

Integrated fish farming and poverty alleviation/hunger eradication in Nigeria

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Abstract: *With increase in population in Nigeria, Integrated fish farming remained a key player in agricultural enterprises due to its sustainability and focuses on diversified agricultural production with emphasis on fish. This paper reviews the integrated fish farming and its impact in the development of Nigerian youth and women in order to have a long term and sustainable impact on alleviation of poverty/hunger eradication. Youth and women form a significant (60-80%) agricultural labour force in Nigeria and Africa at large. They play a very significant role in fish farming which are often overlooked by many people. Three types of integrated fish farming were identified; fish cum Poultry, fish cum piggery and fish cum rice and vegetable. Integrated fish farming has potentials of job creation particularly the unemployed youth in Nigeria and can improve the standard of living among women. Integrated fish farming like other sectors of agriculture are faced with so many problems for both youth and women, these include; Ground water availability, Capital, Unavailability of high quality, Fingerlings, Sources of information, Government Policy, Access to extension services, Soil and Water, Availability of land, Cooperative Society, Credit Subsidies, Input Subsidies and Access to information. This review revealed that, capital is the major constraint for both youth and women.*

Keywords: *Fish, Hunger Eradication, Integrated, Poverty Alleviation, Nigeria.*

I. Introduction

Hunger and malnutrition remain amongst the most devastating problems facing the world poor and needy [1]. Nigeria is one of the developing countries affected by hunger, deprivation and abject poverty by its citizenry in spite of its enormous natural and human resources [2]. Nigeria is among the largest fish consumers in the world with over 1.5 million tons of fish consumed annually [3]. Fish farming in Nigeria has its antecedents in the traditional African reciprocal, communal, technical, labour support/skills transfer system of about 10,000 years ago. Fish production from aquaculture accounted for about 96,000 metric tons in year 2000, while only 20,000 metric tons in 1994 [4].

Integrated farming involving fish is defined broadly as the concurrent or sequential linkage between two or more human activity systems, of which at least one is aquaculture. Furthermore, the linkages between aquaculture and human activities involve not only agriculture (i.e. crops, livestock, irrigation dams canals) but also include roles in sanitation (night soil, septage or other forms of human excreta re-use, sewage treatment), nutrient recovery (hydroponic-fish, breweries) and energy recovery (culture in heated effluents of power plants, dairies, etc) [5]. In contrast, theoreticians used to differentiate Integrated Fish Farming system from mixed farming, in which production sub-systems of a farm are not mutually supportive and do not depend on each other [6]. The principle of integrated fish farming involves farming of fish along with livestock and agricultural crops. This type of farming offers great efficiency in resource utilization, as waste or by-product from one system is effectively recycled. It also enables effective utilization of available farming space for maximizing production. In Nigeria, Integrated fish farming has been reported in many states of the federation in which 50% of fish farmers integrate, poultry, piggery or livestock with fish production, while integrated fish cum crop production is on the rise also in several states [7]. According to [8] the essence of integrated system is to increase the productivity of fish as to meet the challenges of food shortage and reducing the unemployment rate in Nigeria. Socio-economic conditions should be considered when developing integrated fish-farming systems. The development of a diversified economy depends on the harmonious interactions between socio-economic conditions, agricultural productions and regional environmental conditions [9].

In any part of the country, the type and level of integration depends on the prevalent environmental conditions, social norms, cultural values and religious factors [10]. For example in the northern part of the country, fish cum pig integration is not advisable because of religious factors. The agricultural enterprise to be combined and their level of intensity determine the type of integration. Fish culture can be extensive, semi-

intensive or intensive. The semi-intensive earthen pond fish culture is the most suitable integrated aquaculture system because of the natural ecosystem that can conveniently accommodate both crop and livestock production [10]. Apart from market forces, demands for agricultural products should be put into consideration before establishing any integrated farming enterprise in any area [11].

Employment in the primary capture fisheries and aquaculture production sectors in 1998 is estimated to be 300 million people worldwide while the number of people dependent on fisheries as an income was estimated at 200 million [10]. Of these the vast majority cannot even afford to eat fish they catch and handle [10]. Fishers are often demeaned and exploited by those who can afford to buy their crops, which leads to the disintegration of traditional communities and increasingly marginalized rural societies. Consequent upon this there was massive rural-urban drift leading to youth migrating to urban centres for "greener pasture" leaving the old people in the rural area. Unfortunately gainful employment is increasingly scarce in the cities. This has in no small way created social problems and in fact to the level of social unrest in Nigeria [10].

II. Impact Of Integrated Fish Farming

Integrated fish farming combines livestock production with fish farming. Animal manure is shed directly into a fish pond as fertilizer and supports the growth of photosynthetic organisms. The livestock, mainly chickens and pigs, is often fed feed containing growth promoters [12]. The farming systems are relatively confined units with little exchange of water. Manure from livestock production is administered to fish ponds; the manure is directly consumed by fish, and the release of nutrients supports the growth of mainly photosynthetic organisms [13]. This integrated fish farming system produces high yields with low input, with the fish receiving limited, if any, supplementary feed. In contrast, the livestock on the integrated farms, which includes chickens and pigs, is reared intensively, and antimicrobial agents are used as growth promoters and for prophylactic and therapeutic treatment. Within integrated fish farming systems, antimicrobials, their residues, and antimicrobial-resistant bacteria may enter the fish ponds through animal manure and/or excess feeding and are potential sources of antimicrobial-resistant bacteria [12].

In recent years, a number of studies on the impact of rural livestock-fish farming systems on household nutrition have been conducted. The benefits of integrated fish farming result 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 [14], [15], [16], [17], [18], [19]

[20] Listed the benefits of integrated fish farming in a community to include:

- i. The provision of cheap feedstuff
- ii. Organic manure for pond fertilization, without any use of supplementary feeds.
- iii. Cost reduction of inorganic fertilizers and commercial feed
- iv. 30-40% increase in profit
- v. Self-sufficiency and self-reliance for communities due to production of grains, vegetables, fish and livestock from integrated fish farming systems.
- vi. Use of silt (rich water) from fish ponds for fertilizing crops which lead to reduction of chemical fertilizers.

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 [10]. Various types of livestock and crops have been integrated with fish farming. Integrated culture system is quite compatible with the earthen pond culture, which in Nigeria is the most popular fish farming system particularly in the rural areas. This is due to expansive natural ecosystem the earthen pond offer, which ensures fast degradation of the organic wastes. For example livestock manure commonly used in phytoplankton bloom generation, ensures natural oxygen supply through photosynthetic activities and also serves as natural feed source. The pond dykes are suitable for vegetable production. In swampy areas where rice cultivation is practiced, the large area needed for rice serves as a potential area for both semi-intensive and extensive fish culture.

While maximizing land use, integrated farming approach reduces cost of input, diversifies protein production encourages enterprise combination to improve profitability and therefore farmers socio-economic status [10]. The impact of livestock integration with fish increases productivity by manure loading from animal's wastes. [10] also reported that, efficiency in resources use is also shared by integrating fish farming with irrigation system as well as by utilizing inland surface waters and flood plains for cage culture, fish cum vegetable/crops integrated culture system. New forms of integrated culture system that can effectively respond to resources and environmental challenges need to be developed. In this connection attention should be given to resolving the economic and environmental challenges of stock enhancement and ranching.

III. Types OF Integrated Fish Farming

Integrated fish farming systems practice in Nigeria include fish cum poultry (broiler and layer), fish cum piggery and fish cum rice and vegetables [10].

3.1 Fish Cum Poultry

This system utilises Poultry dropping of fully built-up poultry litter for fish culture [21]. Poultry-fish farming is the integration of poultry, such as chickens, ducks and geese with fish farming. The poultry house can be constructed over the pond or adjacent to the pond. In both cases the excreta from the birds can serve as feed, which fertilizes the pond or the fish can feed on the excreta directly. The use of poultry in an integrated production system with fish has several benefits such as low digestibility due to the size of digestive tract resulting in nutrient rich manure and subsequent low input integration, as well as the apparent synergistic relationship between the two production systems under integration. Poultry waste contains less moisture, fibre and compound such as tannins that discolour water when used as fish pond fertilizers. Poultry manure is a complete fertilizer with characteristic of both organic and inorganic fertilizers, which can be used without resorting to the addition of supplementary feed [22].

3.2 Fish Cum Piggery

This system has certain advantages over others. Pig farming is widely practiced across the Southern and Middle belt of Nigeria, offers the farmer a husbandry which is easier than chicken farming. It has good returns [23]. The pig is a highly prolific animal and its combination with fish not only increase economic efficiency, but also increase its ecological efficacy as wastes, residues, and left over from kitchen, aquatic plants are often used as pig food [7]. The excreta in turn are used as organic manure in fish ponds. Farmers practicing pig cum fish farming may benefit from up to 28% - 30% economic advantage over normal pig farming [7]. [24]Recorded an impressive performance in the culture of *Oreochromis niloticus* using pig manure not only as source of fertilizer but as source of feed.

3.2.1 Benefits of Fish cum Pig Farming

- i. The fish utilize the food spilled by pigs and their excreta which is very rich in nutrients.
- ii. The pig dung acts as a substitute for pond fertilizer and supplementary fish feed. Hence, the cost of fish production is greatly reduced.
- iii. No additional land is required for piggery operations.
- iv. Cattle fodder required for pigs and grass are grown on the pond embankments.
- v. Pond provides water for washing the pig - sties and pigs.
- vi. It results in high production of animal protein per unit area.
- vii. It ensures high profit through less investment.
- viii. The pond muck which gets accumulated at the pond bottom due to constant application of pig dung can be used as fertilizer for growing vegetables and other crops and cattle fodder.

3.3 Fish Cum Rice and Vegetable

This is the cultivation of agricultural crops (e.g. vegetables and arable like maize, rice etc) and aquatic plants (like water spinach, water chestnut, aquatic weeds like Pistia, duckweed, water hyacinth, Azolla etc.) with fish farming [25]. The common practice in fish cum crop production in the country is in cultivation of fish with rice, and vegetables. This is widely practiced among the farmer in the rural areas, at subsistence level. The vegetables, like water leaf and spinach among others are planted on the dykes, while in the case of rice; it is planted right inside the pond. The crops derive water and nutrients from the fish ponds while the crops serves as food, especially for herbivorous fish. Besides, periphytons on the crop may enhance yield of cultured fish species [25]. Aquatic cash crop like Makhana (*Euryale ferox* and *Singhana* (trapaspp) integration can also be done with air-breathing or carnivorous fishes [26].

IV. Integrated Fish Farming As A Solution To Poverty Alleviation/Hunger Eradication In Nigeria

[21]Listed the Advantages of integrated fish farming in a community to include:

- i. Efficient waste utilisation from different culture practice for fish production.
- ii. It reduces the additional cost for supplementary feeding as well as fertilisation.
- iii. It is an artificial balanced ecosystem where there is no waste.
- iv. It provides more employment avenues.
- v. It reduces the input and increases output and economic efficiency.
- vi. The integrated fish farming provides fish along with meat (chicken, duck, beef, pork etc.), milk, vegetables, fruits, eggs, grains, fodder, mushroom etc.

- vii. This practice has potential to increase the production and socio-economic status of weaker section of our society.

Integrated fish farming is a system that focuses diversified agricultural production with emphasis on fish. It has a capacity of bridging the wide gap between fish demand and supply [10]. The fish integrated culture is discussed emphasizing its importance and relevance to poverty alleviation/hunger eradication. Integrated fish farming has enormous potentials for job creation particularly for the restive youth in Nigeria that has drifted to urban centres for employment that are not in existence. Women socio-economic situation in the society can be tremendously improved. Numerous examples exist in which aquaculture has been suggested as a tool for poverty alleviation and sustainable rural livelihoods [5]. Integrated poultry-fish farming systems, fish, meat and eggs could be produced which are excellent sources of nutrients crucially required by many households to meet the recommended dietary requirements of the family. These products supply amino acids, vitamins, macro and trace-minerals and energy essential for the wellbeing of the population. The products of the poultry fish-farming system thus provide food security and raise the nutritional status by providing important complementary ingredients for better nutrition particularly in developing regions such as Africa where the diet may be heavily dependent on root crops such as cassava or cereals such as maize [27].

The high nutritional value of fish, particularly for vulnerable groups such as pre-school children, pregnant and lactating women is widely known [28]. With the prevailing economic situation in developing countries, there is a need for farmers to engage in a result-oriented farming system that will guarantee and sustain adequate food security [23]. Since there is a demand for protein rich foods in the developing countries e.g Nigeria and its supply is extremely expensive for the rural poor, this problem needs to be attended seriously considering available limited resources. Integrated fish farming offers a big opportunity and hope of life, as it serves as a food production base that combines cultivation of crops, rearing of livestock and fish farming. Integrated fish farming system will not only supply enough manure to produce a large quantity of fish, but also produce meat, milk, eggs and vegetable [23]. The study by [29] also reported that the integrated farming system outperforms the commercial farming system in all its dimensions of multifunctional agriculture as it gives a more secure supply of food and also better matches the social needs for agriculture as a supplier of materials for food, economic and environmental functions.

Most of the poverty alleviation programme in time past has focused on men and some elites in the communities at the detriment of the women and youth who are the majority in most communities in Nigeria [30]. In order to have a long term and sustainable impact on alleviation of poverty, the place of women and youth in the communities must be critically analysed. It has been estimated that women and youth provide some 60 - 80% of agricultural labour force in Africa [31]. They play a very significant role in aquaculture, which are often overlooked. [32]Acknowledged that women and youth are key players in African agricultural sector and their participation is critical to achieving food security and economic well-being. Women often play major role in small-scale fisheries. They are often by tradition the manager of small mixed farms including fish ponds and are also involved in harvesting of shell fishes e.g. periwinkle, oysters among others [33]. They are also responsible primarily for the post-harvest activities-processing and marketing of fish [34]. According to [35], Women in rural areas suffer from poverty in fishing community more than men. The problem of declining fish stock from capture fisheries is often compounded within families. Often fish provides a livelihood for the whole family. A lower catch means less to process and market and none left for the family to eat. There is therefore the urgent need to develop aquaculture more vigorously and also to empower women and youth for active participation [30].

There are various strategies of agricultural empowerment by the Federal Government to attack poverty alleviation/eradication through agriculture such as food security project. The effect is not yet realized because poverty and hunger are still pervasive in both rural and urban areas. Empowerment of women and youth is very important to turn around fish production in Nigeria through integrated fish farming system. Women and youths have all what it takes to make success 'of integrated fish farming in Nigeria. Their involvement right now is limited, mostly to marketing and limited in the aspect of management through family involvement. Fish integrated farming must be regarded as a strong tool for job creation hence poverty alleviation/hunger eradication. The seemingly neglect of women and youths in various empowerment programmes must be redressed [10]

V. Problems OF Integrated Fish Farming In Nigeria

Integrated fish farming like other fish farming are faced with different problem/challenge for both women and youth. [36]reported that the major constraint faced by integrated fish farming is lack of capital. [10]Also reported that fund is the major limitation for both women and youth in the production system of integrated fish farming hence the need for empowerment. Fund is not the only problem/limitation to integrated fish farming, but is facing some challenges such as: Ground water availability, Capital, Unavailability of high

quality, Fingerlings, Sources of information, Government Policy, Access to extension services, Soil and Water, Availability of land, Cooperative Society, Credit Subsidies, Input Subsidies and Access to information [36].

VI. Conclusion

In conclusion, integrated fish farming is a combination of fish culture alongside with Poultry, Piggery, Vegetable production etc. This system has an advantage over fish farming along. Integrated fish farming is the blending of various compatible agricultural enterprises into a functional or unified farming system for the purpose of sustainability and it varies from one area to another in terms of production combination, rates and sizes. Women/youth being the most vibrant group of people are involved in this system. It plays a very important role in many aspects of women/youth development and empowerment and more profitable than unitary system of farming as it ensures a spread of financial risk for its varied diversified nature in rearing fish, animals and crops; it has a capacity of making more food available thus enhancing food security. Besides, it provides employment, thus alleviating poverty and enhancing the economic status of the rural populace in Nigeria and reduce to the barest minimum the level of violence from disenfranchised youth that is characteristic of the country in recent times. The benefits of integrated fish farming result 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 in Nigeria.

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