the country's hydropower output. However, there is rising tension between the upstream water users who are smallholder farmers and the downstream water users who depend largely on the water for their daily living. This is as a result of the unchecked expansion of farming which has led to land degradation. Consequently, elevated sediment loads are entering the river system, impacting the delivery of water to Nairobi water users (TNC, 2015).

Therefore, there is a need for conservation measures to ensure that both the upstream and downstream water users both benefit from the Upper Tana watershed. These conservation measures should recognize the importance of gender perceptions on sustainable water management to ensure that everyone is involved in the management. Michael (2000) reckons that inclusion of men and women in water resources management upholds the right to be included in

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decision making on matters that affect their lives such as use and access of natural resources such as water. According to Khosla & Pearl (2003) it also builds sustainability since the roles and responsibilities of both genders are considered and felt.

The government of Kenya has tried to address the gender issues that exist in the country through government policies, development plans and programs and through the ratification of various international instruments as well as other gender related legal reforms. However, despite of all the efforts, a gap exists in how men and women access, use and get involved in the management of water resources. Understanding gender issues in the management of water resources is essential because it is at this level where households are influenced by gender issues of access and use of water (Mwangi, 2015).

According to Ochelle (2012) there is lack of sustainability of most of the water projects initiated by government and non-governmental organizations as demonstrated by annual serious water shortages in dry areas during droughts therefore sustainability of water management depends on the perceptions that both men and women have towards water access, use and management. Ochelle (2012) adds that the sustainability of a project may be threatened because women are not effectively involved in the project. Therefore, involving both men and women effectively in the project phases need to be emphasized and implemented in the achievement of project sustainability. Gender perceptions on the benefits of sustainable water management initiatives should be similar so that both men and women will work towards the same goal of achieving practicing sustainable water management. Sustainable management of water resources and sanitation provides great benefits to a society and the economy as a whole. Thus, it is crucial, first, to involve both women and men in water resource management (UN-WATER & IANGWE 2005-2015).

Objectives of the Study

The main objective of this study was to examine the different gender perceptions on the socio-economic impacts of sustainable water management practices on household wellbeing in Ndakaini sub-watershed. The study was guided by the following specific objectives:

- To analyze the gender perceptions on the health effects of rainwater harvesting practices on households in Ndakaini sub-watershed.
- To determine the gender perceptions on the income effects of runoff water management practices on households in Ndakaini sub-watershed.
- To ascertain the gender perceptions on the production effects of soil water management practices on households in Ndakaini sub-watershed
- To assess the moderating effects of socio-economic background between the practice of water management for household wellbeing in Ndakaini sub-watershed.

LITERATURE REVIEW

Gender and Development

The GAD approach to socio-economic development was introduced in the 1980s in response to advocacy from feminist sociologists. GAD was an attempt to address the weaknesses of previous approaches, such as the Women in Development (WID) and the Women and Development (WAD) (Phuong, 2001). GAD not only focuses on women's issues, but on various aspects of the social relations between men and women (Kattel, 1992). For this reason, it is necessary to understand the structure and dynamic of gender relations in order to analyze social progress and social organizations. GAD is based on the premise that both men and women are equally responsible for development.

Diffusion of Innovation Theory

Diffusion of innovations is a theory profound by Everett Rogers that seeks to explain how, why, and at what rate new ideas and technology spread. Rogers (1995) argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. For Rogers (2003), adoption is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation". Rogers defines diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system". As expressed in this definition, innovation, communication channels, time, and social system are the four key components of the diffusion of innovations (Roger, 1995).

Sustainable Livelihood Theory

Development has many meanings, Cowen and Shenton (1998) have made an interesting case for two basic forms: (i) Immanent development (or what people are doing anyway): this denotes a broad process of advancement in human societies driven by a host of factors including advances in science, medicine, the arts, communication, governance etc. It is facilitated by processes such as globalisation (an international integration) which helps share new ideas and technologies. (ii) Intentional (or Interventionist) development: this is a focused and directed process whereby government and non-government organisations implement development projects and programmes (typically a set of related projects) to help the poor. The projects are usually time and resource bound, but have an assumption that the gains achieved would continue after the project had ended. According to Cowen and Shenton (1998) both of these forms can and do occur in parallel, with 'Immanent' development providing a broad background of change in societies while 'Intentional' development takes place as planned intervention. Thus, they state that a country will be continuously undergoing 'Immanent' development as its public, private and 'Third' sectors gradually invest in infrastructure (roads, hospitals, water provision etc.), education and training, consumer products and services. The same country may also be host to a number of development projects, perhaps funded by foreign-based agencies.

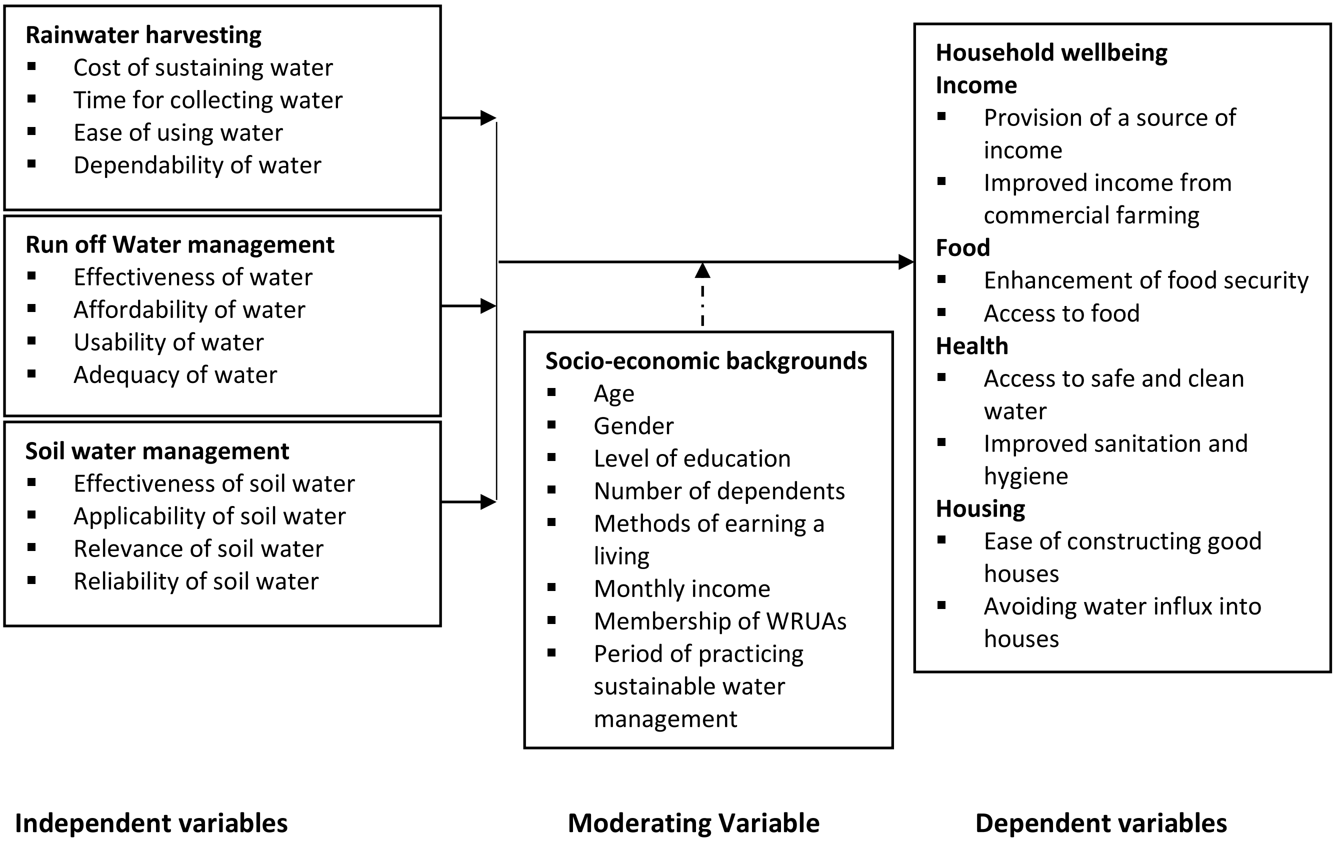

Figure 1: Conceptual Framework

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Empirical Literature Review

Water has a positive effect on socio-economic development especially in Africa where most of the economic activities depend on water availability. With this view, the huge investment in water infrastructure and promotion of water governance can make a contribution to both absolute and chronic poverty alleviation in developing countries; this can be done by supporting such broad purposes as economic growth, rural and agricultural development and national food security.

Rainwater harvesting is a simple and low-cost water supply technique that involves the capturing and storing of rainwater from roof and ground catchments for domestic, agricultural, industrial and environmental purposes. Rainwater harvesting yields numerous social and economic benefits, and contributes to poverty alleviation and sustainable development (Mati et al., 2005).

Soil water management practices are farming practices conducted by smallholder farmers aimed at controlling soil erosion (Madyanga, 2010). The use of soil water management practices has widely increased across different parts of the world; and recognized as important for ecological systems worldwide (UNEP, 2001). It leads to sustainable management of watershed resources since different economic activities such as agriculture, food production and rural livelihood in most developing communities depend on these resources. Generally, there are soil water management practices on erosion control and soil-water quality enhancement practices that are used across many countries in the world including Africa (Madyanga, 2010).

METHODOLOGY

The study employed a descriptive survey research design which made use of questionnaires. Quantitative information was used to compare the gender perceptions of socio-economic impacts of sustainable water management on household wellbeing. Questionnaires were employed as the quantitative data collection instrument for this research. The study was based in the Upper Tana watershed, Ndakaini sub-watershed (Thika-Chania sub-watershed). The population for the study was 2444 people from the Ndakaini area, this is according to the Republic of Kenya population and housing Census (2010). For purposes of this study, judgmental sampling was used to select a sample size of 344 households which participated in the study. Data was analyzed using SPSS. Quantitative data was analyzed using descriptive statistics which helped in summarizing or describing the data (CIRT, 2018).

FINDINGS AND DISCUSSION

Descriptive statistics and chi-square for household wellbeing

The mean scores showed that the female and male respondents stated that the sustainable water management practices enhanced their household wellbeing in a great extent and in a very great extent (see Table 1). On average the respondents rated the provision of a source of income, improved income from commercial farming, enhancement of food security, access to food, access to safe and clean water, improved sanitation and hygiene, ease of constructing good houses, avoiding of problems related to water influx into houses leading to demolitions in a great extent with some stating that it has a very great extent. According to Gimutai and Bwisa (2015), water harvesting tanks and ponds at the household level are proposed as a practical and effective alternative to improve the lives of rural people at little cost. They also state that the technology yields numerous social and economic benefits and contributes to poverty alleviation and sustainable development.

The findings indicated that females have a positive and significant perception on the enhancement of household wellbeing. This is given by positive coefficients of the chi^2 and p-values of less 0.05 except for the case of ease of constructing good houses. In particular, the results indicate that, there is a general positive perception on the enhancement of household wellbeing by the

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practice of sustainable water management. Women scored a higher mean with regard to provision of a source of income, improved income from commercial farming while men scored higher means concerning other indicators. According to Ray (2007) women are universally responsible for managing domestic water supplies with extensive health and social benefits accruing to the whole household and hence the reason why women scored a higher mean with regard to provision of a source of income, improved income from commercial farming while men scored higher means concerning other indicators.

Table 1: Tabulation indicators for household wellbeing

Aamong the following to what extent has your wellbeing improved due to engaging in water management techniques	**Mean**			**Chi-squared Gender**	**Chi-squared overall**
	Female	**Male**	**Overall**		
Provision of a source of income	4.22	4.12	4.16	Coef. = 95.77 P-value = 0.037	Coef. = 99.32 P-value = 0.023
Improved income from commercial farming	4.14	4.10	4.11	Coef. = 97.00 P-value = 0.038	Coef. = 35.18 P-value = 0.067
Enhancement of food security	4.28	4.38	4.34	Coef. = 87.30 P-value = 0.003	Coef. = 79.95 P-value = 0.047
Access to food	4.25	4.44	4.36	Coef. = 33.14 P-value = 0.025	Coef. = 95.95 P-value = 0.013
Access to safe and clean water	4.28	4.45	4.38	Coef. = 34.28 P-value = 0.011	Coef. = 130.92 P-value = 0.002
Improved sanitation and hygiene	4.19	4.33	4.27	Coef. = 89.23 P-value = 0.009	Coef. = 15.95 P-value = 0.000
Ease of constructing good houses	3.94	4.02	3.99	Coef. = 60.14 P-value = 0.051	Coef. = 88.41 P-value = 0.006
Avoiding of problems related to water influx into houses leading to demolitions	3.89	3.98	3.94	Coef. = 18.26 P-value = 0.048	Coef. = 51.08 P-value = 0.033
Key	1.00-1.79: very small extent				
	1.80-2.59: small extent				
	2.60-3.39: moderate				
	3.40-4.19: great extent				
	4.20-5.00: very great extent				

Descriptive Statistics and chi-square for rainwater management (cost of sustaining rainwater)

The cost of sustaining rainwater is in terms of the materials required and the process of sustaining itself. This process is in terms of collecting, storing and purifying the rainwater. Generally, the mean scores showed that there was a low cost of sustaining water for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping is low (with the range 1.80-2.59). On average both female and male respondents ranged the cost of sustaining rainwater with the low-cost range. Nevertheless, the mean for females was relatively higher than that of male.

The positive and significant coefficients of the chi-square are an indication that both female respondents had a positive perception on the cost of rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Therefore, this means that the female respondents in Ndakaini had a positive perception on the cost of rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping.

With regard to time for accessing rainwater, the mean scores show that both the female and male respondents stated that it takes them little time to access rainwater within their households. Results showed that on average the mean scores for both male and female respondents on the time used to access rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and keeping is little.

Given the positive chi-square coefficients and p-values that are less than 0.05, the study argues that female respondents had a positive perception on the time for accessing rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Thus, there is a general positive perception on the time used to access rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. This is attested by Mohan (2001) who posits that the division of water use into household use and productive has brought about the assumption that women's strategic interest in water is concentrated primarily in having access to convenient, reliable and safe sources close to the homestead for their domestic responsibilities. In addition, the mean scores for male respondents are generally lower than those of females.

Table 2: Rainwater Management Indicators

Water uses	Cost of sustaining water			Time for accessing water			Ease of using rainwater			Dependability of using rainwater			Challenges of using rainwater		
	F	M	O	F	M	O	F	M	O	F	M	O	F	M	O
Usage of water for food preparation	2.30	2.26	2.27	2.17	2.03	2.09	3.47	3.52	3.49	3.10	3.10	3.10	2.39	2.21	2.28
	Coef. = 187.28 P-value = 0.001		Coef. = 89.32 P-value = 0.023	Coef. = 230.49 P-value = 0.001		Coef. = 167.29 P-value = 0.048	Coef. = 318.50 P-value = 0.002		Coef. = 276.40 P-value = 0.018	Coef. = 173.36 P-value = 0.016		Coef. = 77.82 P-value = 0.023	Coef. = 260.37 P-value = 0.008		Coef. = 188.56 P-value = 0.03
Usage of water for drinking	2.30	2.25	2.27	2.24	2.02	2.11	3.60	3.60	3.60	3.15	3.11	3.13	2.37	2.23	2.28
	Coef. = 198.95 P-value = 0.029		Coef. = 105.18 P-value = 0.008	Coef. = 247.74 P-value = 0.000		Coef. = 105.18 P-value = 0.009	Coef. = 215.86 P-value = 0.60		Coef. = 199.05 P-value = 0.090	Coef. = 204.40 P-value = 0.061		Coef. = 161.83 P-value = 0.07	Coef. = 319.86 P-value = 0.090		Coef. = 210.18 P-value = 0.082
Usage of water for hygiene and sanitation	2.38	2.34	2.23	2.33	2.16	2.23	3.49	3.56	3.53	3.15	3.13	3.14	2.42	2.29	2.34
	Coef. = 228.91 P-value = 0.003		Coef. = 91.89 P-value = 0.041	Coef. = 228.91 P-value = 0.006		Coef. = 191.76 P-value = 0.005	Coef. = 369.11 P-value = 0.002		Coef. = 276.00 P-value = 0.009	Coef. = 219.63 P-value = 0.009		Coef. = 186.01 P-value = 0.042	Coef. = 321.70 P-value = 0.000		Coef. = 191.89 P-value = 0.01
Usage of water for vegetable gardening	2.40	2.32	2.35	2.31	2.11	2.19	3.33	3.38	3.34	2.85	2.76	2.79	2.42	2.29	2.34
	Coef. = 122.88 P-value = 0.025		Coef. = 130.92 P-value = 0.019	Coef. = 161.19 P-value = 0.045		Coef. = 95.92 P-value = 0.029	Coef. = 176.90 P-value = 0.005		Coef. = 192.29 P-value = 0.029	Coef. = 79.91 P-value = 0.004		Coef. = 60.25 P-value = 0.002	Coef. = 182.00 P-value = 0.003		Coef. = 60.76 P-value = 0.011
Usage water for chicken keeping	2.45	2.32	2.37	2.35	2.14	2.23	3.40	3.39	3.39	2.0 4	2.95	2.11	2.46	2.32	2.38
	Coef. = 190.14 P-value = 0.000		Coef. = 75.01 P-value = 0.043	Coef. = 204.44 P-value = 0.017		Coef. = 144.57 P-value = 0.031	Coef. = 300.94 P-value = 0.280		Coef. = 257.44 P-value = 0.37	Coef. = 109.19 P-value = 0.033		Coef. = 99.01 P-value = 0.043	Coef. = 256.40 P-value = 0.012		Coef. = 175.01 P-value = 0.037
Key	1.00-1.79: Very low cost			1.00-1.79: Very low cost			1.00-1.79: Very difficult			1.00-1.79: Very low dependability			1.00-1.79: Very small extent		
	1.80-2.59: Low cost			1.80-2.59: Low cost			1.80-2.59: Difficult			1.80-2.59: Low dependability			1.80-2.59: Small extent		
	2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate		
	3.40-4.19: High cost			3.40-4.19: High cost			3.40-4.19: Easy			3.40-4.19: Dependable			3.40-4.19: Great extent		
	4.20-5.00: Very high cost			4.20-5.00: Very high cost			4.20-5.00: Very easy			4.20-5.00: Highly dependable			4.20-5.00: Very great extent		
	F = Female			M = Male			O = Overall								
	1=Male, 2=Female, 3=Overall														

The results showed that on average, the mean scores for both male and female respondents on the ease of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping falls within the easy range of the Likert scale (3.40-4.19).

The chi-square coefficients are an indication that the female respondents had a positive perception on the ease of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Thus, the general positive perception on the ease of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. However, the means scores for male with references to ease of using water are higher as compared to those of females. This imply that males had relatively stronger perception on the ease of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping.

The gender perceptions on the dependability of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping within their households were also shown in Table 2. The mean scores showed that on average the female and male respondents stated that the dependability of using rainwater is moderate. This was attested by Hartun (2002) who states that even though water is life, millions of people throughout the world still lack enough of this basic commodity for their hygiene and/or have no good quality water for drinking and preparing food. The same applies in Ndakaini where some still cannot depend on rainwater due to the lack of equipment such as big tanks that can be able to collect enough rainwater which they can depend on.

The significance of the results as given by the p-values, less than 0.05 are an indication that the female respondents had a positive perception on the dependability of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Thus, there is a general positive perception on the dependability of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping.

From the results, more than 80% of both female and male respondents seem to be of the opinion that they use rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Only a small percentage of the female and male respondents stated that they do not use rainwater within their household.

The mean scores show that on average the female and male respondents stated that the challenges of using rainwater are in a small extent. The respondents stated that in most cases they do require filters or any chemicals to clean rainwater, they consume it in its natural form so they face challenges in a small extent with regards to the use of rainwater.

The study establishes that all the coefficients are significant at p-value 0.05 and 0.1, implying that female respondents had a positive perception on the challenges of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. Thus, there is a general positive perception on the challenges of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. This positive perception means that both male and female respondents agreed that the challenges they face when using rainwater for their household use are manageable and do not prevent them from the continuing to practice sustainable rainwater management.

The results indicated that females had a higher means scores than males with regard to the cost of sustaining water for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping. However, this cost was found to be low. Similar results were reported by Worm (2006) who argued that rainwater harvesting is cheap, sustainable and has low operation and maintenance costs. In addition, females had higher mean scores than males with reference to time for accessioning water, ease of accessing water and challenges of using water.

On the part of males, they scored higher mean scores with regard to dependability of using rainwater for food preparation, drinking, hygiene and sanitation, vegetable gardening and chicken keeping within their households. These findings are consistent with Hartun (2002) who observed that even though water is life, millions of people around the world still lack enough of it.

Descriptive statistics and chi-square for runoff water management

Table 3 showed indicators for the gender perceptions on the effectiveness of using runoff water for usage in watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock within their households. The male and female respondents stated that using runoff water for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock is sometimes effective.

The insignificance of the results given p-values that are greater than 0.05, the study argues that there are no differences in opinion between female and male respondents on the perception of the effectiveness of using runoff water for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock. Nevertheless, chi-square coefficients show that there is a positive perception on the effectiveness of using runoff water for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock by females. In addition, females had higher mean scores than males on their perceptions.

The indicators for the gender perceptions on the affordability of using runoff water for usage for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock within their households were also shown in Table 3. The mean scores show that the female and male respondents stated that the affordability of using runoff water for watering cash crops (tea), usage for fruit tree nurseries is moderate. However, the mean scores for female respondents were relatively higher than those of males, except for the usage for watering fruit trees (to sell fruits) where the mean score for males was relatively higher.

The insignificance of the results is an indication that both female and male respondents had no differences in opinion regarding their perception on the affordability of using runoff water for for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock. Nevertheless, the chi-square coefficients show that there is a positive perception on the affordability of using runoff water for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock.

The mean scores showed that the female and male respondents stated that the usability of runoff water for watering cash crops (tea) and usage for fruit tree nurseries is moderate. Nevertheless, the mean scores for females are generally higher than those of males. The results were insignificant for all cases, except for the case of usage for fruit tree nurseries where the p-value was less than 0.05. This implies female and male respondents had no differences in their perfection on the usability of using runoff water for for watering cash crops (tea), usage for watering fruit trees (to sell fruits), and usage for watering grass for livestock but, they had differences in opinion with reference to usage for fruit tree nurseries. The coefficients show that females had positive perception on the usability of runoff water for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock.

Table 3: Runoff water management indicators

Water uses	Effectiveness of runoff water			Affordability of Runoff water			Usability of Runoff water			Adequacy of Runoff water			Challenges of using runoff water		
	F	M	O	F	M	O	F	M	O	F	M	O	F	M	O
Usage for watering cash crops (tea)	1.68	1.59	1.67	2.61	2.5	2.55	2.62	2.54	2.57	2.35	2.26	2.30	2.02	1.98	1.99
	Coef. = 93.79 P-value = 0.071		Coef. = 69.27 P-value = 0.68	Coef. = 127.54 P-value = 0.32		Coef. = 69.42 P-value = 0.069	Coef. = 102.21 P-value = 0.361		Coef. = 89.32 P-value = 0.053	Coef. = 122.89 P-value = 0.109		Coef. = 296.32 P-value = 0.022	Coef. = 191.17 P-value = 0.062		Coef. = 89.32 P-value = 0.023
Usage for fruit tree nurseries	1.77	1.74	1.75	2.69	2.66	2.67	2.81	2.76	2.78	2.46	2.41	2.43	2.03	2.01	2.02
	Coef. = 48.51 P-value = 0.190		Coef. = 37.78 P-value = 0.087	Coef. = 131.23 P-value = 0.051		Coef. = 127.53 P-value = 0.037	Coef. = 79.40 P-value = 0.030		Coef. = 75.68 P-value = 0.008	Coef. = 151.73 P-value = 0.610		Coef. = 244.55 P-value = 0.078	Coef. = 96.86 P-value = 0.335		Coef. = 100.80 P-value = 0.081
Usage for watering fruit trees (to sell fruits)	2.10	2.09	2.10	3.23	3.27	3.25	3.11	3.29	3.29	2.91	2.91	2.91	2.22	2.26	2.24
	Coef. = 69.46 P-value = 0.084		Coef. = 97.54 P-value = 0.260	Coef. = 224.29 P-value = 0.093		Coef. = 91.89 P-value = 0.530	Coef. = 194.44 P-value = 0.074		Coef. = 111.89 P-value = 0.103	Coef. = 308.33 P-value = 0.47		Coef. = 295.09 P-value = 0.350	Coef. = 253.84 P-value = 0.050		Coef. = 219.96 P-value = 0.073
Usage for watering grass for livestock	2.19	2.14	2.16	3.33	3.22	3.26	3.38	3.31	3.33	2.99	2.91	2.94	2.24	2.21	2.22
	Coef. = 32.95 P-value = 0.051		Coef. = 30.92 P-value = 0.044	Coef. = 227.37 P-value = 0.089		Coef. = 130.92 P-value = 0.042	Coef. = 133.99 P-value = 0.244		Coef. = 120.02 P-value = 0.014	Coef. = 314.86 P-value = 0.010		Coef. = 303.92 P-value = 0.000	Coef. = 292.81 P-value = 0.204		Coef. = 199.30 P-value = 0.532
Key	1.001.00-1.66:-.1.66: Never			1.00-1.79: Very small extent			1.00-1.79: Very small extent			1.00-1.79: Very small extent			1.00-1.79: Very small extent		
				1.80-2.59: Small extent			1.80-2.59: Small extent			1.80-2.59: Small extent			1.80-2.59: Small extent		
	1.67-2.33: Sometimes			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate		
				3.40-4.19: Great extent			3.40-4.19: Great extent			3.40-4.19: Great extent			3.40-4.19: Great extent		
	2.34-3.00: Always			4.20-5.00: Very great extent			4.20-5.00: Very great extent			4.20-5.00: Very great extent			4.20-5.00: Very great extent		
	F = Female			M = Male			O = Overall								

The indicators for the gender perceptions on the usability of runoff water for usage for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock within their households were also shown.

The mean scores show that one half of the female and male respondents stated that the adequacy of using runoff water for watering cash crops (tea), fruit tree nurseries, watering fruit trees (to sell fruits) and usage for watering grass for livestock is moderate. The other half stated that the adequacy is low.

The results are only significant in relation to usage for watering grass for livestock. This means that both female and male respondents had similar opinions of their perceptions on the adequacy of runoff water for watering cash crops (tea), and usage for fruit tree nurseries usage for watering fruit trees (to sell fruits), and different opinion with regard to usage for watering grass for livestock. In addition, the coefficients indicate that there was positive that there is perception on the adequacy of using runoff water for for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock. This explains why the majority of both female and male respondents stated that they did not use runoff water for watering cash crops, fruit tree nurseries and watering grass for livestock as shown on the runoff water management table in the appendix. Only a small percentage of the female and male respondents stated that they use runoff water for watering fruit trees within their household.

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Results showed indicators for the gender perceptions on the usability of runoff water for usage for watering cash crops (tea), usage for fruit tree nurseries, usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock within their households. The mean scores show that on average both the female and male respondents stated that the challenges of using runoff water for watering cash crops (tea), fruit tree nurseries, watering fruit trees (to sell fruits) and usage for watering grass for livestock are in a small extent. This is due to that fact that the majority of the respondents do not use runoff water within their practice, hence they do no relate to the challenges of using runoff water for household wellbeing.

The p-values in all cases are greater than 0.05 indicating the chi-squares are insignificant. This imply that there are no differences in opinion with regard to female and male perceptions on the challenges of runoff water for for watering cash crops (tea), usage for fruit tree nurseries usage for watering fruit trees (to sell fruits) and usage for watering grass for livestock. Nevertheless, the female perceptions are positive given, the positive coefficients.

Descriptive statistics and chi-square for soil water management

Descriptive results for soil water management are presented in Table 4. This showed soil water management indicators for the gender perceptions on the effectiveness of soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover for household wellbeing. The mean scores show that on average the female and male respondents stated that soil water management is always effective except for the usage to increase cash crop (tea) production, and usage to reduce soil erosion where they indicate that soil water management was sometimes effective. This means that the respondents always experience the benefits of using soil water management which helps them to be able to get better yields on their tea production and fruit trees.

The results were significant except in the case of usage to improve vegetation cover where the p-value is greater than 0.05 (0.051). This imply that female respondents had a positive perception on the effectiveness of practicing soil water management for increased cash crop (tea), increased fruit tree production, and reduced soil erosion. In addition, the results indicate that there were no differences in opinion between female and males regarding the perceptionon the effectiveness of practicing soil water managementto improve vegetation cover. Since, women are usually the ones who do farm work in their households, they are the ones who will easily see the benefits of the soil water management practices.

The mean scores showed that half of the female and male respondents stated that the applicability of soil water management is low. The other half stated that the applicability is moderate. Applicability of soil water management means that the respondents are able to apply the different soil water management practices on their farms and get better yields as a result of that. Nevertheless, the mean scores for male respondents are relatively higher.

With regard to significance of the results, all the p-values are less than 0.05. This imply that female respondents had a positive perception on the applicability of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover. Thus, there is a general positive perception on the applicability of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover.

Table 4 showed indicators for the gender perceptions on the relevance of soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover for household wellbeing. The mean scores show that on average the female and male respondents stated that the relevance of soil water management is moderate.

This moderate relevance is due to the fact that most of the household farms in Ndakaini are tea plantations, where less soil water management is practiced. There are a few farmers who grow other crops such as maize and practice soil water management on their farms.

The significance of the p-values is an indication that the female respondents had a positive perception on the relevance of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover. Thus, there is a general positive perception on the relevance of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover.

Table 4: Soil water management indicators

Water uses	Effectiveness of soil water mgt			Applicability of soil water mgt			Relevance of soil water mgt			Reliability of soil water mgt			Challenges of using soil water mgt		
	F	M	O	F	M	O	F	M	O	F	M	O	F	M	O
Usage to increase cash crop (tea) production	2.30	2.38	2.35	3.34	3.46	3.41	2.82	2.67	2.73	3.19	3.13	3.16	2.33	2.31	2.31
	Coef. = 134.03 P-value = 0.015		Coef. = 83.85 P-value = 0.013	Coef. = 382.69 P-value = 0.000		Coef. = 354.32 P-value = 0.023	Coef. = 335.77 P-value = 0.002		Coef. = 298.32 P-value = 0.030	Coef. = 347.05 P-value = 0.000		Coef. = 201.32 P-value = 0.023	Coef. = 361.91 P-value = 0.038		Coef. = 289.02 P-value = 0.023
Usage to increase fruit tree production	2.34	2.42	2.39	3.26	3.39	3.33	2.73	2.64	2.68	3.11	3.11	3.11	2.33	2.27	2.29
	Coef. = 115.75 P-value = 0.010		Coef. = 145.16 P-value = 0.007	Coef. = 357.05 P-value = 0.030		Coef. = 105.18 P-value = 0.008	Coef. = 335.19 P-value = 0.030		Coef. = 225.18 P-value = 0.006	Coef. = 222.58 P-value = 0.031		Coef. = 115.14 P-value = 0.000	Coef. = 352.07 P-value = 0.073		Coef. = 300.85 P-value = 0.091
Usage to reduce soil erosion	2.33	2.4	2.37	3.40	3.46	3.44	2.79	2.68	2.73	3.17	3.19	3.18	2.38	2.31	2.34
	Coef. = 134.33 P-value = 0.023		Coef. = 121.99 P-value = 0.041	Coef. = 363.56 P-value = 0.035		Coef. = 291.89 P-value = 0.230	Coef. = 353.18 P-value = 0.021		Coef. = 291.89 P-value = 0.040	Coef. = 373.53 P-value = 0.010		Coef. = 191.42 P-value = 0.300	Coef. = 363.51 P-value = 0.023		Coef. = 322.89 P-value = 0.350
Usage to improve vegetation cover	2.38	2.45	2.42	3.34	3.41	3.38	2.81	2.69	2.74	3.13	3.19	3.16	2.41	2.29	2.34
	Coef. = 119.73 P-value = 0.051		Coef. = 91.27 P-value = 0.200	Coef. 364.87 P-value = 0.005		Coef. = 330.92 P-value = 0.007	Coef. = 361.67 P-value = 0.050		Coef. = 333.92 P-value = 0.024	Coef. = 250.77 P-value = 0.011		Coef. = 130.92 P-value = 0.009	Coef. = 560.48 P-value = 0.083		Coef. = 303.92 P-value = 0.054
Key	1.00-.1.66: Never			1.00-1.79: Very small extent			1.00-1.79: Very small extent			1.00-1.79: Very small extent			1.00-1.79: Very small extent		
				1.80-2.59: Small extent			1.80-2.59: Small extent			1.80-2.59: Small extent			1.80-2.59: Small extent		
	1.67-2.33: Sometimes			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate			2.60-3.39: Moderate		
	2.34-3.00: Always			3.40-4.19: Great extent			3.40-4.19: Great extent			3.40-4.19: Great extent			3.40-4.19: Great extent		
				4.20-5.00: Very great extent			4.20-5.00: Very great extent			4.20-5.00: Very great extent			4.20-5.00: Very great extent		
	F = Female			M = Male			O = Overall								

Source: Author, 2021

The mean scores showed that on average the female and male respondents stated that the reliability of soil water management is moderate. The reason for this moderate score is due to the fact that some respondents do no practice it while some do. Those who practice it do not only rely on it since they use other inputs to increase production in their farms.

The significance of the p-values is an indication that the female respondents had a positive perception on the reliability of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover. Therefore, the results imply existence of positive perception on the reliability of practicing soil water management for increased cash crop (tea), increased fruit tree production, reduced soil erosion and improved vegetation cover. Meinzen and Zwarteveen (1998) acknowledged that women are knowledgeable on the availability, quality, reliability, and purity of water sources across the contexts of household and community.

The mean scores showed that on average the female and male respondents stated that the challenges of soil water management are in a small extent. This is because for them to realize the benefits of soil water management in their farms they depend on themselves and the amount of work they put in.

The results are significant with respect to the challenges of practicing soil water management for increased cash crop (tea), and reduce soil cover. This means that female respondents had a positive perception on the challenges of practicing soil water management for increased cash crop (tea) and reduced soil erosion. On the other hand, the findings with reference to the challenges of practicing soil water management for increased fruit tree production, and improved vegetation cover are insignificant implying that both female and male had no differences in opinion with regard to challenges of practicing soil water management for increased fruit tree production, and improved vegetation cover. The female respondents indicated that there is a positive perception on the challenges for using soil water management because according to Meinzen and Zwarteveen (1998) women face greater obstacles than men in accessing water in large scale for irrigation purposes or for livestock breeding.

Discussions of Overall results

The findings indicated that rainwater for household use influences income generation, food and good housing negatively. This is shown by negative coefficients (-0.141, -0.256 and -0.106 respectively). These results are not significant for good housing where the p-value is (0.057>0.05). However, the results were significant for income generation where the p-value is (0.006<0.05) and food where the p-value is (0.000<0.05).

They also indicate that water for cash crops influences income generation and good housing positively, where the coefficients are (0.449, 0.030). This imply that a unit change in water for cash crops leads to 44.9% increase in income generation and 03.0% increase in good housing. Thus, water for cash crops has an effect on income generation since the smallholder farmers are able to earn an income from selling tea in their farms. Similar results have been reported in previous studies. For instance, Achterbosch et. al. (2014) states that cash crops like coffee, cacao etc. generates income and employment to the rural economy. They also state that cash crops are an essential part of sustainable intensification as income generated with cash crops provides farm households with means to save and invest in a more productive farm.

However, there is a negative influence between food and water for cash crops (-0.099). These results are not significant for food and good housing where the p-value for food is (0.154>0.05) and the p value for good housing is (0.673>0.05). The results are significant for income generation where the p value is (0.000<0.05).

Moreover, there is a negative influence between income generation; good housing and crop production (-0.066; -0.088). However, there is a positive influence between food when regressed with crop production (0.117). These results are not significant for all the independent variables where p-value for income generation is (0.274>0.05), the p value for food is (0.067>0.05) and the p value good housing is (0.180<0.05).

The negative influence between the independent variables and the dependent variables can be attested to by referring to Amartya Sen's capability approach which focuses on what people are able to do and be, as opposed to what they have, or how they feel. Sen argues that, in analysing well-being, we should shift our focus from 'the means of living', such as income, to the 'actual opportunities a person has', namely their functioning and capabilities (Sen, 2009). With regards to this research, women and men both have capabilities to sustainably manage water resources, however, if one is hindered from participating, they tend to have different perceptions on their benefits in household wellbeing.

This study sought to evaluate differences in gender perceptions on the socio-economic impacts of sustainable water management practices on household wellbeing in Ndakaini sub-watershed. The study conducted three regression models to examine this, that is, the overall, male and female models. This research question that the study sought to answer was, "is there differences in gender perceptions on socioeconomic impact of sustainable management practices on household well-being in Ndakaini sub-watershed?" This section undertakes a comparative analysis basing on regression results.

With regard to comparison of gender perception on socio-economic effects of sustainable water management practices on household wellbeing, the study reveals that female respondents have negative perception with reference to how the cost of sustaining rainwater for household use affects income generation, food and good housing. Similar findings were established by the overall model where negative and statistically significant relationship was observed between cost of sustaining water for household use and food preparation, income generation and good housing. Though the perception of male respondents is negative with respect to food preparation and income generation, the coefficients ae not statistically significant. These findings can be attributed to the fact that male respondents are necessarily not involved in using water for household chores but females do.

Concerning adequacy of runoff water for cash crops, both male and female respondents have positive and statistically significant perception towards income generation. This imply that both male and female are engaged in cash crop farming in Ndakaini. Nevertheless, the perception of both gender on food is negative and not statistically significant. In addition, there is also negative perception for female regarding good housing and positive perception for males. However, the results for female respondents are not statistically significant. These could be attributed to the fact that males and not females are concerned with securing good housing for the family in this community. With regard to the overall results, similar results are reported in reference to income generation but with respect to food preparation, a negative and statistically coefficient was obtained. The coefficient for good housing was not statistically significant like the coefficients for gender.

With reference to the adequacy of runoff water for watering fruit trees and livestock feed, the study has found negative perceptions for both gender in connection to good house housing and income generation. The results for both income generation and food are not statistically significant for both male and female respondents. The coefficient for food in positive and not statistically significant for both male and female. Nevertheless, the overall model reports negative and statistically significant results with regard to income generation. In addition, there is a positive and statistically significant coefficient with respect to good housing.

Finally, on the effect of reliability of soil water management, the perception for both male and female are not statistically significant. This imply that reliability of soil water management has no effect on income generation, food and good housing in Ndakaini according to male and females. Nevertheless, the overall model finds the coefficient for food preparation as positive and statistically significant at 10%.

CONCLUSIONS AND RECOMMENDATIONS

The researcher made several conclusions from the summary of the findings. Firstly, the study concluded that most households practicing sustainable water management are not registered members of WRUAs. Secondly, the study concludes that education is very important the understanding of the benefits of sustainable water management and perceiving it in a positive manner.

Thirdly, the study concludes that women are the ones who mostly handle water in their households, they are able to see the change in the health of their families, they are also able to have available water supply that enables them to cook food for their families, have easy access to bathing water and for many other uses that are vital in the wellbeing of their families.

Fourthly, the study concluded that women in many households are mostly the ones who take care of vegetable gardens where they plant vegetables that are consumed within the household. With the availability and affordability of sustaining rainwater, it makes it easy for them to maintain their vegetable gardens and therefore have food for their families, drinking water and for other activities such as chicken keeping which also enables their food security.

Fifthly, the study concluded that both male and female respondents in Ndakaini agreed that income generation in their households is mostly from the runoff water they use to water fruit trees and livestock feed. Sixth, the study concludes that male and female respondents are equally practicing soil water management and have equally seen the benefits of the practice in enhancing their food security and access to food within their households.

Seventh, the study concluded that male and female respondents have positive and statistically significant perception towards income generation and eighth, it is concluded that female respondents have negative perception with reference to how the cost of sustaining rainwater for household use affects income generation, food and good housing as opposed to male whose findings are not significant.

The study made the following recommendations:

- From the finding that most households practicing sustainable water management are not registered members of WRUAs, the study suggests that all households practicing sustainable water management be registered under WRUA. This could help them to have an understanding on the importance of water management.
- From the finding that education is very important the understanding of the benefits of sustainable water management and perceiving it in a positive manner, this study recommends that WRUA should educate and sensitize members on the benefits of sustainable water management.
- From the conclusion that both male and female respondents in Ndakaini agreed that income generation in their households is mostly from the runoff water they use to water fruit trees and livestock feed, the study recommends that the authorities should develop household's capacity for sustainable water management as this has the ability of improving the well-being of the locals through high incomes.
- Women should be allowed to participate and voice their opinions on the most effective ways of practicing sustainable water management this is because women have knowledge and needs that are crucial for water management.
- There should be more effective WRUAs in the study area that will help in monitoring and mentoring the respondents on the importance of sustainable water management practices.

- The study recommends to the government to play a role in ensuring that there are effective gender policies that are coherent to development and the sustainable use of water resources.

Recommendations for Further Studies

The study recommended that separate studies on the perceptions of the two different genders on sustainable water management practices for household wellbeing should be carried out to fully understand each gender's perceptions. Also, a study on the role of gender perceptions on adopting sustainable water management practices for household wellbeing should be carried out. Moreover, there is a need of carrying out other studies that will look at ways in which governments can embrace gender in the effective management of water resources.

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