Journal of Poverty, Investment and Development
ISSN 2422-846X An International Peer-reviewed Journal
Vol.24, 2016

Poverty Alleviation through Integrated Pond Fish Farming with Poultry and Vegetables Production at Small Scale Farmers' in Dilla Zuria Woreda, Southern Ethiopia

Mohammed Ibrahim Garade[1*] (Principal investigator) Tadesse Megersa (Co- investigator)[2]
Haile Ketema (Co- investigator)[3]
1.Basic Science Department, Wolaita Sodo ATVET College, PO box 120, Wolaita Sodo, Ethiopia
2.Natural Resource Department, Dilla University, Dilla, Ethiopia
3.Animal Science Department, Wolaita Sodo ATVET College, Wolaita Sodo, Ethiopia

Abbreviations

AFD	Action for Development
ATVETC	Agricultural Technical Vocational Educational Training
ATVETC	Agricultural Technical Vocational Educational Training College
CSA	Central Statistics Agency
CSO	Civil Society Organizations
DA	Developmental Agents
EIGS	Ethiopia Institute of Geological Surveys
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
IFAD	International Fund for Agricultural Development
NGO	Non- Governmental Organization
NPK	Nitrogen phosphorus and Potassium
NPV	Net Present Value
PRA	Participatory Rural Appraisal
SNNPRS	South Nation's Nationality People's Regional State
SPSS	Statistical Package of Social Science
WFP	World Food Program

Abstract
This study was conducted on the title " Poverty Alleviation through Integrated Pond Fish Farming with Poultry and Vegetable Production on Small Scale Farmers' in Dilla Zuria Woreda, Southern Ethiopia" aiming to demonstrate and assess the possibility of reducing poverty at small scale farmers' level through integrated pond fish farming with poultry and vegetable production, to see the profitability of integrated pond fish farming with poultry and vegetable production in comparing to mono farming at small scale farmers' level and to identify factors that affect farmers' to implement integrated Pond fish farming with Poultry and Vegetable production at the study area. The primary data were collected by using PRA tools and secondary data from related literatures. The data were analyzed by using both qualitative (tabulation, narration) and quantitative techniques (percentage, frequency and cost-benefit analysis using Net present value (NPV). The results of this study revealed that, integrated pond fish farming with poultry and vegetable production can play a significant role in increasing manifold production, income and nutrition over mono farming for poverty alleviation at small scale producers. In principal a project is accepted if the NPV is non-negative. Accordingly, the NPV of the project at 8.5% of discount rate was found to be Birr 622 per 0.0224ha of land is acceptable. The major factors that affect farmers to implement this integration at the study area were: lack of training and researches on improving farmers' indigenous knowledge on integration, and lack of improved vegetables seeds and fingerling dissemination center to the farmers in the areas. Based on the results, the following recommendation forwarded: it is imperative that policy makers and local extension planner, agricultural extension implementers and NGOs pay utmost attention to this integrated farming to reduce poverty at small scale farmers and pay attention to the constraints that affect farmers' to implement this integration. The issues that need immediate attention include, among others, delivery of training to farmers' on improving skill and knowledge on this integration, and developing fingerling dissemination center to the farmers' in the study area.
Keywords: Poverty, integrated Agriculture, Farmers

1. Introduction

1.1. Background and justification

It is increasingly recognized that poverty is a complex and multi-dimensional concept the words "poverty" and "vulnerability" are often used as alternating synonyms. However, poverty is often considered to be simply a

matter of an income to meet basic subsistence needs whereas vulnerability is not the same as income-poverty. Poverty has also been defined as low consumption, which is easier to measure. This is the normal meaning of poverty among economists and is used for measuring poverty lines, for comparing groups, and regions, and often for assessing progress in development. In addition to low incomes; it is characterized by poor health, under nutrition, low physical asset base, inadequate housing and living conditions. Poverty is often seasonal; poverty is about poor access to education, risks, uncertainty, vulnerability and crisis in coping capacities. Poverty is expressed in each of these and all of these together. However, in general poverty can't be reduced if economic growth has not occurred (Farrington J., 2001).

There are four broad avenues that can help us to think strategically about poverty. These are lack of pro-poor economic growth, lack of human development, lack of social safety net and lack of participatory governance. World aquaculture production has been increasing rapidly in recent years contributing to food supplies and now accounts for 32 percent of total fisheries production (FAO, 2005). Alongside aquaculture, agriculture products such as vegetable and fruits are also major nutrient-rich food items providing both macro and micro nutrients (i.e. protein and carbohydrate, vitamins and minerals) to the world's population. It is clear that as there is limited scope for horizontal land expansion to cope up with the future food demand, rather vertical intensification through integration of different agricultural enterprises could help to meet expected increases in production demand and quality. Reductions in poverty and malnutrition would be a major expected benefit of such integration. A recent study covering 58 developing countries concluded that a 1% increase in agricultural productivity was associated with a reduction by between 0.6 and 1.2 percent in the proportion of people living on less than $1 a day (Thirtle et al., 2002).

Agriculture is known for its multi functionalities of providing employment, livelihood, food, nutritional and ecological securities. For achieving rapid progress in rural area, Government strategy must focus on; conserving natural resources, enhancing efficient of resource use, increasing productivity and profitability and improving quality and competitiveness through reduced unit cost of production. Integrated plant nutrients and protection systems of crop, livestock and aquaculture production are being updated for various agro-ecologies. Water is emerging as international challenge and its most efficient management as well as recycling has been given high priority in the plan of formulation. Integrated fish farming can serves as a model of sustainable food production. The integration of fish and plants results in a polyculture that increases diversity and yields multiple products, Water is re-used through biological filtration and recirculation, local food production provides access to healthy foods and enhances the local economy (Othman K., 2006; Bibha kumara, not dated).

Even though, the majority of the systems used in African for aquaculture were introduced through technology development and transfer projects, the current state of most research, development and extension (R, D & E) in Africa is poor. Low levels of annual expenditure have rendered in national and regional programs more or less incapable of managing the growth of the industry. A large percentage of governmental aquaculture facilities are either abandoned or dysfunctional for various reasons (FAO, 2000).

Due to increased population growth and problems such as environmental degradation, land and water scarcity, the integration of aquaculture with agriculture has been advocated in order to increase resource use efficiency (Barg et al., 2000).

Integrated fish farming is the blending of various compatible agricultural enterprises into a functional or unified whole farming system for the purpose of sustainability. It is a no waste, low cost and low energy production system in which the by-products of one enterprise is recycled into another as input (Ayinla, O. A., 2003)

Aquaculture contributes to human food fish demands, poverty alleviation and rural development and is often mooted as the fastest growing food production sector in the world (FAO, 2010)

Small scale farmers in developing countries are often poorer than the rest of the population, often getting less food to lead healthy lives. Arresting poverty and hunger, therefore means confronting the problems that farmers face in their daily struggle for survival (EAC, 2012).

Ethiopia's economy is based on agriculture, which accounts for 46% of GDP and 85% of total employment with population below poverty line 29.2% (FY09/10 est.). The agricultural sector suffers from poor cultivation practices and frequent drought, but recent joint efforts by the Government of Ethiopia and donors have strengthened Ethiopia's agricultural resilience, contributing to a reduction in the number of Ethiopians threatened with starvation (CIA, 2013).

Ethiopia has been plagued with food insecurity, including famine, for centuries and malnutrition is widespread, particularly among children and women. The multi-sectoral nature of nutrition contributes to this state and the integration of nutrition programs with health, agriculture, education and poverty reduction programs have been challenging and. These entities are interrelated (Berti, P. R, J. Krasevec, and S. Fitz Gerald, 2004)

For Ethiopia to achieve middle-income status by 2025 and make substantial inroads against food insecurity, concerted and strategic investment and strategic choices in the agricultural sector are vital.

Concentrations of food insecurity and malnutrition are endemic in rural areas, with a population of six to seven million chronically food insecure, and up to 13 million seasonally food insecure. Over 90 percent of agricultural output is driven by smallholder farmers (Bill & Melinda Gates Foundation, 2010).

Using poverty line set for the country and the data depicted that, the majority of the respondents (53) are living below the food poverty line. Some of the respondents associated income shortage with decline of production of cash crops and price instability. Accessibility to food encompasses both economic and physical. Economic accessibility implies that financial costs associated with the acquisition of food for an adequate diet without compromising the attainment and satisfaction of other basic needs. Actually this was one of the main problems of people in the Gedeo Zone (Shumete Gizaw, 2009)

The contribution of fisheries aquaculture for food security recognized by federal, regional, local and policy makers'. Availability of favorable agro-ecology, abundant seasonal rainfall and several small water bodies create conducive environment for the sector. The abundance and fast increment of small water body due to irrigation agriculture intensification can be used for fishery and aquaculture resources (Hussein Abegaz, 2009)

By practicing the pond based farming systems programme, farmer could be able to utilize his/her resources judiciously and effectively. Regarding this view, the research work was carried out to optimize production of different components with benefits (cost and return) and to utilize family labor and create employment opportunity in a pond based integrated production system (M.Robiul alaml *al.e.a.*, 2009).

Despite, addressed in the literatures as there are huge water resources, salubrious climatic conditions, topography and varied soil conditions conducive to start integrated fish farming with others agricultural activities in Ethiopia, particularly in SNNPR to reduce poverty in rural areas, it is almost nonexistent. So, this study was conducted to fill the gap and show as integrated Pond fish farming with poultry and vegetable production on small scale farmers' level can alleviate poverty in the rural areas.

1.2. Objective of the research

1.2.1. General objective

- To develop and implement integrated pond fish farming with poultry and vegetable production at small scale farmers' level to mitigate poverty in the rural areas.

1.2.2. Specific objectives

- To demonstrate and assess the possibility of reducing poverty at small scale farmers' level through integrated pond fish farming with poultry and vegetable production.
- To see the profitability of integrated pond fish farming with poultry and vegetable production in comparing to mono farming at small scale farmers' level.
- To identify factors that affect farmers' to implement integrated Pond fish farming with Poultry and Vegetable production at the study area.

1.3. Significance of the Study

- The study gives insight for policy makers, Gedeo Zone and Dilla Zuria Woreda Agricultural Bureaus to plan and design Agricultural development projects in relation to integrated farming to efficiently use of resources and reduce poverty in the rural areas.
- The local farmers benefit from the research by adopting the integrative pond fish farming with poultry and vegetable.
- The study helps ATVET Colleges and Universities to modify their teaching methods and outreach agricultural development projects in relation to integrative farming.
- Used as document for further researchers.

2. Methodology

2.1. Location and Descriptions of Study Area

Gedeo is one Zone in the Southern Nations Nationalities and People Regional State (SNNPR) of Ethiopia. Gedeo is bordered on the East, South and West by the Oromia region, and on the north by sidama. The Zone is located in 369 km from Addis Ababa to South Addis Ababa-Moyale international road and 90 km from Hawassa (capital city of the region) in Southern Nations Nationalities and People Regional State (SNNPRS). Geographically, the Zone is located North of Equator from 50 53'N to 60 27'N Latitude and from 380 8' to 380 30' East, Longitude. The altitude ranges from 1500 to 3000m. The Zone has sub-humid tropical climate receives mean annual rainfall 1500 with range of 1200 and 1800 mm. The rainfall pattern is bimodal, with short rain season between Marchs and May accounting for 30% of total rain fall and long rain season between July and October accounting for more than 60 % of total rainfall. The mean monthly temperature is 21^{o}C with mean monthly maximum and minimum temperature of 25 ^{0}C and 18^{o}C, respectively. The Zone experiences three distinct agro ecologic Zone Namely 'Dega' (30%),'Woyina Dega' (67%) and 'Kefil-Kola' (3%). Agriculture is the base of the economy of

the zone and it provides employment for an estimated 89 percent of the population and accounts for about 65 percent of the Zone gross domestic product. Gedeo zone is one of the most densely populated regions in the country with an estimated population density of 617.53 people per square kilometer (Gedeo Zone Agricultural Bureau, 2010).

2.2. Methods of data collection

Data were collected by both primary and secondary methods. The primary data were collected by using PRA tools which include transact wake, group discussion, structured interview and method demonstration. The secondary data were collected from related research results, books, and journals.

2.2.1. Methods of data sampling techniques and sample size

To conduct this study Chichu Kebele was selected purposively because of problems related to the topic, availability of water for integration in addition to the Kebele near to the College for field demonstration and monitoring. All ADAs in the Chichu Kebele and 50% of Agricultural Woreda experts were purposively selected based on their proficiency in relation to research topic. For group discussion 10 women and 30 men HH heads were selected purposively based on their long experience in farming, hard working and technologies adoption experience through obtaining farmers background information from kebele leaders and ADAs. For interview a total of 80 household heads were selected by using PPS random sampling of MHHs and FHHs in the selected Kebele.

2.3. Criteria used to select target farmers

The criteria used for selection of target farmers were include the following:

1. Interest of farmer to adopt technology
2. Availability of water throughout the year in/around his/her farm
3. Suitability of land position for integrating of Pond fish farming with poultry and vegetable production.
4. Target Farmer should have interest to teach and transfer technology to other non-farmers after the research implemented. Based on these criteria 2 target farmers were selected. Then the selected target farmers were trained through method demonstration.

   After the target farmers were selected i.e. before beginning the construction of pond fish, the following consideration taken into account carefully. These includes:

   - How water will be brought to the pond
   - The type of soil available for building the pond (earth pond)
   - The size, shape, and depth of the pond
   - The slope of the pond bottom
   - The type of drainage system used
   - The layout of ponds used for irrigating vegetables

2.4. Data Analysis

The data were analyzed by using both qualitative (tabulation, narration) and quantitative techniques which include percentage, frequency and cost-benefit analysis using Net present value.

Cost-benefit analysts typically use one of several metrics or a combination of them to report their findings. The benefit-cost ratio, return on investment and net present value report the results of a cost-benefit analysis by comparing discounted costs with discounted benefits.

All three metrics can be used to report results for a cost-benefit analysis. Each one emphasizes a different aspect of the relationship between benefits and costs.

The BCR is commonly used to demonstrate an investment's "bang for the buck" by showing the relationship between total benefits and total costs. The BCR is thus a relative measurement of the investment's benefits and costs. The ROI is frequently used in financial settings and reports the gain from the investment. It is also a relative measurement. The NPV reports the total difference between benefits and costs in dollar terms. It is an absolute measurement of a program's net benefit or cost. Because each metric calculates benefits and costs differently, it is possible for an investment to have a higher BCR and ROI, but a lower NPV than another investment. (Sudhakar Raju, 2008)

Therefore, NPV was selected for this project analysis due to the above mentioned and the following reason. Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an investment or project adds to the capital invested. NPV is better than the other cost-benefit analysis type because of the time value of money is probably the single most important concept in financial analysis.

3. Results and Discussion

3.1. Poverty alleviation through integrated pond fish farming with poultry and vegetable production

The results of this study revealed that, integrated pond fish farming with poultry and vegetables production can play a significant role for reducing poverty through:

- creates awareness for farmers towards semi-intensive integration, improve farmers use of untapped resources and this result in reducing inputs cost,
- enable target farmers' for increasing manifold production and productivity by producing two times and above in a year from integrated production than mono farming,
- farmers can easily get balanced diet from integrated pond fish farming with poultry and vegetable production over traditional management,
- The utilization of family labor round the year in pond based integrated production system contributed to improve the production, productivity as well as create employment opportunity for income generation,
- this integrated production seen as an excellent package for sustainable production (organic farming), skill development of target farmers, empowering rural women and increase income of target farmers as input cost reduced by using waste of one as inputs for others and because of farmers produce two times and above in a year from integrated production than mono farming,

Similar studies also showed that, the benefits of integrated fish farming result in either from direct consumption of fish by the producing households or from gains in income resulting in the purchasing of other cheaper foods, which lead to improved household food consumption (Prein, M., and Ahmed, M., 2000; Ahmed, M., and Lorica, M.H., 1999).

3.2. Cost-Benefit Analysis of the Project by using Net present value

The Net Present Value (NPV) reflects the net benefits of a project in dollar terms. To calculate NPV, subtract the total discounted costs from the total discounted benefits. A positive NPV means that benefits outweigh costs and the investment should be considered. A negative NPV means that the costs outweigh the benefits. And NPV of 0 means the benefits are equal to the costs.

The following 5-step process was used in net present value analysis:

Step 1. Select the discount rate.

Step 2. Identify the costs/benefits to be considered in analysis.

Step 3. Establish the timing of the costs/benefits.

Step 4. Calculate net present value of each alternative.

Step 5. Select the offer with the best net present value

The formula used for calculating NPV is:

$$NPV = \sum_{t=0}^{n} \frac{(Benefits - Costs)_t}{(1 + r)^t}$$

where:
r = discount rate
t = year
n = analytic horizon (in years)

(Sudhakar Raju, 2008)

Table1: Cost-Benefit Analysis for integrated pond fish farming with poultry and vegetable production.

Year (EC)	Capital cost	Op. & mon. cost	Total cost	Net av.Ret without integration	Net av. Return with integration	Total net benefit	Net cash flow	Discount factor (8.5%)	Pres. val.ben	Total income
			14050.							
2002	2810	11240.8	7	-123	3,275	3,152	-10,898	0.921659	-10044.6	17,326
2003	648.9	6973.9	7622.8	-123	10,050	9,927	2,304	0.849455	1957.089	17,673
2004	668.37	7183.1	7851.5	-123	10,174	10,051	2,200	0.782908	1722.411	18,026
2005	688.42	7398.6	8087.0	-123	10,299	10,176	2,089	0.721574	1507.692	18,386
2006	709.07	7620.6	8329.6	-123	10,425	10,302	1,972	0.665045	1311.44	18,754
2007	730.34	7849.2	8579.5	-123	10,550	10,427	1,847	0.612945	1132.27	19,129
2008	752.25	8084.7	8836.9	-123	10,675	10,552	1,715	0.564926	968.8923	19,512
2009	774.82	8327.2	9102.0	-123	10,800	10,677	1,575	0.520669	820.1068	19,902
2010	798.07	8577.0	9375.1	-123	10,925	10,802	1,427	0.47988	684.799	20,300
2011	822.01	8834.3	9656.3	-123	11,050	10,927	1,271	0.442285	561.9331	20,706
NPV										622.0

Source: Own computation from data collected from 2010-2011

Note: based on the data obtained from market survey in 2002/2003 3% cost and 2% income price increment used for project analysis.

The Table:1 reveals that the cost benefits analysis of integrated Pond fish farming with poultry and vegetable versus monoculture system on vegetables in 2002-2003E.C.

Total farm area was 0.0224ha for integration i.e. for fish pond 0.0048ha Tilapia production, near the pond there was poultry house on the area of 0.0036ha with 20 hens of white leghorn breed and 0.014ha for vegetables production and also 0.0224ha for mono farming of vegetables as a control. Poultry manures were

washed into the fish pond and water outlet from the pond drained into the vegetable farm/beds.

In principal a project is accepted if the NPV is non-negative. Accordingly, the net present value of the project at 8.5% of discount rate (Commercial Bank of Ethiopian, 2011) was found to be Birr 622 per 0.0224ha of land is acceptable.

This indicate that the integration can generate profit of 29619.05Birr/ha of land. The poultry farm has a backward linkage effect on fish feed and as organic fertilizer for vegetable farming through reducing cost of inorganic fertilizer for Agricultural farming. Similarly vegetable, poultry and fish waste recycle as feed one for an others.

Similar result was found by M. Robiul alam, (et.al., 2009). In case of integrated pond management, adoption of two additional components like poultry and vegetables and improved fish management encouraged manifolds of the economic return. The gross return and gross margin from poultry and vegetables completely exhibited an additional income which remarkably contributed to increased income of the households. The gross return and gross margin obtained from fish component with improved management was Tk. 13932 and 11697, respectively, which was 229.36 and 382.75% higher over traditional fish cultivation. It was indicated that among the components in integrated pond management, poultry rearing showed the maximum economic return followed by improved fish management.

An analysis of economic returns from both integrated and non integrated tilapia farm in Tanzania revealed that an integrated farm gave higher economic returns compared to a non-integrated one (Shoko AP, et.al., 2011)

3.3. Factors that affects farmers to implement (impede adoption of) integrated Pond fish farming with Poultry and Vegetable production in the study area.

During conducting group discussion with farmers, and interviewed respondent farmers, methods demonstrating target farmers the following factors were identified as major factors that affect farmers to implement integrated pond fish farming with poultry and vegetable production in the study area. These include:

- Lack of knowledge and skill to use locally available untapped resources through semi-intensive integrated farming,
- Lack of training and researches on improving farmers' indigenous knowledge on integrated agro-farming for the use of locally available untapped resources,
- Land scarcity because most of farmers land occupied by perennial crops/Coffee, 'Enset', fruit tree,
- Familiarity of farmers with traditional farming in the areas,
- accessibility and availability problems of improved vegetables seed,
- Lack of fingerling dissemination center to the farmers in the study area,
- Lack of improved poultry breeds.

4. Conclusion and Recommendation

4.1. Conclusion

The overall results revealed that the integrated pond fish farming with poultry and vegetable was an excellent package for sustainable production, skill development, income generating, reducing poverty, increase use of untapped resource and creates awareness for farmer towards semi-intensive integration. The results of the study showed that there were different factors affecting farmers' to implement integrated pond fish farming with poultry and vegetable in the area. This includes: lack of knowledge and skill to use locally available untapped resources through semi-intensive integrated farming, lack of training and researches conducted on integration, land scarcity and traditional farming most of farmers' land occupied by perennial crops/Coffee, 'Enset', fruit trees.

4.2. Recommendation

Development program and project intervention that designed to reduce poverty at small scale farmers' level should have to give attention to the following recommendation:

- Governmental and Non- Governmental Organizations that designed projects to reduce poverty at small scale farmers' level should have to promote integrated farming in the area on how to use untapped resources and scale up integrating pond fish farming with poultry and vegetable production to boost rural development in the area.
- Any measures aimed at reducing factors that affect farmers to implement integrated pond fish farming with poultry and vegetable at small scale farmers level should have to take into account on how to improve knowledge and skill of farmers, how to reduce familiarity of farmers with traditional farming in the areas and on how to disseminate fingerling, improved vegetable seeds and poultry breeds to the farmers in the areas

5. Reference

Ahmed, M., and Lorica, M.H., (1999). Improving developing country food security through aquaculture development: socioeconomic and policy issues. Paper Presented at World Aquaculture 99, the Annual International Conference and Exposition of the World Aquaculture Society, Sydney, Australia, 26 April–2 May (No published proceedings).

Ayinla, O. A. (2003). Integrated fish farming: A veritable tool for poverty alleviation/Hunger eradication in the Niger Delta Region. In A.A Eyo and J.O Atanda (eds). Conference Proceedings of Fisheries Society of Nigeria, Owerri, Nigeria. Pp. 40-41.

Barg, U., Bartley, D., Kapetsky, J., Pedini, M., Satia, B., Wijkstrom, U. and Willmann, R. (2000) Integrated resource management for sustainable inland fish production. FAO Aquaculture Newsletter 23 , 4-8.

Berti, P. R, J. Krasevec, and S. FitzGerald. 2004. "A Review of the Effectiveness of Agriculture Interventions in Improving Nutrition Outcomes." Public Health Nutrition 7 (5): 599–609.

Bibha kumara (not dated). Integrated Fish Farming Department of zoology, A, N. College, Patna ,(Bihar), India.

Bill & Melinda Gates Foundation. (2010) Accelerating Ethiopian Agriculture Development for Growth, Food Security, and Equity.

Centro International de Agricultural Tropical 2001. CGIAR, national partners and farmers collaborate to test forages in Ethiopia.CIA World Fact book.(2013) http://www.indexmundi.com/ethiopia/economy_profile.html

EAC (East African Commission). (2012). Food safety, a critical matter for the region. 4th East African Commission development strategy (2012-2016), Deepening and accelerating integration 2012.

FAO. (2000). Africa regional aquaculture review: proceedings of a workshop held in Accra, Ghana, 22-24 September.

FAO (2005) National Aquaculture Sector Overview - Bangladesh. In: Inland Water Resources and Aquaculture Service (FIRI) , (Ed.) National Aquaculture Sector Overview Fact Sheets, Fisheries Global Information System (FIGIS), FAO, Rome)

FAO, (2010). The State of World Fisheries and Aquaculture. FAO Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations Rome.

Farrington, J. 2001. Sustainable livelihoods, rights and poverty reduction strategies. Paper for Sida Poverty Seminar, Sandhamn, 22-24 October 2001.

Hussein Abegaz, (2009). The Pilot Project on Aquaculture Development in Ethiopia: - Bridging the gap of fish seed demand through hatchery establishment and village based extension approach. Ministry of Agriculture and Rural Development, Kampala.

International Fund for Agricultural Development. 2008. Improving Crop-Livestock Productivity through EfficientNutrient Management in Mixed Farming Systems of Semi-arid West Africa.

M. Robiul alam, m. Akkas ali, m. Akhtar hossain, m. S. H. Molla4 and f. Islam(2009). Integrated approach of pond based farming systems for sustainable production and income generation. Bangladesh J. Agril. Res. 34(4): 577-584

Othman, K., 2006. Integrated farming system and multifunctionality of agriculture in Malaysia. Acta Hortic., 655: 291-296.

Prein, M., and Ahmed, M., (2000).Integration of aquaculture into smallholder farming systems for improved food security and household nutrition. Food and nutrition Bulletin, 21, pp 466-471.

Rajbanshi KG and MB Shrestha A case study on the economics of integrated farming systems: Agriculture, aquaculture and animal husbandry in Nepal. In: Integrated Agriculture Aquaculture Farming Systems, R.S.V. Pullin and Z.H. Shehadeh (eds), ICLARM Conf. Proc. 4, 1980; 195–208.

Shoko AP, Getabu A, Mwayuli G and YD Mgaya Growth Performance, Yields and Economic Benefits of Nile Tilapia *Oreochromis niloticus* and Kales *Brassica oleracea* cultured Under Vegetable-Fish Culture Integration. *Tanzanian Journal of Science*, 2011; 37: 37-48.

Shumete Gizaw Woldeamanuel. 2009. In: Proceedings of the 16th International Conference of Ethiopian Studies, A/A. date of conference, 2009. Poverty, Food insecurity and Livelihood strategies in Rural Gedeo: The case of Haroressa and Chichu PAs, SNNP. Svein Ege, Harald Aspen, Birhanu Teferra and Shiferaw Bekele, Trondheim. Publisher name.

Sudhakar Raju. (2008). Project NPV, Positive Externalities, Social Cost-Benefit Analysis—The Kansas City Light Rail Project. Journal of Public Transportation, Vol. 11, No. 4

Thirtle, C., Beyers, L., Lin, L., McKenzie-Hill, V., Irz, X., Wiggins, S. and Jenifer, P. (2002) Then impact of changes in agricultural productivity on the incidence of poverty in developing countries. Report to DFID No. 7946: Department for International Development.