STUDY ON THE POTENTIAL OF AQUACULTURE IN AFRICA

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Executive Summary

This in depth study on the potential of aquaculture in Africa was commissioned by CTA with the aim to identify opportunities for aquaculture development in Africa and the drivers for success, as well as highlight needed interventions to accelerate the growth of the sector. This study drew lessons from the experiences of various countries and from knowledge generated by the Aquaculture Working Group of the NEPAD Partnership for African Fisheries (PAF) over the past 5 years. The studies from the PAF Aquaculture Working Group constituted the bulk of knowledge that informed the aquaculture section of the Pan-African Policy.

From the study it is clear that need to accelerate aquaculture growth in Africa is dire, in a continent where human population growth rate is generally much higher than the global figures. For instance, between 2005-2010 was 2.45 per cent,(in Sub Saharan Africa) while global population growth rate was 1.16 per year. This implies a greater demand for fish if the current consumption rates are to be maintained. The potential wealth that can be generated from aquaculture plus the current contribution of the sector to employment of men, women and youth exacerbated the need for accelerated growth of aquaculture. In addition, the rising African middle-class and urban population, coupled with the general rising in economic development has led to rising demand for fish; and aquaculture, especially in the peri-urban zones,

On the other hand Africa has the land and suitable water environment but which remain unexploited for aquaculture including brackish waters, coastal areas and land where cages, ponds and other culture systems can be suitably placed. For instance, The long coastal region of West Africa is suitable for shrimp farming but which remain unexploited. Much of the southern African coastal region can be put to use for seaweed culture, shrimp and other aquatic products. Similar opportunities lie with the Small Island Development States (SIDS). Using the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa as a base, eight points have been identified as key drivers to obtain accelerated growth of aquaculture in Africa. Africa needs to: Strengthen knowledge base of aquaculture to accelerate aquaculture growth and transformation

- Harnessing markets and trade opportunities
- Harnessing investment financing for Small and Medium Enterprises in aquaculture
- Increase awareness of contribution of Fish and aquaculture to Food Security and nutrition
- Incorporate resilience and risk management, including Climate Changein aquaculture development
- Enhance data collection, analysis and dissemination
- Incorporate gender and youth in aquaculture development
- Support Implementation of Continental Policy and institutions

It is argued that these eight areas identified in this study are the key drivers and menu which, if implemented, are likely to see aquaculture growing in the next 5 years.

1.0 Background

Africa include a total of 55 national states, of which 54 are members of the African Union (AU), Morocco is not a part of AU. Within the AU, the continent is subdivided into eight officially recognized Regional economic Communities (RECs), namely Economic States of West African States (ECOWAS), covering countries in West Africa; (ECCAS) comprising countries in Central Africa; East African Community (EAC); Inter-Government Authority for Development (IGAD), mainly comprising countries in the Horn of Africa; Southern African Development Community (SADC); Union of Arab Maghreb (UMA); (COMESA); and SENCAD, covering countries in the Sahel.

Africa is characterized by a population that is predominantly in the rural areas and largely dependent on agriculture as the mainstay of its economy. Development strategies at national, regional and continental levels have taken agriculture as one of the key sectors that require special attention; with agricultural productivity and value addition being key drivers of growth. For instance in the poverty reduction strategies, the drive is to reduce poverty in most of the African countries where majority of the people live on less than US$1 per day. Regional economic communities (RECs) have aligned their agricultural strategies to the Comprehensive African Agricultural Development Programme (CAADP); a reformist agenda of the African Union which has set a target of agricultural production increasing at the rate of 6% per annum. CAADP has been internationally accepted as a framework for agricultural growth in Africa.

The continent is endowed with enormous water resource in terms of oceans (Indian and Atlantic, in the Eastern and Western seaboard, respectively), Mediterranean Sea in the north bordering Southern Europe; Red Sea in the north-west bordering the Arabia peninsular; lakes, rivers and floodplains. Fisheries are some of the major resources in these water bodies. Therefore, fisheries is a key subsector to Africa's agricultural productivity. This includes both capture fisheries and aquaculture. Fish is the main source of animal protein and micro-nutrition for about 30% of Africa's population, and the fisheries sector as a whole employs 12.3 million people as full-time fishers or full-time and part-time processors, accounting for 2.1% of Africa's population of between 15 and 64 years old. Of these employed, almost half are fishers; 42.4% are processors and 7.5% are engaged in aquaculture. Women are heavily involved in the fish sector, accounting for about 27.3%

of the total workforce in fisheries and aquaculture, and they are directly involved in fishing (3.6 %), processing (58%), and aquaculture (4%). With regard to food and nutrition security, fish is very important source of animal protein, accounting for an average of around 5% of total protein FAO (2014).

The need for structured trans-boundary management of these fisheries resources has necessitated the creation of Regional Fisheries (Management) Bodies/Organizations, and the main ones are the Sub-Regional Fisheries Commission (SRFC) comprising Mauritania, Senegal, Cape Verde; The Gambia, Guinea Bissau, Guinea (Conakry) and Sierra Leone; Fisheries Commission for West-Central Gulf of Guinea (FCWC), with membership drawn from Liberia, Cote d'Ivoire, Ghana, Togo, Benin and Nigeria; Fisheries Commission for Gulf of Guinea (COREP) covering Cameroon, Equatorial Guinea, Gabon, Sao Tome & Principe; Congo, and Democratic Republic of Congo; Benguela Current Commission, for Angola, Namibia and South Africa; and South West Indian Ocean Fisheries Commission (SWIOFC); Lake Victoria Fisheries Organization (LVFO); Lake Tanganyika Authority (LTA); Niger Basin Authority; and Lake Chad Commission. Current talks are aimed at pitching the aquaculture agenda within these trans-boundary waters very high as they are sources of genetic material for aquaculture in the riparian countries whose managed movement conservation is critical at this point.

In an effort to guide prudent fisheries and aquaculture management at regional level, a number of RECs have developed Regional Fisheries and Aquaculture Management Strategies. The SADC Protocol on Fisheries was endorsed by the SADC Heads of State and Government in 2001. Recently, COMESA developed the Regional Fisheries Strategy as part of the Comprehensive Africa Agriculture Development Program (CAADP); likewise, ECOWAS, IGAD and ECCAS have their own regional plans. In order to consolidate these regional efforts, the AU/NEPED Fish For All Summit which was held in 2005 in Abuja approved the NEPAD Action Plan for the Development of African Fisheries and Aquaculture. Later in September 2010, the AU held the first Conference of African Ministers of Fisheries and Aquaculture (CAMFA) in The Gambia. Later, the CAMFA was endorsed by African Union Heads of State and Government as a continental policy organ responsible for fisheries. The first CAMFA called for the development of a common fisheries policy for Africa. In May 2014, the second CAMFA endorsed the African Union

Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (Pan-African Policy).

The Pan-African Policy has twelve sections. Section 1 aims to establish national and sub-national governance and institutional arrangements that ensure that the societal contribution generated by Africa's sectors have the greatest impacts at the most appropriate level; section 2 focuses on improving and strengthening the contribution of small-scale fisheries to poverty alleviation, food and nutrition security and socio-economic benefits of fishing communities; section 3's objective is to jumpstart market-led sustainable aquaculture through a variety of strategies and, where appropriate, support interventionist development approaches in aquaculture by strong strategic and implementation plans; section 4 is for harnessing significantly. the benefits of Africa's' fisheries and aquaculture endowments through accelerated trade and marketing; section 5 is for strengthening South-South (bilateral and regional) cooperation, and develop coordinated mechanisms among RECs, RFBs and LME-based commissions to ensure coherence of fisheries policies and aquaculture development and their adoption and adaptation; section 6 aims to increases awareness of the potential and importance of the sector and enhanced capacity of people and institutions in the African fishery sector to ensure the sustainable development of capture fisheries and aquaculture, based on current and emerging trends, challenges and needs; section 7 is for increasing and consolidating the African Voice in the governance and management of high seas fisheries; section 8 is for strengthening resilience and reducing vulnerabilities to climate change in African fisheries and aquaculture; section 9 is for promoting and protecting women's and youth rights in all aspects of fisheries and aquaculture in order to strengthen sustainable positive changes in gender equality; the objective of section 10 is to enhance private sector investments and financing mechanism for fisheries and aquaculture in Africa; section 11 illustrates the reform strategy; and section 12 outlines the implementation guidelines for the policy framework and the reform strategy. It is important to note from the above that aquaculture agenda runs through many of the sections of the Pan African Policy.

The need to have accelerated aquaculture growth in Africa is more pressing than ever before if one considers the disparity in country production coupled with the increased human population. While the Pan African Policy provides policy guidance and

environment for this growth, it is important to unravel the factors that should be taken aboard in order for Africa to achieve its potential in terms of aquaculture development. Therefore, in support of the Africa-Caribbean and Pacific (ACP) regional efforts to accelerate aquaculture development, CTA commissioned this study with the aim to identify opportunities for aquaculture development for the ACP regions and the drivers for success; as well as highlight needed interventions to accelerate the growth of the sector. This study was specifically undertaken for the Africa region.

The structure and content of this report is guided by the TOR outlined in Annex I. The outline helped to guide the exhaustive assessment of issues, potential and challenges of aquaculture development in Africa. The methodology included a literature review and synthesis of studies drawn from various organisations including those that were produced by the Aquaculture Working Group of the NEPAD Partnership for African Fisheries (PAF) over the past 5 years. The studies from the PAF Aquaculture Working Group constituted the bulk of knowledge that informed section 3 (aquaculture) of the Pan-African Policy. Since the study was done as part of the ACP-wide aquaculture assessment, it is envisioned that the information provided by this report will be instrumental in developing a strategy that will assist African Union Commission (AUC) and the NEPAD Agency in strengthening their efforts towards the implementation of the Pan-African Policy as well as guide ACP Secretariat in enhancing the coordination of aquaculture issues under the ACP Fisheries Mechanism.

2.0 Status of Aquaculture in Africa

The African aquaculture industry is largely underdeveloped, dominated by small scale farmers in rural and remote areas. The dominance of small scale aquaculture is due to the goal set for aquaculture development; that of food security with less emphasis on profit maximization. As a result there has been a proliferation of small scale pond aquaculture heavily dependent on donor support. Experience from Asia and elsewhere has shown that aquaculture developed because it was oriented towards commercial production. Therefore, expansion of commercial operators is key for sustaining the future of Africa's aquaculture.

2.1. Main Farmed Species

The main farmed species can be divided into four major species groups, namely pisces, crustacean, mollusca and invertebrata aquatic, In terms of commodity groups, production from Africa is dominated by Pisces which constitute 96% of total volume with small contributions from aquatic plants, molluscs and crustaceans (Fig. 1).

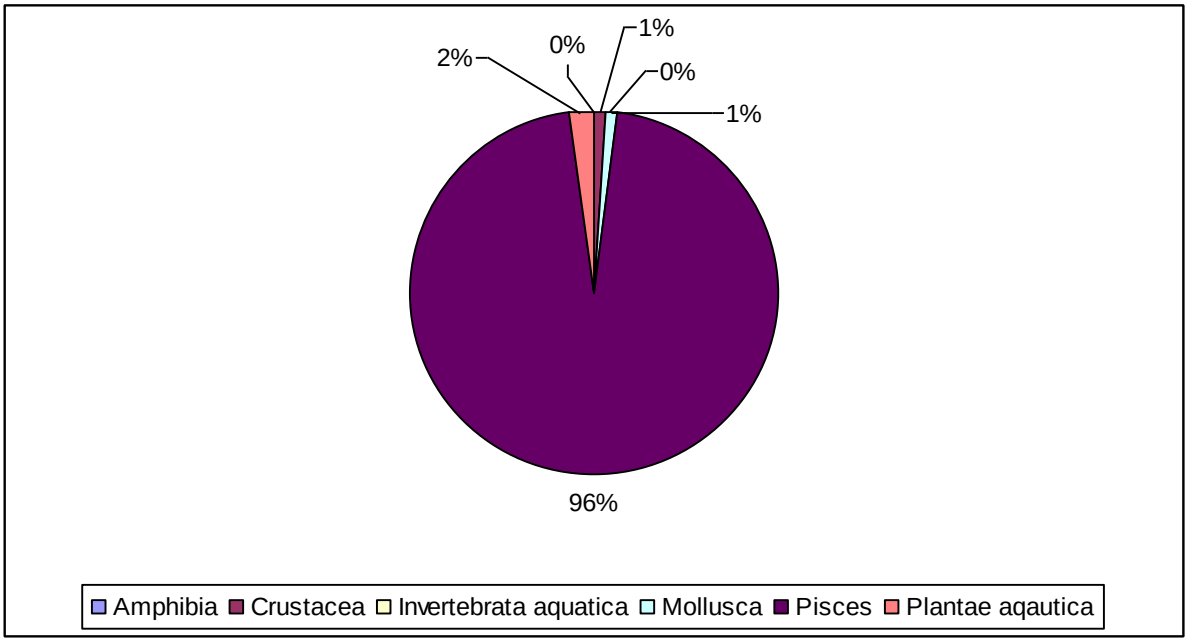

Figure 1: African aquaculture production by major groups- total 1950-2008

Green turtle is the only Amphibia produced in aquaculture in brackish water and marine environments from the Reunion. Production decreased from 30 tonnes in 1989 to 5 tonnes in 1993 and there has been no production reported thereafter. Invertebrata is represented by sea cucumber and red bait produced in marine environment in Madagascar and South Africa, respectively; their production was reported from 1989 to 1992 then dropped to zero from 1993 to 2006. Production volumes of crustaceans have increased from 183 tonnes in 1989 to 11,931 tonnes in 2005, followed by a declining trend. Production level for molluscs has remained below 3,400 tonnes per annum and cultured in marine and brackish water environments. Aquatic weeds are produced in Burkina Faso, Madagascar, Mozambique, Namibia, Senegal, South Africa and Tanzania. Aquatic plants

are produced in all the three environments; *Spirulinaplantensis* is produced in freshwater in Burkina Faso in quantities ranging from 20 tonnes in 2005 to 70 tonnes in 2008 while *Spirulina maxima* is produced in brackish water in Senegal. Most of the aquatic plant species are produced in marine environment in Madagascar, Mozambique, South Africa and Tanzania. The largest quantity of aquatic plants production is from Tanzania especially in Zanzibar (Table 1).

Table 1. African aquaculture production of major groups excluding Pisces for the period 1989-2008 in tonnes

Year	*Planta aquatica*	Amphibia	Crustacean	Invertebrata	Mollusca
1989	100	38	183	10	1673
1990	908	30	377	20	2175
1991	2597	30	283	35	2859
1992	3248	20	347	30	2944
1993	1885	10	1131	0	3170
1994	2576	5	819	0	3472
1995	4044	0	1911	0	2988
1996	4923	0	2896	0	2384
1997	3794	0	3210	0	3379
1998	4438	0	3297	0	3527
1999	6782	0	3929	0	3016
2000	5823	0	5402	0	1393
2001	9018	0	5844	0	1533
2002	13328	0	8428	0	1696
2003	13878	0	8565	0	1896
2004	11290	0	7889	0	1974
2005	11696	0	11931	0	1999
2006	12051	0	10485	0	2170
2007	13301	0	9615	1	2351
2008	14797	0	7792	1	2373

2.2. Aquaculture production

FAO and NEPAD (2014) reported that of the total of 19.7 million tonnes of fish produced in Africa, 1.49 million came from aquaculture; and of the total 7.1 million (10% of the global total) jobs created in the fish sector, almost 1 million were in aquaculture (1.6% of the global total), and 4% of these were women. FAO (2014) reported that the growth in aquaculture production between 2005 and 2010 was fastest in Africa (14.8%) compared to Asia (6%). Therefore, over the past decade Africa has experience significant growth in aquaculture growth with production in rising from 399,000 tons in 2000 to 1.49 million tons in 2011, accounting for 2.2% of the global production; and the fastest growing continent (11.7%) (FAO 2014).

The phenomenal growth occurred between 1970–2008 which was has been steadily increasing at an annual average growth rate of 12.6% per annum, and then between 2006-2010 at 18.6% per annum (Fig. 2).Thus for Africa, aquaculture is no longer just considered as a means to supplement production of fish from capture fisheries and to increase supply of fish to rural and poor households, aquaculture is developing into an industry with high potential to contribute towards regional and national food supply, trade and nutritional security.

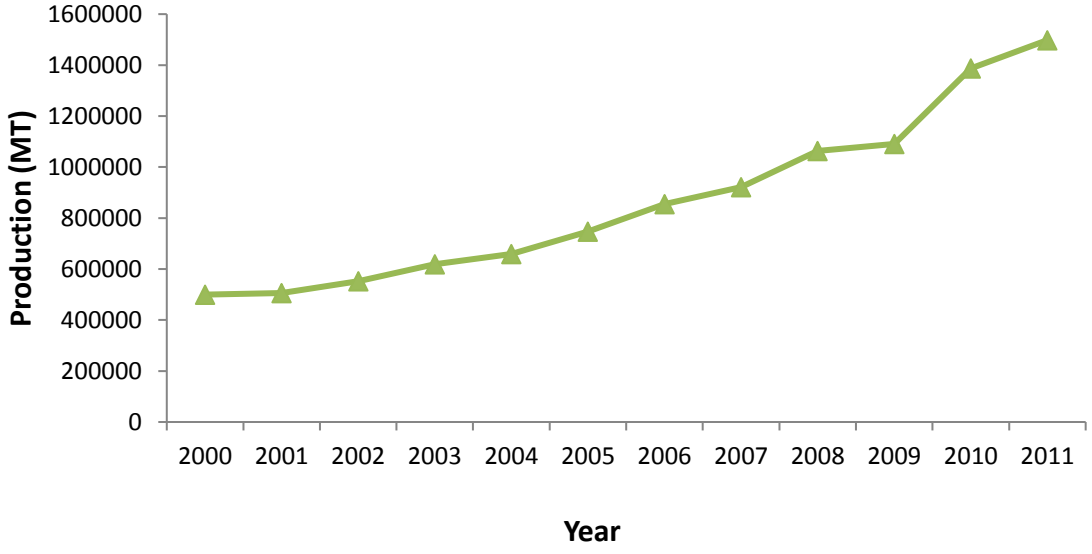

Figure 2: Aquaculture production (MT) in Africa – 2000-2011 (Source: FAOFishStat 2014)

Much of the production from aquaculture comes from Egypt (70.6%), Nigeria (15.8%), and Uganda (6.1%)(Table 2).Other upcoming producing countries include Kenya, Ghana and Zambia. Africa has great potential for aquaculture with about 43% of the continent having potential for farming tilapia, African catfish and carp. In southern Africa alone, nearly 23% of the land is suitable for farming tilapia and catfish on commercial scale but less than 5% was being used during the early 2000s (TIPS and AusAID, 2007).

Table 2 Major Aquaculture Producing Countries in Africa (2005 – 2011) in tonnes

Country	2005	2006	2007	2008	2009	2010	2011
Egypt	539,748	595,030	635,516	693,815	705,490	919,585	986,820
Nigeria	56,355	84,578	85,087	143,207	152,796	200,535	221,128
Uganda	10,817	32,392	51,110	52,250	76,654	95,000	85,713
Kenya	1,047	1,012	4,240	4,452	4,895	12,154	22,135
Ghana	1,154	2,270	3,820	5,594	7,154	10,200	19,092
Zambia	5,125	5,210	5,876	5,640	8,505	10,290	10,530
Madagascar	9,396	11,233	11,293	10,836	6,116	6,886	8,835
Tunisia	2,603	2,855	3,581	3,561	4,907	5,424	8,126
Zimbabwe	2,452	2,450	2,500	2,602	2,652	2,702	7,602
South Africa	2,895	3,037	2,669	3,587	3,433	3,133	3,572
Malawi	812	1,500	1,500	1,700	1,620	2,631	3,433
Côte d'Ivoire	866	866	1,290	1,290	1,340	1,700	3,394

Source: FAO FishStat (2014)

Production of fish in aquaculture systems in Africa shows considerable variation especially from 1990s where production in brackish water systems was higher than in the freshwater systems (Fig. 3). Production in the marine environments is the lowest and does not show much signs of picking up even in the recent years. Tunisia shows an increasing trend in brackish water aquaculture production while Algeria's production drops between 1992 and 2004 but picked up in 2008 (Table 3. Production from Nigeria drops from 3481 tonnes in the early 1990s to zero from mid-1990s to 2008 (Table 3).

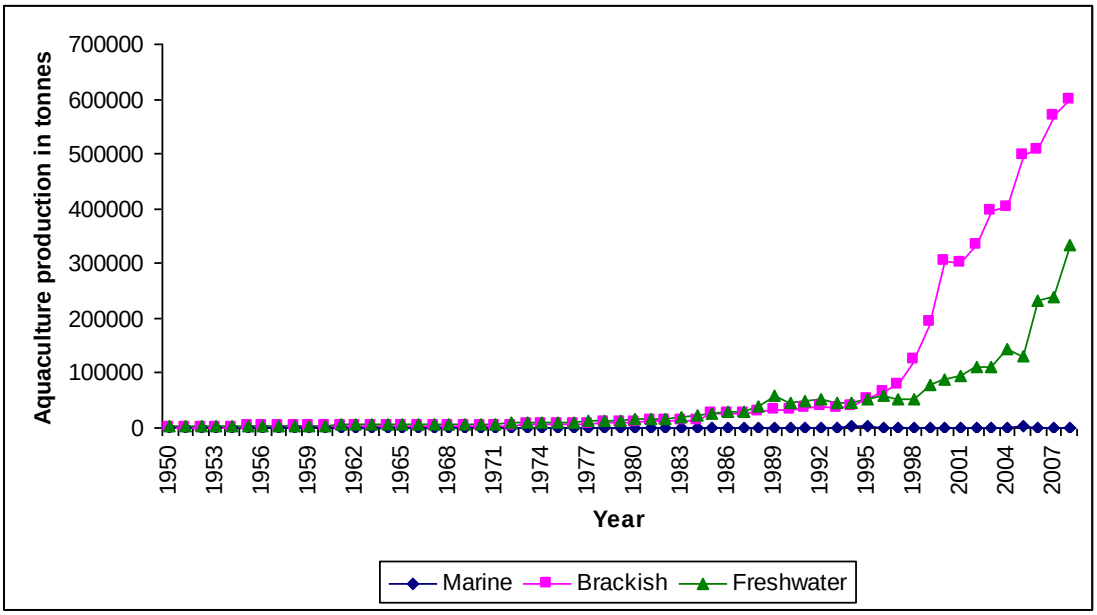

Figure 3: Production trends of fishes in aquaculture environments

Table 3. Fish production from brackish water systems in Africa in tonnes

	1988	1992	1996	% of 1996	2000	2004	2008	% of 2008
Egypt	28200	35000	66144	**99.07**	303573	401849	594851	**99.57**
Tunisia	565	341	509	**0.76**	613	1144	1895	**0.32**
Algeria	111	12	56	**0.08**	74	22	561	**0.09**
Cote d'Ivoire	80	276	28	**0.04**	642	431	140	**0.02**
Tanzania	0	0	0	**0.00**	0	2	2	**0.00**
Benin	69	0	0	**0.00**	0	0	0	**0.00**
Comoros	0	0	1	**0.00**	3	0	0	**0.00**
Reunion	0	0	0	**0.00**	15	0	0	**0.00**
Morocco	0	41	29	**0.04**	35	30	0	**0.00**
Mozambique	3	4	0	**0.00**	0	0	0	**0.00**
Nigeria	932	3481	0	**0.00**	0	0	0	**0.00**

Senegal	10	0	0	**0.00**	7	7	0	**0.00**
Total production	29970	39155	66767	**100.00**	304962	403485	597449	**100.00**

2.3Main Markets and Quality and Food Safety Standards

As demand for fish outstrip supply in many African countries, farmed firewater fish is mainly going into domestic markets. Therefore, a typical value chain is fairly simple (Fig. 2.2). Small-scale farmers sell their harvests on-farm to the final consumers; while large-scale farmers store the harvest in cold-storage facilities and transport the fish to urban centers where they sell to wholesalers or retailers; and retailers on-sell the fish to the final consumers in urban areas.

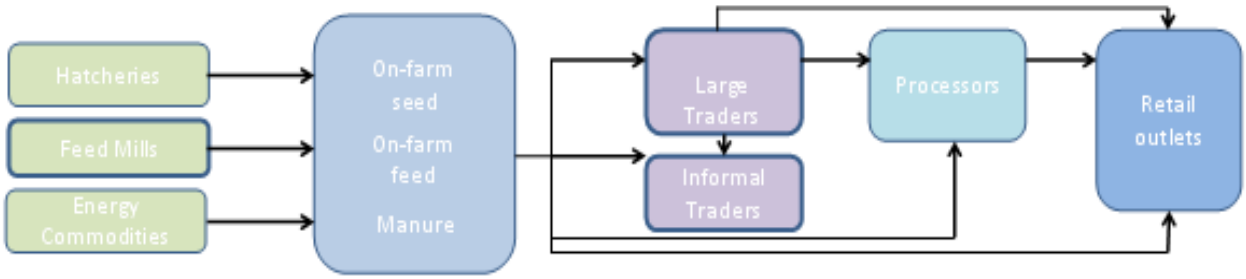

Fig. 4 Typical aquaculture value chain in Zambia

Source: Beveridge, M. and Kruijssen, F., 2011

Earlier private sector investments in freshwater aquaculture were motivated by the need to target export markets. However, demand dynamics have led to domestic markets being more lucrative than prospects for exports. Therefore, while some have continued to export (e.g. Lake Harvest on Zimbabwe side of Lake Kariba), many have responded to the enormous domestic demand. Nonetheless, there are a few commercial farmers for freshwater species that are exporting their produce; mainly to niche markets. Examples

are the trout production in Lesotho that is exported to Japan and South Africa; in Uganda tilapia produced by Walimi Fish Framers Cooperative Society –WAFICOS and the Source of Nile – SON are mainly to Democratic Republic of Congo. Marine aquaculture has largely targeted export; for example, a producer in Mauritius exports to Dubai, South Africa, Hong Kong, Singapore, United Arab Emirates, USA and European Union (EU).

In order to facilitate regional and global exports of farmed fish, safety and quality standards are essential. A number of RECs and countries have attempted to put in place regulatory mechanism and countries such standards. Lack of regional standards and guidelines on quality standards in farmed fish value chains in Africa has led to aquaculture products from Africa generally having low acceptance in foreign markets due to lack of confidence as to the safety of such products to consumers. The perception imposes non-tariff barriers on African countries, consequently they are kept out of international markets. Issues of food safety and quality are therefore of key importance. Madagascar has gone round the problem by obtaining international accreditation for its shrimp industry. Similarly Uganda, Tanzania and Kenya have had major breakthroughs with meet quality and safety standards of the EU markets following the bans that that were imposed on these countries in past on all fish from Lake Victoria. Whereas such countries have individually tried to meet EU quality standards and food safety, generally there are limited regional standards and guidelines on quality standards that countries can use in order to improve accessibility to markets (TIPS and AusAID, 2007). This would also require harmonization of rules and regulations for intra-regional trade. On recently, SADC developed Regional Aquaculture Strategy (2015-2025) with the aim of "promoting adherence to best practices in food safety standards".

2.4 New opportunities in market development

The recent rising in aquaculture development in Africa has been attributed to three main factors, namely, (i) i**ncreasing demand for fish**, (ii)**improved environment for investments,** and (iii) **reduced risk of production.** The rising African middle-class and urban population, coupled with the general rising in economic development has led to rising demand for fish; and aquaculture, especially in the peri-urban zones, has benefited. This is evident in the rise in GDP for the top countries with the fastest rising aquaculture production over the past few years (Table 4); hence suggesting a positive environment for investment and increased production.

Table 4.GDP growth rate in top African countries with fastest rise in aquaculture

Top aquaculture producers	**Percentage rise in aquaculture production since**	**Percent GDP rise***		
Country	**2009#**	**2012**	**2013**	**2014**
Nigeria	44.7	4.3	5.4	7.0
Uganda	11.8	2.8	5.8	5.8
Kenya	352.2	4.6	4.6	5.4
Ghana	166.9	8.8	7.1	4.5
Zambia	23.8	6.8	6.7	6.5
Madagascar	44.5	2.5	2.4	3.0
Tunisia	65.6	3.7	2.3	2.8
Zimbabwe	186.7	10.6	3.3	3.1
South Africa	4.0	2.5	1.9	1.4
Malawi	111.9	1.9	5.2	5.7
Côte d'Ivoire	153.3	10.7	8.7	8.6

Source: #FAO (2014); *Knoema/IMF World Economic Outlook 2014

The rise in demand for farmed fish has in return led to rise in fish prices making investments in aquaculture enterprise more profitable and hence, creating an opportunity for entrepreneurship. Enhanced research and scientific knowledge of major commercially farmed fish species such as tilapia and catfish, that has been brought about by Foreign Direct Investments in African aquaculture has led to reduced risk of aquaculture production. The risk of failure of aquaculture has also been helped by strong legislation and policies, including environmental management regulations that have promote aquaculture development. Private sector investment have also benefited from improvement in overall governance in many African countries where there are clear and enforced land and water rights, creating investor confidence.For example, foreign investors are reported to have invested a lot of funding for aquaculture in Zimbabwean aquaculture which by July 2015 will rise to US$10milion in investment. Recently, the Africa Development Bank reported to have allocated around US$32 million for Zambian aquaculture.

Further, Aquaculture systems in Africa have concentrated on inland pond aquaculture systems with limited diversification into cage culture and other relatively efficient producing systems. There is high potential for investment into brackishwater and marine culture systems. For example, there are currently efforts to promote shrimp farming in West Africa which will mainly target international markets for frozen shrimp especially in Europe where West African countries could benefit from preferential market through the EU-ACP trade agreements. The shrimp could also target African domestic markets for fresh and frozen shrimp to supply the growing tourist industry (SWAC/OECD, 2006). West African countries have land along the coast that is suitable for shrimp farming which is in form of flat land behind mangrove areas and open coastal flats. However there is need for feasibility studies to be carried in order to provide information for decision making. For example, feasibility studies carried out by NEPAD Agency also found that oyster farming could be possible in Sierra Leone (Hecht, Abban, Elago, Kaunda & Peacock 2012) but not much action has been taken to identify or designate sites or integrate shrimp farming in the coastal zone management plans. This calls for ECOWAS or its member states individually to identify or designate legal sites for shrimp farming. Although the region has vast potential for shrimp farming, necessary caution needs to be taken to avoid impacting on sensitive mangrove sites in such countries and areas as Guinea Bissau, Guinea, the Niger delta and Cameroon. The Black tiger shrimp is the most suitable species and can successfuly be exported to foreign markets. Other species that require further research are *Penaeusnotalis, P. karathurus, Parapenaeopsis atlantics* and *P. vannamei*(SWAC/OECD, 2006).

In Southern Africa, Mozambique has an estimated total potential of120,307 hectares that can be put to use for ponds (77,592 ha), cages(32,124); and seaweed beds (10,591), respectively. This could potentially produce almost 1 million tonnes products (marine ponds and cages 791,000 ton/year and a total of 640,000 tonnes/year of seawead) (SADC 2015). Such system could be used to produce high value aquaculture species for export within and outside the continent. There are lessons from Egypt where brackishwater aquaculture has been well developed can be spread to the whole continent. The improved breeds of Nile tilapia, mullet and cyprinids could be introduced into the brackishwater aquaculture developed in other countries, albeit with sufficient biosafety measures put in place.

Recently, Lesotho developed aquaculture systems for **Rainbow Trout** (*Oncorhynchus mykiss)* which is being produced commercially in cage culture systems. In 2014 Lesotho produced 900 tons with value of US$4.9 million. About 90% of this production is destined for export markets. Ability to produce for such stringent export markets as Japan, has been possible because Lesotho Highlands Water Project (LHWP) had invested in putting in place policies and standards for environmental management as well as quality assurance, that are currently being used to monitor commercial aquaculture operations. Such niche species and production systems could be expanded in suitable locations and countries in Africa, as long as careful environmental regulatory frameworks are put in place.

2.5 Aquaculture in Small Island Developing States (SIDS)

Traditionally, SIDS have relied on their vast seas for fish, making aquaculture development less attractive and unnecessary. However, recently, a number of Island states have realized the potential for and attempted to put in place strategies to develop aquaculture. Promotion of CAADP in many SIDS has resulted in the realization of the potential opportunities of exploring aquaculture as part of the food and nutrition security drive. In Madagascar, farmed shrimp has been an important export commodity until the white spot virus wiped out most of the farms. In addition, recent feasibility studies have revealed that 50,000 hectares are suitable for shrimp aquaculture and additional 11,000 hectares are suitable for construction of ponds which could potential produce 480,000 tonnes of farmed fish, of which, 300,000 tonnes could be at commercial scale. Currently, Mauritius produces 500 tonnes, but the 2007 Aquaculture Master Plan identified 21 potential sites for Barachois for 'ecotourismeaquacole' and potential for freshwater fish farming with an annual production estimates of 29,000 tonnes in the medium term and 39, 000 tonnes in the long term.

Seychelles used to produce an average of 50 tonnes of farmed prawns until production stopped in 2009. However, following the 2008 global food crisis, the government got concerned and decided to put in place a national aquaculture strategy. In 2009 a scoping study was conducted for a quick survey to identify potential for mariculture. This resulted in the production of a Mariculture Master Plan (2011-2015). Currently, a number of studies are being conducted for full assessment of gaps and needs, to establish elements for a complete framework, to develop an implementation plan, and establish an institutional capacity, infrastructure, code of practice, licensing conditions and other regulatory

frameworks for marine aquaculture. Seychelles is aiming at aquaculture production of 20,000 tonnes by 2020, using finfish, crustaceans and molluscs, employing over 2,000 people, and producing enough for the local fish markets (especially for tourism) and to enter new international markets (Seychelles Fishing Authority 2015).

3.0 Significance of Aquaculture in Africa

Aquaculture contributes or has the potential to significantly contribute to food and nutrition security as well as economic growth of Africans, and in particular poor households.

3.1 Contribution of Aquaculture Food and Nutrition Security

According to the 1996 World Food Summit, "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.*" According to recent statistics, a of 19.7 million tonnes of fish is produced every year in Africa (10.6 million from marine and 6.2 million from inland fisheries and 2.9 million from aquaculture). Much of this fish is consumed locally but part of it is sold for incomes which are used to purchase other types of food. An estimated 200 million Africa depend on fish as source of food. Fish contains high quality protein, ranging from 18 to 20% as well as all the eight essential amino acids, especially lysine, methionine, and cysteine. Since most cassava and maize-based diets lack these amino acids, the fish-dependent communities do benefit greatly from consuming fish. Fish is rich in polyunsaturated fatty acids such omega 3 fatty acids, which are important for the growth of children and do not lead to cardiovascular diseases. It's also rich in vitamins A, D and B, especially B1, 2 and 3 as well as micronutrients, zinc, calcium and iodine.

In addition, farmed fish is more superior food than most staples. For example, farmed tilapia is a better source of higher protein levels (14.1%) than rice (7%) or maize (9%). In addition, aquaculture has lower water footprints (0.75 litres.kg^{-1}) than most staples maize (1,000 litre.kg^{-1}) and rice (844-1670 litre.kg^{-1}) (Table 5). Therefore, tilapia farming is more ecologically sustainable; while at the same time, farmers gain more through better prices.

Table 5. Comparison of commodity prices, water footprint and protein levels

Crop	**Price (US$/kg)[1]**	**Water footprint[2] (litre/kg)**	**Protein (%)**
Maize	0.383	1,031	9
Beans	1.7	4,053	2.5[#]
Cacao beans	2.56	9,063	19
Potatoes	0.59	290	2.2[#]
Rice (paddy)	0.57	844 – 1670	7
Sugarcane	0.19	210	
Meat-cattle	2.89	15,415	12.0[#]
Meat-chicken	1.96	4,325	15.7[#]
Tilapia aquaculture	**2.07**	0.75*	14.1*

Source: [1]Adpated from FAOStats; [2]http://www.waterfootprint.org; *Boyd et al. 2007; Gephart et al. 2014

It is clear from these statistics that aquaculture is a very important source of food and nutrition security for many Africans, especially women. The contribution to food and nutrition security is in three ways, (i) as a direct source of food; and (ii) as a source of employment that enables those involved to earn wages with which to buys food and other household needs; and (iii) it leads to increased economic activities in communities involved through multiplier effect in the secondary economy.

3.2 Contribution of Sustainable Fish Farming to Socio-Economic Development

Aquaculture is developing into an industry with high potential to contribute socio economic development of the countries. Although the sector is its infancy in Africa, with development predominantly in a few a countries, it is already responsible for a significant portion of the economic activities, accounting for an estimated value of almost US$3 billion per year (de Graaf& Garibaldi 2014)[2]. The fisheries sector as a whole employs 12.3 million people as full-time fishers or full-time and part-time processors, representing 2.1 % of Africa's population of between 15 and 64 years old, of which, 42.4 percent are processors and 7.5 percent work in aquaculture. About 27.3 percent of the people engaged in fisheries and aquaculture are women, with marked differences in their share among fishers (3.6 percent), processors (58 percent), and aquaculture workers (4 percent). Case studies from Nigeria indicate that fish farming can be an attractive livelihood option to small scale operators who can earn as high as US$10000- US$15000/annum if well guided and supported.

In 2011, the value provided by the fisheries sector as a whole was estimated at more than US$24 billion, representing 1.26% of the Gross Domestic Product (GDP) of all African countries, with aquaculture producing an estimated value of almost US$3 billion per year (de Graaf& Garibaldi 2014)[1] (Table 5). Relatively, per unit production of fish is much higher from fish farms than natural sources of fish (oceans and lakes); and like crop farming, it is possible for fish farmers to control the farming environment and raise production through intensification. This is the reason why aquaculture has been attractive option to the dwindling fish production by make African policy-makers.

And relative to its size aquaculture contributes a lot to agriculture GDP (0.96%)(Table 5), hence, integration of aquaculture in CAADP has been easier than capture fisheries because fish farming is more easily associated with agriculture. Farmed fish has better prices (average US$2.kg^{-1}) compared to many crops grown by many farmers in African. For example, the staple such as maize (average US$0.38.kg^{-1}) and cash crops such as sugar cane (average US$0.19.kg^{-1}) or some of the common animal products such as chicken (average US$1.96.kg^{-1}) grown by many farmers in African (Table 6.)

[1]deGraaf, G. and Garibaldi, L. 2014. The Value of African Fisheries.Food and Agriculture Organization of the United Nations.FAO Fisheries and Aquaculture Circular No. 1093, Rome, Italy

Table 6.**Fisheries and aquaculture contribution to GDP in Africa**

Item	Gross value added (US$ million)	Contribution to GDP (%)		Average Price (US$/kg)	Employment	
		Overall GDP	Agric. GDP		Total (%)	Women (%)
Total GDPs African countries	1,909,514					
Total Fisheries and Aquaculture	24,030	1.26	6.02			27.3
Total Inland Fisheries	6,275	0.33	1.62	2.33	40.4	26.7
Total Marine Artisanal Fisheries	8,130	0.43	1.82	1.73	32.9	23.8
Total Marine Industrial Fisheries	6,849	0.36	1.62	3.46	19.2	43.5
Total Aquaculture	2,776	0.15	0.96	2.07	7.5	4.8

Source: FAO & NEPAD (2014)

4.0 The need for Accelerated Growth of Aquaculture in Africa

One needs to understand the development phases of aquaculture in Africa to appreciate the need for accelerated growth of aquaculture in Africa.

4.1 Development phases of aquaculture in Africa

The development of Aquaculture in Africa said to be at early stage of expansion phase with few countries dominating production of a large proportion from Aquaculture. The development of the sector can be categorised into four phases; three of these phases have been described by Hecht et. al (2006), who reported that **Phase 1**was between 1950 and 1970 when aquaculture was popularized through development efforts, but with limited knowledge and technical understanding; and most government departments and research centres were formed during this time.**Phase II** was from 1970 to 1995, which Hecht et al called "the expansion phase", and this phase saw significant donor support, active Research and Development (R&D), and government involvement in seed supply and extension. During this phase, commercialization of the sector was experienced in some countries, notable Nigeria, Madagascar, Côte d'Ivoire, Zambia, and South Africa.**The third phas**e was from 1995 to 2006, during which donor support to aquaculture development was reduced but the commercial sector also emerged. In addition to the three phases, it is clear that **Phase IV** has emerged from 2006 to date. This is phase coincides with the Pan-African focus on fisheries and aquaculture development as a result of political commitment that was made during the AU-NEPAD Fish For All Summit that was held in Abuja, Nigeria in September 2005. The summit was co-sponsored by the WorldFish and NEPAD Secretariat (now NEPAD Agency) as a joint initiative by WorldFish to promote fish consumptions (Fish For All Campaign) and NEPAD's continental agricultural development initiative, Comprehensive Africa Agricultural Development Program (CAADP). The Summit endorsed the NEPAD Action Plan for the Development of African Fisheries and Aquaculture, as a framework for integrating fisheries and aquaculture into the CAADP. This resulted in the increased awareness by governments of the development potential of aquaculture and increased private sector; with concomitant taking off of aquaculture production in many countries in Africa as can be seen in Uganda,(Figure 5), Kenya (Figure 6) and Ghana (Figure 7)

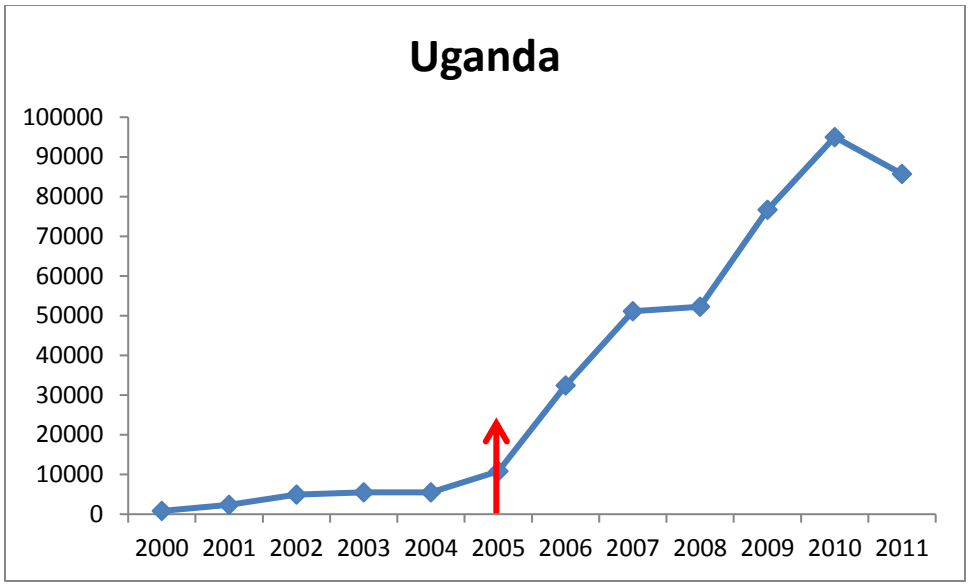

Fig. 5 Aquaculture Production in Uganda, showing the point to take-off

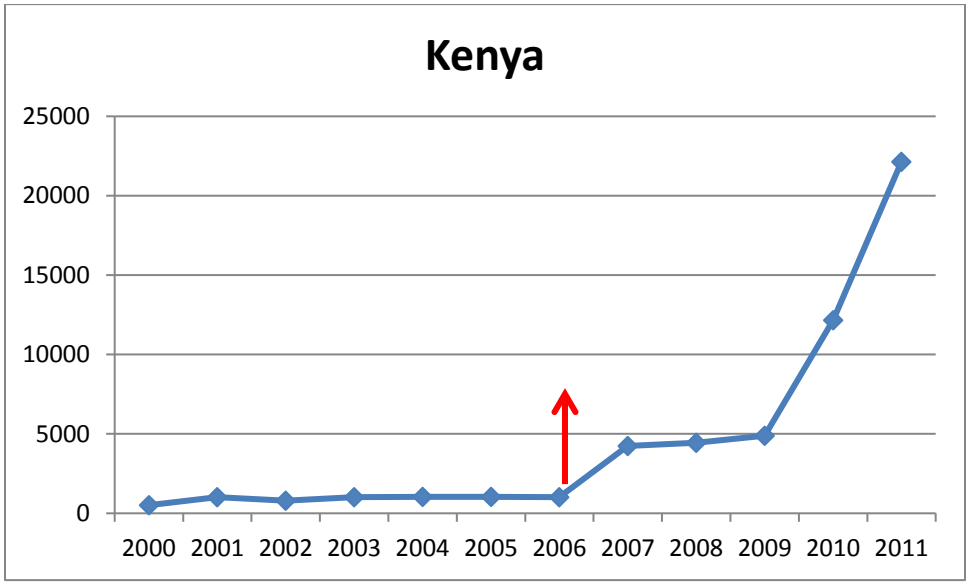

Fig. 6 Aquaculture Production in Kenya, showing the point to take-off

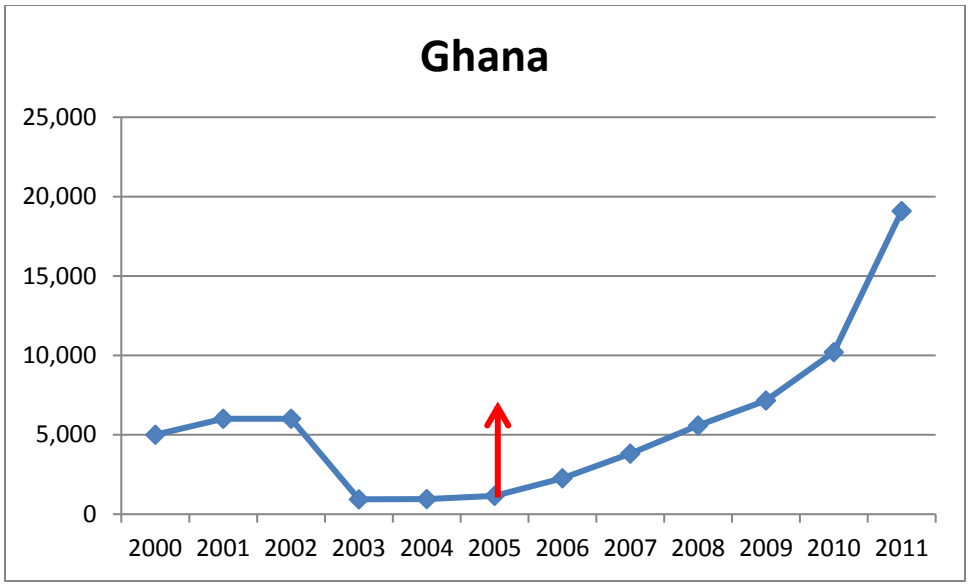

Fig. 7 Aquaculture Production in Ghana, showing the point to take-off

The rise in political attention of aquaculture is not misplaced. It is clear that there is need for concerted effort to respond to pressing issues of human population growth, urbanisation and the need for increased food production, especially the source of animal protein. Human population growth rates in Sub-Saharan Africa are among the highest in the world. Though declining, they remain well above world averages. The rate of growth in the region reached a peak during 1980–1985, 2.82 percent per year. Global population growth rates during 2005–2010 were 1.16 percent per year, and that is projected to decline to 0.34 percent by 2050. Comparatively, the Sub-Saharan African population growth rates for the comparable periods are 2.45 percent per year and 1.68 percent, respectively. The implications are a greater demand for food and agricultural output for both domestic and international needs. Similarly, rapid urbanization is also a remarkable characteristic of Sub-Saharan Africa. While the region is the least urbanized region of the world at 37.2 percent, its urban population is growing at 3.7 percent per year.

Population growth and urbanization are strong demand drivers as the total food need expands and urbanization changes diets and preferences.With income growth and rapid urbanization in Sub-Saharan Africa, the current supply trends suggest that demand growth would have to be met largely by an increase in imports and/or by expansion in aquaculture. Based on population growth alone, regional fish consumption (which

measured some 6.7 million metric tons in 2007) could easily exceed 10 million metric tons by 2030. If the region's fish consumption were to rise to current global average consumption levels, the regional demand could reach at least 20 million metric tons. In these circumstances, imports and aquaculture would have to increase from current annual levels of some 2 million metric tons (90 percent of which is imports) to more than 5 million metric tons, simply to meet demands associated with population growth.

The accelerated aquaculture growth needs a number of critical infrastructure support, including quality feeds, improve disease control systems and improved feeds and pond fertilization regimes.

4.2 Aquaculture Feeds Requirements

Expansion of the aquaculture industry will increase demand for organic and inorganic fertilizers for improving pond productivity and feed as supplement to natural foods in the culture systems or as main source of nutrition in culture systems that do not depend on natural productivity. Feed which constitutes more than 60% of production costs is mostly from farm-based manufacturing systems and is of low quality. In cases where the feed is manufactured by formal industries, it is expensive and some of the ingredients are imported from outside the continent. Innovations in the utilizations of locally available feed ingredients are not fully developed and information on locally produced animal protein ingredients like fish meal is not readily available. These challenges call for policies that will promote availability of organic and inorganic fertilizers and high quality feed at affordable price so that the aquaculture industry becomes profitable even for small scale commercial farmers and produces large quantities of fish that will compensate for the decline in capture fisheries.

The quantity demand for fish feed for aquaculture in Africa remains unknown, but a rough guide is the constituent ingredients of the feeds, that mainly comprise the protein (either from animal, usually fish meal or plant sources, mainly soy bean); a carbohydrate source (mainly maize); a source of lipid and other vitamins and minerals. Clearly, a rise in farmed fish production will require a resultant rise in maize and soybean. As the number of farmers moving from non-commercial to commercial aquaculture increases and with the growing advocacy for commercial aquaculture, the demand for aquaculture feeds is likely

to increase. Currently the aquaculture sector relies on farm-made feeds while feed manufactured by the formal industry accounts for less than 20% in most of the countries except in Egypt, Nigeria, Ghana, Mauritius, Zimbabwe, Zambia, Malawi, Uganda and other fast growing aquaculture countries.

4.2.1 Local sources of aquaculture feeds

Innovations have been made in seed production, pond construction and other technologies for aquaculture production in Africa but there is still the challenge of getting optimum fish feeds. This challenge needs to be addressed by continued exploration of the potential feed ingredients available on the continent and improving local production of high quality fish feed in order to maximize profits. Africa stands a chance of exploring alternative sources of protein for fish feed especially those that are plant based. Predominant feedstuff used in Africa are categorised into "conventional" and "non-conventional". The non-conventional are mostly not used for human consumption but in non-commercial aquaculture systems in rural areas. They comprise kitchen wastes, plant materials and animal materials. Kitchen waste are from household waste that are fed to fish for instance left-over foods including bread, cooked rice, hard porridge made from maize and other cereals, cassava and yam peels. Non-conventional feeds of plant sources are non-conventional plant feed stuff (NCPF) which are abundant in Africa and incorporated into aquaculture feeding regimes depending on availability, types of species being cultured, aquaculture system being practised and the nutrient level of the material. Although there may be many sources of the NCPF in Africa, their use is restricted by the fact that they are generally low in nutrition with low protein content, amino acid imbalance and some of them have anti-nutritional factors which may limit the growth of fish. Animal feed sources include tadpole meal, maggots, earthworm meal, housefly larvae. They are high in protein feeds but are unavailable in large quantities resulting in inconsistent supply.

Conventional feedstuff are manufactured based on specific standards and mostly originate from agro-industrial sources like rice bran, maize bran and some are animal based like fish meal, blood meal etc. They are used in the formulation of fish feed where a combination of cost of the feed ingredients and their richness in nutrients is crucial in producing a cost effective feed for fish. Unfortunately, the protein sources of fish feed are still expensive in Africa and information on the quantities of fish meal that is produced locally in African countries is not readily available.

4.2.2 Fertilizer use and feed manufacturing situation in the African aquaculture – selected case studies

African countries are capable of producing aquafeeds on commercial scale through on-farm production by informal manufacturers. There are also some formal producers of aquafeeds for instance in Egypt, Cameroon, Ghana, Uganda and Malawi. Pelleted fish feed are produced in few countries mostly in Egypt, Nigeria and South Africa, largely manufactured by animal feed industry on request, however it is expensive for most small-scale commercial operators to make profit in their enterprise.

In Egypt, chicken manure is used to improve pond productivity and the demand is expected to increase as the aquaculture industry grows. Inorganic fertilizer are used but to a very limited extent, estimated to be around 0.01% of total fertilizer used in the country. Commercial aquafeed production is on the increase, expected to reach 1.2 million tonnes/year by 2017 mostly dominated by sinking pellets but there is limited use of farm-made feeds. The main challenge experienced by the Egyptian aquafeed manufacturing industry is increasing price of ingredients, high tariffs on imported ingredients, spoilage during handling and storage and limited research on fish nutrition.

In Nigeria, application of chicken manure for pond enrichment is common but inorganic fertilizers are rarely used. Feed ingredients for manufacturing fish feed are locally available except fish meal, soybean and additives. In the early 2000s there were 620 feed mills operational for producing poultry feed and some of them produced fish feed on demand. Although there are 215 feed mills for the Catfish industry they still import about 4000 tonnes per annum of extruded pellet. The country experiences the constraint of availability of feed ingredients, a large proportion of farms are dependent of natural production and fish farm produced feeds. There is no animal feed manufacturing association in Nigeria, thus resulting in that commercial feeds produced are unregulated and not controlled by any branch of the state. The feed manufacturing industry is only operating at 56% of its potential capacity.

Uganda has a feed policy and a bill to ensure safety to consumers and good feed quality. A total of 80,000 tonnes of fish feed per annum is produced. One of the constraints for Uganda regarding feed is that it does not import fishmeal, availability of fishmeal from

the Nile Perch industry is affected by competition with human consumption therefore impacting on the price of the commodity and production is sporadic.

South Africa has a more development structure than other countries in Africa. As a result the country is able to regulate the feed produced through the Animal Feed Manufactures Association (AFMA) and it is the only country that is capable of producing good quality feed that is stable in water. In 2006 it had 73 feed mills that were members to the AFMA. Feed mills in Namibia and Botswana have also been allowed to join the association such that by 2010 there were 103 members. Due to the AFMA and its relevant infrastructure, South Africa has a large capacity to produce commercial aquatic feeds.

4.3 Aquatic Animal Health

Aquatic disease outbreaks in recent times has led to massive losses of shrimp farms in Mozambique and Madagascar mainly caused by the white spot syndrome virus (WSSV) (FAO 2015, Van Wyk*et al.* 2014). Epizootic ulcerative syndrome (EUS) has been reported in wild freshwater fishes in the Chobe-Zambezi River system due (FAO 2009) and the disease is thought to be spreading at a fast pace. Therefore, private sector and governments in many countries have realised the need to pay attention to this, and put in place policy and regulatory measures as well as practical steps to try and prevent future infections. RECs also realise the need to constitute regional strategies to deter the spread, noting that many countries are vulnerability since the water systems are shared, and hence turned localised infections into transboundary aquatic animal diseases (TAADs). As a result SADC recently finalised a regional strategy to enhance aquatic animal health and improve aquatic biosecurity at both the national and local levels.

In many parts of the continent, research into disease and water quality is sporadic and rudimentary, except for a number of universities, such as University of Ghana, Rhodes University in South Africa. The state of qualified fish veterinarians is weak in many countries. Recently, Rhodes University commissioned training courses aimed at retraining livestock veterinarians into fish disease experts.

5.0 The Way Forward: The Need for Evidence-based Policy Guidance for Aquaculture Development

Africa needs a comprehensive and evidence-based guidance to deal with the emerging advances in aquaculture development. This must be done within the context of:

a) **Changing development outlook:** since aquaculture has been identified by African Union and NEPAD as one of the important food production sector that can support the continent to alleviate the shortfall in the continent's growing demand for fish. Therefore, there is a need for a doubling of fish farming production in order to meet the demand for fish. For this to happen there is a need for an enterprise-led strategy for sectoral growth.

b) **Diversified development trajectory**: since aquaculture sector in Africa today is faced with factors that present great opportunity for growth, including positive and sustained production growth in many countries; rising urban (middle-class) population which is acting as catalyst for demand; and changing investment financing models where entrepreneurs, rather than farmers are investing in fish farming. However, situations differ from country to country. Therefore, in order to consolidate and achieve rapid progress, there is a need to understand the model for growth on a country by country basis. This will enable aquaculture to develop over a range of agro-economic zones and socio-economic contexts which characterize markets, demand and supply trends in many African countries.

c) **Alignment of development frameworks**: as stated earlier, the recent the second Conference of African Ministers of Fisheries and Aquaculture (CAMFA) that was held at AUC Headquarters in Addis Ababa, Ethiopia from 30th April to 1st May 2014, endorsed the AU Policy Framework &Reform Strategy (Pan-African Policy Framework). The Pan-African Policy Framework provides a guide to African countries for the development of aquaculture and creates a common platform for African fisheries policy-makers to define a common voice on global policy issues that have implications of African fisheries and aquaculture development. In addition, the CAADP is gaining momentum in many countries; and 30 of the 40 countries which have signed their CAADP Compacts have identified fish as one of the key drivers of the 6% growth target. Therefore, aquaculture development must be undertaken within the CAADP framework in order to contribute the country

food and nutrition security strategies as well as take advantage of the policies that facilitate the development of infant sectors.

d) **Impact monitoring**: as aquaculture is emerging as one of the growth sub-sectors of agriculture, it is critical to ensure that the incremental change in production and productivity is reflected in the CAADP Results Framework. The climax of the 2014 AU Year of Agriculture and Food Security was marked during the 23rd Ordinary Session of the AU Assembly in Malabo, Equatorial Guinea, on 26-27 June 2014 during which the Heads of State and Government (HOS&G) of the African Union adopted the Declaration on "Accelerated Agricultural Growth And Transformation for Shared Prosperity and Improved Livelihoods" (the "Malabo Declaration"). The Malabo Declaration adopted seven key commitments comprising the 2025 vision and goals of Africa Accelerated Agricultural Growth and Transformation (3AGT). Following Malabo, AU Commission and NEPAD Agency formulated the **Implementation Strategy and Roadmap (IS&R),** which wasadopted by AU Summit and launched during the 24th ordinary session of the AU Summit in January 2015. Therefore, quantifying the impact of aquaculture at farm, community and countries levels will enable the African Union and NEPAD, together with their member states to determine the conditions needed for aquaculture to support drive rural economies and transformation.

6.0 Areas of Intervention for the next 5 Years: Key Drivers and Lessons for Scaling Up

The study has generated a number of lessons that have great potential relevancy to policy makers in order to accelerate the sector's growth in Africa. And these include: (i) the need to strengthen knowledge base to understand demand and supply trends in order to generate and disseminate practical strategies that provide a guide on how to target public and private sector investment in order to realize positive social, economic and environmental outcomes; (ii) importance of providing high quality technical advice and support to policy-makers to enable them to effectively undertake requisite policy and governance reforms; and (iii) paying attention to the factors of production, including water, stocking materials, feed and managerial skills in order to stimulate adaptation of sustainable aquaculture business that lead to increased farmer incomes, resilient to external shocks, and rural job creation.

Therefore, in order for Africa to scale-up current success and accelerate aquaculture development, there is a need to focus on the following 6 issues:

6.1 Strengthen knowledge base of aquaculture to accelerate aquaculture growth and transformation

The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa emphasises the urgent need to strengthen the knowledge base of the sector and increase the capacity of key stakeholders to develop and implement a strategic perspective on its future. A few years ago, the African Network of Fisheries Scientists (AfriFishNet) was launched with the aim of enhancing the role of scientists in increasing the profile of fish issues in the country CAADP process (CAADP Expert Pool on Fisheries). Research and science have a critical role to play in this transformation, yet current capacity among research, knowledge and training institutions in Africa is still weak. The following are some of the key recommendations with regard to science for aquaculture transformation:

a. Strengthen and build capacity for aquaculture research as well as develop high performance fish farming techniques
b. Facilitate development of human and institutional capacities for scientific work at regional (including options for an ACP-wide collaboration) and national levels
c. Build aquaculture management capacities for implementation of new approaches in aquaculture e.g. Ecosystems approach to Aquaculture (EAA)
d. Encourage private-sector research and extension services
e. Create African Centres of Excellence for Aquaculture (ACEA)
f. Strengthen aquaculture research and technology development and policy networks, through AfriFishNet and Aquaculture Network of Africa (ANAF) as well as Regional Organisation under the FARA systems (e.g. RUFORUM, ANAFE)
g. Support/strengthen the capacity or development of training institutions for middle-level manpower development in aquaculture technologies

6.2 Harnessing markets and trade opportunities

The expected impact of the fisheries and aquaculture efforts of the African Union, as defined during the first CAMFA, is that **African fisheries resources contribute sustainably to inclusive growth.** One of the Intermediate Development Outcomes (IDOs) is that **"**national and regional economic growth is facilitated through integrated trade in fish and fish products". Fish and fishery products have been reported to be among the most traded food commodities worldwide, with trade volumes and values reaching new highs in 2011 and expected to carry on rising with developing countries continuing to account for the bulk of world exports. FAO estimated that between 2008 and 2010, Africa has been a net exporter by value, US$5 billion per year, against imports of US$2.9 billion; with a modest level of intra-regional trade of US$744 million. However, Africa is also the major importer of fish and fishery product; with imports outstripping exports in terms of volume. Fish imports show up three key priorities: i) importing to add value through further processing and then re-exporting; ii) importing to meet the needs of a more wealthy section of the population, whether locals or tourists; and iii) importing to feed those who are poorer. The following are recommendations:

a) Strengthen the development of value added products for aquaculture in order to support wealth creation
b) Harmonize fish trade policies & legal frameworks (REC Protocol on trade)
c) Reduce tariffs and non-tariff barriers and support establishment of common external tariff in order to enhance intra-regional fish trade
d) Strengthen trade capacities at country level, especially for local fish farmers, and build physical and institutional trade infrastructure in order to increasing domestic and intra-African fish trade and investment.
e) Support the implementation of eco-labelling mechanisms consistent with the policy on aquaculture environment and biosafety requirements.
f) Improve the fish trade data collection system, analysis and reporting and harmonisation in all countries in Africa.

6.3 Harnessing investment financing for Small and Medium Enterprises in aquaculture

As many African countries are finalising their CAADP processes and signing Compacts, it has been observed that most of the National Agriculture Investment Plans are less clear on how the 6% growth will be contributed to by the private sector investments. While NPCA and AUC have guided governments in designing instruments for public sector investments, such as CAADP, not much has been done to facilitate the private sector to play its role in supporting governments deliver on their development goals. Furthermore, small and medium enterprises struggle to find funding to finance their fisheries and aquaculture business because banks are less inclined to fund business with small capital requirements. Therefore, the concept of Impact Investment Fund for SMEs in African Fisheries & Aquaculture has been developed and will aim at establishing an innovative source of funding for the SMEs. The following are recommendations:

a. Develop strategies to improve the financial services that are offered to SMEs in the aquaculture value chains.
b. Review and deepen the understanding of the aquaculture value chains, including axillary industries, as well as processing and tertiary services.
c. Specific actions, aimed at improving the enabling environment for financial services for aquaculture be included in the CAADP Country Compact Investment Plans
d. Promote the Impact Investment Fund for SMEs in Aquaculture, especially targeting women and youth
e. Assist member states to develop innovative approach for increasing private sector investment in aquaculture through PPP, clearly identifying roles of private and aquaculture
f. Support/strengthen the operationalization of AFRM as an AU coordinating platform for coherence in aquaculture development interventions/investments by development partners

6.4 Increase awareness of contribution of Fish and aquaculture to Food Security and nutrition

In general there little attention paid by policy makers to the contribution of fish or aquaculture to food and nutrition security. A recent study that analysed 84 policy papers of Eastern African countries, found that only 40% of policy papers mention fish, and only very few food-security policy papers take fish products into account. The overlooking of fish happens in many countries, even in those countries where fisheries contribute significantly to animal-protein intake.

In addition, African scientists have not been able to develop acceptable fishery products to use as complementary foods for young children. Furthermore, efforts by countries to strengthen aquaculture and fisheries programmes by mainstreaming nutrition in their community-based projects have not been common and well implemented. The following are recommendations:

a) Undertake research to gain a better understanding of the role of fish in decreasing malnutrition and improving the health of the sick.
b) Deepen the understanding of the value/benefits of aquaculture to rural livelihood and food security and ensure that reforms are undertaken within the context of food and nutrition security considerations.
c) Strengthen regulatory frameworks to protect operations of small-scale aquaculture
d) strengthen consideration of aquaculture in national and regional policies and actions on food security
e) support post-harvest activities through adequate investments and policies
f) develop sector-wide strategies at national level for expansion and intensification of aquaculture
g) harness the opportunities for small and medium enterprise development provided by expanding domestic markets for fish, including growing urban demand
h) expand the adoption of integrated small-scale aquaculture as a means of increasing rural productivity and food security
i) Training of fish farmer and fish processors – with specific focus on women processors - and fish traders on better handling of fish products, in order to reduce physical post-harvest losses.

j) Support the development of national policies for aquaculture that promote appropriate infrastructures for enhancing fish processing, trade and marketing in urban and rural centres to ensure good quality and lucrative fish products.

6.5 Resilience and risk management, including Climate Change

The aquaculture sector is vulnerable to general disasters of human origin, changes in food and nutrition security, conflicts, protracted crises, and the HIV and AIDS pandemic. Other sector-specific hazards and disasters also exist such as transboundary aquatic animal diseases and pest outbreaks that can have significant impacts on aquaculture production. Impact of climate change on aquaculture might be manifested through weakening supply and delivery of such inputs as feed and seeds; as well as the weakening of pond productivity. Key priorities include:

a) support the inclusion of aquaculture in existing Climate Change & Agriculture (CCA)/Disaster and Risk Management (DRM) Policy and Strategy processes in order to address vulnerabilities of aquaculture, as appropriate.
b) strengthen regional research that provides improved understanding of climate change impacts and knowledge to reduce uncertainty
c) strengthen partnerships between organisations to share practical lessons on CCA and DRM and to improve strategic planning to increase resilience
d) support the inclusion of aquaculture in national planning processes and frameworks, taking into consideration community needs, such as in the NAPAs, National Communications, CAADP compacts, Poverty Reduction Strategy Papers (PRSPs), DRM policies and plans,
e) Update Ecosystems Approach to Aquaculture (EAA) management plans, taking into account CCA and DRM needs and support implementation.
f) Climate-proofing of the national (CAADP) investment plans (in respect to aquaculture) as well as providing a step-by-step guidance on how to do this
g) Establish early warning systems at local, national and cross-national levels
h) Support the implementation of international and regional best practices and technological adaptation for aquaculture development.

6.6 Data collection, analysis and dissemination

African fisheries and aquaculture data-collection systems are not performing satisfactorily, and do not deliver all the information required for assessing the appropriateness of fisheries and aquaculture policy and management decisions, and for tracking the status of exploitation of fishery resources and the overall performance of existing fishery management measures. Therefore, the first CAMFA Decisions and the subsequent Pan-African Strategy on Improvement of Fisheries and Aquaculture Data Collection, Analysis and Dissemination were in response to this call. This strategic document is intended to provide a framework and guidelines that should lead to improvements in the availability and quality of national and regional data to support fisheries management, aquaculture development and policy development in Africa. The following are the recommendations:

a. Strengthen the biological, economic, social and governance dimensions in aquaculture data collection and analysis
b. Strengthen/establish training institutions for professional middle-level manpower development in data collection for aquaculture;
c. Incorporate aquaculture statistics into National Statistical Systems and the National Strategy for the Development of Statistics (NSDS);
d. ensure that aquaculture data contributes to the monitoring of the Comprehensive Africa Agriculture Development Programme and the Global Strategy to Improve Agricultural and Rural Statistics.

6.7 Gender and youth

In African fisheries the latest data indicate a total employment of 19.2 million people with 34% who are women; 96% of the female employment is in post-harvest activities 3.1 % are employed as fisher and 0.7 % are employed in aquaculture. The total contribution of fisheries and aquaculture to Agriculture GDP is estimated at 9.2% (26.6 billion USD) of which an important share is generated by women. Approximately 60 percent of the African population is younger than 35 which make it the 'youngest' continent. In spite of gender having been on the development agenda for many years, gender inequalities continue to hamper sustainable development and economic growth. Insufficient attention is given to the complex relationships between women and men in the fish value chain and the power imbalance between men and women in access and control over resources,

services, assets and ability to influence decisions affecting their lives. Youths are neglected in most of aquaculture initiative. The following are the recommendations.

a. Gender and youth considerations should be included in aquaculture policy, laws and, based on gender-disaggregated sector data (by age and occupational categories).
b. Promote effective participation of women and youth in decision-making processes (on aquaculture development and investment planning) at local, national and regional levels.
c. Use value chain approach to define support for improving women and youth labour productivity in aquaculture.
d. Eliminated and create conducive and enabling environment for decent youth employment including access to financial services and youth friendly health services.
e. Promote empowerment schemes for enhancing the roles or activities women and youth in aquaculture development activities including trade, marketing, production
f. Facilitate the development of Women and Youth Forums on aquaculture at national and regional levels, e.g Youth For Fish Programme (YFFP), YPARD

6.8 Support Implementation of Continental Policy and institutions

Within the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa are (i) the framework for an AU-based African Fisheries Reform Mechanism (AFRM) and (ii) the reform strategy. The purpose of the Reform Mechanism is to facilitate the development, adoption and implementation of reforms in fishery governance and management that would contribute towards transforming Africa's fisheries from current levels of overexploitation and overcapitalization towards environmental, economic and social sustainability. The reform strategy aims to guide the design and implementation of policy and governance reforms by African states. Under the Mechanism, the CAMFA Secretariat has been established at the AU-IBAR in order to provide secretarial support to the CAMFA; while the NEPAD Agency houses the Think Tank Secretariat which coordinates research and policy dialogue aimed at generating evidence for reforms. The Pan-African Fisheries and Aquaculture Policy Framework and Reform Strategy was developed through partnership and participatory approaches within the framework of this continent-wide coherent mechanism**.** The following are the recommendations:

a. Take into account the full range of benefits from aquaculture, including food and nutrition security, welfare and economic development in order to strengthen the role of aquaculture in national economic development.
b. Build capacity and develop institutions, in both the public and private sectors, to support successful aquaculture reforms
c. Value aquaculture as a potential vehicle for job creation and alternative livelihood opportunities.
d. Support operationalization of the AFRM as well as the AU Aquaculture Working Group, as the continental platform for coordinating coherent intervention and investments in aquaculture, linking with the Caribbean and Pacific

7.0 Conclusion

The need to accelerate growth of aquaculture in Africa is enormous if one considers the importance of fish as income earner as well as its contribution to food and nutrition security. On the other hand Africa has the land and suitable water environment but which remain unexploited for aquaculture including brackish waters, coastal areas and land where fish ponds can be suitably placed. The eight areas identified in this study are the key drivers and menu which, if implemented, are likely to see aquaculture growing in the next 5 years.