

**STRATEGIES FOR MANAGING VULNERABILITY OF WOMEN VEGETABLE FARMERS IN THE  
CENTRAL REGION OF GHANA**

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**ABSTRACT**

Subsistence vegetable farming is a way of survival for most women in the rural areas of Ghana. To make this survival a reality, they need to manage their external environment in order to secure their livelihoods. The paper reports on the strategies for the management of vulnerabilities of women vegetable farmers in the Central Region of Ghana. Understanding the strategies for managing vulnerability will provide accurate decision, capacity building and adaptive strategies in tackling the problems as well as provide practical, scientific, and socio-economic actions to mitigate vulnerability of the farmers and ensure agricultural production on a sustainable basis.

**Keywords:** Women, Vegetables, Vulnerability, Strategies, Sustainability, Ghana

## **INTRODUCTION**

Throughout the world, women represent a substantial, underutilized force for sustainable development producing 70% of subsistence crops and playing major roles in both production and distribution (85%) more than their male counterparts (Ministry of Food and Agriculture [MOFA], 2002). Unfortunately, many of these women lack access to necessary agricultural resources, which, if freely accessible, could decrease global hunger by 12-17% and increase sustainability (Singh, Sharma and Sharma, 2013). The issue of vulnerability of rural women vegetable farmers is vital because rural subsistence women vegetable farmers are affected differently from their counterparts in the city and men in their communities. Researchers like Hasnain (2012) and Bassey (2002) have conducted research on vulnerability of rural women to environmental issues; and women and food security respectively. Less attention however, has been paid to how vulnerable women vegetable farmers are during the production process in spite of the role played by them. When they are vulnerable it affects their livelihoods and hence its sustainability. This work looked at the vulnerability of women vegetable farmers and the strategies employed in the face of vulnerabilities in the Central Region of Ghana. Understanding the strategies for managing vulnerability of women vegetable farmers would provide accurate decision, capacity building and adaptive strategies in tackling the problems as it will provide practical, scientific, and socio-economic actions to mitigate the vulnerability of the women vegetable farmers and ensure sustainability in the agricultural sector in general and the vegetable industry specifically.

Specifically, the study sought to:

- Determine the vulnerability of the women vegetable farmers in the Central Region.
- Determine the strategies adopted to sustainably manage their livelihoods in the face of their vulnerability.
- Determine the relationship between the level of vulnerability and strategies of vulnerability of the women vegetable farmers.
- Determine factors that best predict livelihood in terms of vulnerability and strategies of vulnerability.

## **REVIEW OF SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY, VULNERABILITY AND STRATEGIES OF VULNERABILITY**

Literature was reviewed on sustainability, vulnerabilities and strategies of vulnerability.

### **Sustainable Development and Sustainability**

Sustainable development is often considered a pathway to sustainability and sustainability is closely related to resilience and vulnerability (Kates, 2001). Sustainable development is not possible without addressing vulnerability to hazards and is often defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 2003). Sustainability is on the other hand is maintaining well-being over a long, indefinite period of time (Kuhlman and Farrington, 2010). According to Pearce, Markandya

and Barbier (1989) there are two forms of sustainability. This they classifies into weak and strong sustainability. Weak sustainability is when the next generation inherit a stock of capital, comprising man-made assets and environmental assets, no less than the stock inherited by the previous generation while in strong sustainability the next generation inherit a stock of environmental assets no less than the stock inherited by the previous generation. Agriculture that fails to protect and improve rural livelihoods and social well-being is unsustainable. In ensuring agricultural sustainability, there is the need to strengthen the role of farmers in agricultural production systems and a farmer-centred approach is the key to making this a reality (Benidickson, Boer, Benjamin & Morrow, 2011). Policy makers must however be careful that development efforts do not increase vulnerability but instead consciously reduce it.

### **Vulnerability context**

Vulnerability refers to the external environment where people normally pursue their livelihoods and their exposure (risk) to the negative effects of the external environment, as well as their resilience in resisting and recovering from external shocks, trends and seasonality (Baumann, 2002). It can also be said to be uncertainty or insecurity in an individual, household or community's well-being when there are changes in the external environment (Serrat, 2008). The vulnerability context usually refers to seasonalities, shocks and trends (Department for International Development [DFID], 2000).

Seasonalities: this is usually determined or happens at certain periods of the year. Seasonality comprises of seasonal shift in prices, production, employment opportunities, production, health and workload of farmers among other things (Twigg, 2001).

Shocks: these are generally unexpected, intense and distressing events that have sudden significant impact which are usually negative on people's livelihoods. The indicators of shock include human health shocks, natural shocks (drought, floods), economic shocks (such as the rapid increase in exchange rates), conflicts and crops/livestock health shocks (DFID, 2001).

Trends: they are the general propensity, movement or direction in which certain events occur which affects people's livelihoods. They are long-term and usually large scale. Indicators of trends consist of population, resource, governance and technological change (Twigg, 2001).

### **Vulnerability of farmers**

Vulnerability usually affects farmers productivity and hence their livelihood outcomes. Also, vulnerability and production are usually negatively correlated. Abdullahi, Iheanacho and Ibrahim (2006) and Ezekiel, Olarinde, Ojedokun, Adeleke, Ogunniyi (2012) are of the view that there exist an inverse relationship between drought and

production. Also, people's livelihood outcomes are constrained by the vulnerability context which is often managed by strategies that these people employ (Serrat, 2005).

In Ghana, households that pursue agriculture-based livelihoods are not only vulnerable to climatic shocks (droughts, floods, bushfires), but are also vulnerable to market volatility (food price seasonality, rising input prices), and health risks (disease, malnutrition) (Devereux, 2009). In the northern regions of Ghana, farmers are particularly vulnerable to bushfires, droughts, floods, market volatility, increasing price of agricultural inputs, and human risks such as susceptibility to disease and malnutrition with more than one of these calamities occurring in one year (National Development Planning Commission (NDPC), 2004). Dinye and Ayitio (2013) observed that farmers were particularly vulnerable to inadequate funds which affected their production. Also in Ghana, it has been noted that vegetable farmers are more vulnerable to pests and their farms have to be frequently sprayed with pesticides which are not always affordable to farmers (Aberra & King, 2005).

### **Strategies for managing livelihoods**

Livelihood strategies are usually the combination of capabilities, assets (including both material and social resources) and activities that people choose to undertake in order to achieve their livelihood goals. Rennie and Singh (1996) are of the view that strategies usually consist of adaptive and coping strategies. Adaptive strategies usually occur where a household consciously adopts a process of change in response to long term trends. Coping strategies

According to a study by Ajetomobi, Ajiboye and Hassan (2010) in Nigeria, during period of vulnerability of drought, farmers used irrigation that increased the production of rice and subsequently increased their net revenue. Similarly, Oruonye (2011) in Nigeria found that irrigation improved the livelihood of farmers in the Taraba state. It has also been revealed that to control bush fires, farmers constructed channels on their farms which served as fire belts during fire outbreaks (Codjoe, Atidoh and Burkett, 2011).

## **METHODOLOGY**

The study used a descriptive correlational survey design and three (3) districts (Gomoa West, Gomoa East and Agona West) were purposely selected based on the prevalence of women vegetable farmers in these districts. Face and content - validated structured interview schedules were used for the study because farmers could neither read nor write. The interview schedules were then developed to determine the vulnerability of women vegetable farmers, strategies adopted to manage vulnerabilities, relationship between perceived level of livelihood, vulnerability and vulnerability strategies of farmers and best predictors of livelihood in terms of vulnerability and vulnerability strategies. A five-point Likert-type scale was developed to measure the vulnerability of the farmers (ranging from strongly agree to strongly disagree). Cronbach's alpha was computed to determine the instruments' reliability and the vulnerability subscale (14 items) had Cronbach's alpha co-efficients of 0.703 indicating that the instrument was reliable (Sekaran, 2005).

Stratified proportionate random sampling was used to select 221 farmers who belonged to FBOs from the three districts based on the number of women vegetable farmers in each district. Therefore, 147, 40 and 34 women farmers

where randomly selected from Gomoa West (368), Gomoa East (100) and Agona West (59) respectively. Also, data was collected through personal interviews with the women farmers. With the help of Statistical Product and Service Solutions (SPSS) version 16.0, means, standard deviations, frequencies and percentage distributions, correlations and Ordinary Least Square (OLS) using stepwise multiple regressions step of entry were computed.

## RESULTS

### Vulnerability of Women Vegetable Farmers

The vulnerability of the women vegetable farmers was assessed as seen in Table 1. The results showed that the women vegetable farmers were vulnerable to their external environment. Specifically, they were most vulnerable to increases in prices of inputs ( $\bar{x}$ = 4.2, SD= 0.7) followed by inadequacy of funds ( $\bar{x}$  = 4.0, SD= 1.0). They however were not vulnerable to social unrest ( $\bar{x}$  =1.7, SD= 0.6), theft ( $\bar{x}$  =1.8, SD= 0.6) and land disputes ( $\bar{x}$  =1.8, SD= 0.7).

**Table 1: Perceived Level of Vulnerability of Women Vegetable Farmers**

Vulnerability	N	Mean	SD
Vulnerable to increased price of inputs	221	4.2	.7
Vulnerable to inadequate funds	221	4.0	1.0
Vulnerable to unpredictable rainfall	221	3.7	1.1
Vulnerable to unfavourable prices	220	3.3	1.3
Vulnerable to price fluctuations	221	3.2	1.3
Vulnerable to pest and disease attacks	221	3.1	1.4
Vulnerable to dry spell	221	2.9	1.4
Vulnerable to floods	221	2.8	1.4
Vulnerable to bad health (illness)	221	2.3	1.1
Vulnerable to bush fires	220	2.2	1.2
Vulnerable to insufficient labour	221	1.9	.8
Vulnerable to land disputes	221	1.8	.7
Vulnerable to theft (stolen)	221	1.8	.6
Vulnerable to social unrest	221	1.7	.6
Weighted Mean ( $\bar{X}_w$ )		2.8	0.6

## **Strategies for Managing Vulnerability**

On the issue of the rising prices of farm inputs, majority of respondents (86%) bought the inputs according to their budget constraint which was effective, about 9% of the women vegetable farmers were assisted by their various farmer groups which was also very effective while just about 5% were supported by their husbands which was slightly effective.

Furthermore, majority (82%) of the women vegetable farmers who were vulnerable to inadequate funds used the little money at their disposal to cultivate their vegetables which were effective. About 8% depended on family members for assistance and this was not effective while about 5% went for loans from 'susu' operators. Also, 3% were still negotiating with NGOs to come to their aid while 2% secured loans from banks. The issue of 'susu' operators and loans from banks was however not effective since their interest rates were quite high.

Concerning unpredictable rainfall, majority of respondents (97%) did not employ any strategy while approximately 3% watered their farms from nearby rivers during that period and this was effective. On unfavourable market prices, majority (67%) did not employ any measures, 14% sent their produce to urban markets for sale which farmers said was effective. Furthermore, 10% dried, stored and sold their produce (pepper) when prices were favourable and this was effective while 9% already had customers willing to buy their produce before they harvested which was also effective.

With regards to price fluctuations, majority of respondents (68%) did nothing to offset the situation, about 27% dried, stored and sold their produce when prices had risen and this was mainly done by those cultivating pepper which was effective. Also, around 4% of respondents sold their produce in urban centres when prices were fluctuating while 1% belonged to farmer groups who dictated the prices of the vegetables and farmers testified these strategies were both effective.

For the strategies women vegetable farmers employed in the event of pest and disease attacks, about 95% respondents used pesticides to spray their farms which they testified was effective, approximately 4% did not employ any strategies while about 1% followed good agronomic practices which was effective. Out of 71 respondents who said dry spell was a major problem, about 44% used pumping machines to irrigate their farms during dry spell which was effective, 29% fetched water manually to water their farms and this was also effective while 27% did not employ any measure. This could be due to the fact that their farms were very far from the source of water and pumping machines or manual fetching of water was not feasible. It could also be due to the fact that farmers could not afford to buy or hire pumping machines.

On the issue of floods, about 90% of the women farmers employed no measure while 10% created gutters/channels on their farms to allow the flow of excess water and this farmers confirmed was effective. It was realized from the results that of the 45 women vegetable farmers who responded 'yes' to bush fires, 82% did not employ any measure

while 18% made farm belts around their farms to offset the situation and this respondents claimed was effective in preventing bush fires.

A total of 40 women vegetable farmers responded 'yes' to bad health, about 81% of them visited the hospital whenever they were ill which was effective, 8% self-medicated themselves which they claimed was effective and approximately 11% did not employ any measure. On the issue of theft, majority (75%) did nothing to counteract the situation while 25% had farmer groups monitoring the situation which was not effective. With regards to land disputes a minimal number of (6) respondents were vulnerable to the situation and there was no strategy employed.

There was however no strategies employed by farmers for curbing social unrest as it was not a problem in the area. In the case of insufficient labour a minimal number of respondents (17) employed various strategies with about 76% carrying out all farm activities by themselves which was not effective since their workload was too much, 18% were helped by their children which was not effective since their children only helped on weekends while 6% were helped by their husbands which was effective.

**Table 2: Strategies for Managing Vulnerabilities of Women Vegetable Farmers**

Vulnerability factor	Strategies to manage vulnerability	Percentage
Increased price of inputs	1. Buy inputs with the little money available to them	86
	2. Assisted by farmer groups	9
	3. Supported by husbands	5
Inadequate funds	1. Use only the money available to them	82
	2. Assisted by family member	8
	3. Loan from “susu operators”	5
	4. Negotiating with NGOs to come to their aid	3
	5. Secured bank loans	2
Unpredictable rainfall	1. No strategy	97
	2. Water their farms	3
Pest and disease	1. Sprayed with pesticides	95
	2. No strategies	4
	3. Followed good agronomic practices	1
Unfavourable market prices	1. No strategy	67
	2. Sent produce to urban markets	14
	3. Dried, stored and sold when prices were favourable	10
	4. Had consumers ready to purchase produce before harvesting	9
Price fluctuations	1. No strategy	68
	2. Dried, stored and sold when prices were favourable	27
	3. Sold produce at urban centres	4
	4. Belonged to farmer associations that dictated prices	1
Drought	1. Used pumping machines to irrigate farms	44
	2. Watered farms manually	29
	3. No strategy	27
Floods	1. No strategy	90
	2. Created gutters/channels for the flow of excess water	10
Bushfires	1. No strategy	82
	2. Created farm belts around farms	18
Insufficient labour	1. Carried out activities by themselves	76
	2. Helped by children	18
	3. Helped by husbands	6
Bad health	1. Visited the hospital	81
	2. No measure	11
	3. Self-medication	8
Theft	1. No strategy	75
	2. Groups monitored farms	25
Land disputes	No strategy	100

Source: Field data, 2012

The result of the study is consistent with the findings of CTA (2008) Laary (2012) who revealed that majority of farmers in Ghana used agrochemicals to manage pests and diseases. It is also similar to the findings of Codjoe et al

(2011) who explained that some farmers constructed channels on their farms to prevent flooding, irrigated their farms during periods of dry spell and also created farm belts to prevent the outbreak of bushfire on their farms.

These strategies are environmentally friendly and so will promote sustainable development and hence sustainability

### Relationship between Vulnerability and Vulnerability Strategies

It was revealed from the study that there existed a significant negative relationship (at 0.05 level of significance) between vulnerability and strategies of vulnerability except for that of theft, land disputes, conflicts and insufficient labour. This could be due to the fact that only a few farmers were vulnerable to theft, land disputes, conflicts and insufficient labour and therefore, a correlation could not be computed. The correlation coefficient ranged between moderate and low.

Pearson Product correlation was used because it is the most suitable statistical method when dealing with interval relationships.

### Best Predictors of Vulnerability of Women Vegetable Farmers

Table 3 shows the regression analysis of vulnerability of women vegetable farmers. The results revealed that inadequate fund was the best predictor of vulnerability. Using the stepwise regression method, a significant model emerged ( $R^2=.297$ ,  $F_{4, 216}=24.2$ ,  $p < 0.05$ ).

Regression (OLS) was appropriate in determining the best predictors of vulnerability.

**Table 3: Stepwise Regression of Vulnerabilities of Women Vegetable Farmers**

Independent Variable	Step of entry	Beta	R <sup>2</sup>	Adjusted R <sup>2</sup>	F	Sig
Inadequate funds	1	-0.341	0.222	0.218	62.354	.000
Labour unavailability	2	-0.227	0.052	0.049	41.167	.000
Unpredictable rainfall	3	-0.309	0.022	0.019	30.398	.000
Lack of rain (Dry spell)	4	-0.178	0.014	0.011	24.241	.000

n = 220, Source: Field data, 2012. p < 0.05

$$Y = 3.960 - 0.341X_1 - 0.227X_2 - 0.309X_3 - 0.178X_4$$

## Best Predictors of Vulnerability Strategies on Perceived Level of Livelihood

A regression analysis of strategies on perceived level of livelihood is presented in table 4. The results revealed that the strategies employed in the event of dry spell were the best predictor of level of livelihood. Using the stepwise regression method, a significant model emerged ( $R^2=.255$ ;  $F_{1, 11}= 5.1$ ,  $p<0.05$ ).

**Table 4: Stepwise Regression of Strategies of Women Vegetable Farmers**

Independent Variable	Step of entry	Beta	R <sup>2</sup>	Adjusted R <sup>2</sup>	F	Sig
Strategies of dry spell	1	0.563	0.317	0.255	5.110	.045

n = 221, Source: Field data, 2012. p < 0.05

$$Y = 2.370 + 0.563X$$

## DISCUSSION

The findings suggest that the vegetable farmers were generally vulnerable to their external environment. They were more vulnerable to increased price of inputs, inadequate funds and unpredictable rainfall. Their inadequate funds could, however, be due to inability to assess money from institutions which subsequently translated into their inability to cope with the increase in the price of inputs. The study supports the view that farmers in Ghana are vulnerable to rising price of inputs, market volatility (food price seasonality, rising input prices), climate change, the result of which is decreased severe drought and floods, high disease risk (Devereux, 2009; Domfeh, 2009; Quandzie, 2011). This has repercussions for sustainable development because literature has stated that when farmers are unable to access agricultural resources the attainment of sustainable development and hence sustainability becomes a mirage. Invariably, farmers will not be able to purchase agricultural inputs for production which will affect agricultural production on a sustainable basis and hence sustainability of their livelihoods.

The negative relationship between vulnerability and strategies of vulnerability implies that the more strategies employed by the farmers, the lesser their vulnerability and vice versa. This is similar to the study by the Overseas Development Institute [ODI] (2009) who asserted that strategies are usually adopted to cope with vulnerabilities which impacts positively on livelihood outcomes.

The results of the relationship between vulnerability and vulnerability strategies signify that for every increase in inadequate funds, a 0.341 decrease in the perceived level of livelihood is expected and for every increase in labour unavailability, a 0.227 decrease in the perceived level of livelihood is expected. Also, for every increase in

unpredictable rainfall, it is expected that the perceived level of livelihood will decrease by 0.309. Finally, for every increase in dry spell, we expect a 0.178 decrease in the perceived level of livelihood. The  $R^2$  gives explanation that inadequate funds, insufficient labour, unpredictable rainfall and lack of rain (dry spell) accounted for 29.7% of the perceived level of livelihood of the women vegetable farmers. The results of the study is comparable to that of Dinye and Ayitio (2013) who observed that farmers were particularly vulnerable to inadequate funds which affected their production. It is also similar to the studies of Abdullahi, Iheanacho and Ibrahim (2006) and Ezekiel, Olarinde, Ojedokun, Adeleke, Ogunniyi (2012) in Nigeria who stated that there exist an inverse relationship between dry spell and production.

The results of vulnerability strategies and level of livelihood signify that for every increase in strategies to dry spell, a 0.563 increase in the perceived level of livelihood is expected. This could be attributed to the fact that most of the women used pumping machines to irrigate their farms while a few irrigated their farms by fetching water into buckets when there was dry spell. The  $R^2$  gives explanation that strategies to dry spell accounted for 25.5% of the perceived level of livelihood of the women vegetable farmers. The study is comparable to that of Ajetomobi, Abiodun and Hassan (2010) in Nigeria which revealed that, irrigation increases the production of rice and subsequently increases the net revenue of farmers. It is also similar to the findings of Oruonye (2011) in Nigeria who revealed that irrigation improved the livelihood of farmers in the Taraba state.

These strategies however cannot ensure the sustainability of the vegetable industry. Therefore, there is the need for stakeholders to formulate appropriate policies, strategies, and priorities in research and development with careful attention to gender.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

In this study it was realized that women vegetable farmers were generally vulnerable to their external environment. They were highly vulnerable to high price of inputs, inadequate funds and unpredictable rainfall. The majority of respondents who were vulnerable to high price of inputs, price fluctuations, unpredictable rainfall and floods did not employ any strategies. For farmers vulnerable to pest and disease, most of them sprayed their farms with pesticides. While a great number of those vulnerable to dry spell used water pumps to irrigate their farms. Furthermore, those vulnerable to bad health visited the hospital to seek medical assistance. Generally, there existed a significant negative relationship between vulnerability and strategies of vulnerability. This implies that the more strategies respondents employ the lesser their vulnerability and vice versa. A significant positive relationship between strategies of vulnerability and perceived level of livelihood of respondents. It means that the more strategies respondents utilize in cases of vulnerability, the higher their level of livelihoods and vice versa. A regression of perceived level of livelihood showed that inadequate funds, area of land under cultivation, labour unavailability, and unpredictable rainfall, strategies of dry spell, bushfires and number of times vegetables are grown within a year were the best predictors of perceived level of livelihood. The  $R^2$  revealed that the above variables accounted for 46.8% of the level of livelihood of the women vegetable farmers.

These strategies are not sustainable in the long run. Sustainable development can be achieved only where appropriate policies, strategies, and priorities in research and development are carefully chosen and adhered to with the continuous commitment and allocation of resources and the creation of an enabling environment by governments with sensitivity to gender.

## **Recommendations**

MoFA and the Irrigation Development Authority should invest in sustainable agricultural practices with emphasis on the provision of irrigation facilities because of the unpredictable nature of rainfall. Fertilizer importers such as Wienco, Dizengoff and other private companies should subsidize the cost of fertilizer to vegetable farmers because of the high prices of fertilizer which farmers are not able to afford. MoFA and research institutions such as the CSIR should come up with improved strategies to offset the vulnerabilities of floods, bushfires and unfavourable market prices in the vegetable industry.

The following suggestions are made for further research to improve the knowledge base provided by this study.

- Studies on the factors influencing the sustainable livelihoods of women should be conducted on other commodities in the farming industry.
- Similar studies should be carried out in the other regions of Ghana.

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## **REFERENCES**

- Abdullahi, A.B., Iheanacho, A.C. & Ibrahim, A. (2006). Econometric analysis of the relationship between drought and millet production in the arid zone of Nigeria: a case study of Borno and Yobe States. *Journal of Agriculture & Social Sciences*, 2 (3), 1813–2235.
- Ajetomobi, O.J., Ajiboye, A. & Hassan, R. (2010, September). *Economic impact of climate change on irrigated rice agriculture in Nigeria*. Contributed Paper presented at the Joint African Association of Agricultural Economists (AAAE) and 48<sup>th</sup> Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa.
- Asian Development Bank (2005). *The livelihoods framework*. Washington, DC: Serrat, O.
- Asian Development Bank (2008) *The Sustainable Livelihoods Approach*. Manila: Serrat, O.
- Bassey, C. (2002). Women and food security: a study of vegetable farming in Calabar metropolis. Master thesis. Unpublished
- Baumann, P. (2002). *Improving access to natural resources for the rural poor. A critical analysis of central concepts and emerging trends from a sustainable livelihoods perspective*. LSP Working Paper 1, FAO.

- Benidickson, J., Boer, B., Benjamin A. H. & Morrow, K. (2011). *Environmental law and sustainability after Rio*. Northampton: Edward Elgar Publishing, Inc.
- Codjoe, S. N. A., Atidoh, L. K. & Burkett, V. (2011). *Gender and occupational perspectives on adaptation to climate extremes in the Afram Plains of Ghana*. Springer Science+Business Media B.V.
- Devereux, S. (2009). *Agriculture and social protection in Ghana: A 'LEAP' in the dark?* Future Agricultures Consortium.
- DFID (2000). *Sustainable livelihoods guidance sheets*. London: Department for International Development.
- Dinye, R. D & Joseph Ayitio, J. (2013). Irrigated agricultural production and poverty reduction in Northern Ghana: A case study of the Tono Irrigation Scheme in the Kassena Nankana District. *International Journal of Water Resources and Environmental Engineering*, 5(2), 119-133.
- Ezekiel, A. A., Olarinde, L. O., Ojedokun, I. K., Adeleke, O. A., Ogunniyi, L. T. (2012). Effect of irrigation and drought on agricultural productivity in Kwara state, Nigeria. *Advances in Agriculture & Botany*, 4(1), 6-9.
- Kates R. W. (2001). Sustainability Science. *Science* 292, 641 – 642.
- Kuhlman, T. and Farrington, J. (2010). What is Sustainability? *Sustainability*, 2, 3436-3448.
- Laary, J.K. (2012). Dry-Season Farming and Agrochemical Misuse in Upper East Region of Ghana: Implication and Way Forward. *Journal of agricultural, Food and Environmental Sciences*, 5 (1). Retrieved 20 December, 2012 from <http://www.scientificjournals.org/journals2012/articles/1522.pdf>
- Overseas Development Institute (2009). *Getting it right: understanding livelihoods to reduce the vulnerability of pastoral communities*. United Kingdom: Overseas Development Institute.
- Oruonye, E. D. (2011). An assessment of fadama dry season farming through small scale irrigation system in Jalingo LGA, Taraba State. *International Research Journal of Agricultural Science and Soil Science*, 1(1), 014-019.
- Pearce, D.W.; Markandya, A.; Barbier, E.P. *Blueprint for a Green Economy*; Earthscan Publications: London, UK, 1989. 33.
- Rennie, J.K. & Singh, N. (1996). *Participatory research for sustainable livelihoods*. Winnipeg: International Institute for Sustainable Development.
- Singh, G., Sharma, R., & Sharma, R. (2013). Role of women in sustainable economic development. *Indian Journal of Research*, 3(5), 21-23.
- Soussan, J., Blaikie, P., Springate-Baginski, O. & Chadwick, M. (2001). *Understanding livelihood processes and dynamics*. Livelihood-policy relationship in South Asia Working Paper 7. London: DFID.
- Twigg, J. (2001). *Sustainable livelihoods and vulnerability to disasters*. London: Benfield Greig Hazard Research Centre.
- United Nations (2003, January). *Disaster reduction and sustainable development Paper developed in a participatory manner as a contribution to the process leading to the World Summit on Sustainable Development Johannesburg*.

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