Centre for Development Innovation

Quick scan to identify and discuss options for improved fish production in Rwanda

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Project Report



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February 2013
Project code 8141215200
Report number CDI-13-017
Centre for Development Innovation, Wageningen UR

Quick scan to identify and discuss options for improved fish production in Rwanda

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July 2013
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Report on the outcomes of the quick scan carried out in January 2013 on the request of the Netherlands Embassy in Kigali, Rwanda to appraise the current situation in the fish production sector.

Cover photo
Market in Kigali, Rwanda

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Executive summary

On the request of the Netherlands Embassy in Kigali, Rwanda, a quick scan was carried out in January 2013, to appraise the current situation in the fish production sector.

The intricacy of the various aspects and components as well as the underlying constraints and perspectives of the fish production sector were analysed and discussed with a range of direct and indirect stakeholders, which led to the identification of three main categories of concern:

1. Fish farm economics: *Is fish farming profitable enough to keep farmers interested and to attract investors? In other words does the fish farming enterprise create enough revenues to develop a sustainable business.*
2. Animal feed industries: *How to develop a cost effective animal feed industry?*
3. Governance of the value chain: *What will determine the sustainability of the fish value chain in Rwanda?*

The particular recommendation on the 1st issue is: As data on the economics of fish farming are lacking, it is recommended to initiate a comprehensive study on fish farm economics in Rwanda and to develop common, financially viable prototypes for the farming of fish. As cage farming is assumed to be most promising in view of the many lakes in Rwanda, a pilot project is proposed to examine the feasibility of commercial fish farming in cages, meant to test and verify best equipment, technologies and farming practices and to record results and other relevant data needed for the development of 'evidence based models' for (larger scale) introduction and development of cage farming in Rwanda.

The particular recommendation on the 2nd issue is: To establish a number of small to medium scale animal feed plants (10-20 tons / week) for the processing of local agricultural by-products to strengthen the supply chains and services for the animal production sector at large and to facilitate the production of fish feeds.

The overall recommendation on the 3rd issue: To enhance professional networking and alliances amongst investors, entrepreneurs and knowledge brokers at all levels, to increase the sharing of knowledge and expertise and therewith improve the capacity and competences of farmers as well as the governance of the supply chain (feeds, seeds, equipment) and value chain (transport, storage, marketing and quality assurance).

1 Introduction and background

Over the past decade Rwanda has shown a remarkable increase in agricultural production and economic development. But although Rwanda is endowed with abundant water resources and a relatively favourable climate for fisheries and fish farming, fish production does not meet the demand on the market. Fish production from the lakes is dwindling due to overfishing, while the production from fish farming is still in its initial stage of commercial production.

Fish can be considered as a commodity or cash crop, but must first of all be viewed as a means to improve food security and nutrition, because fish contains high quality proteins, vitamins, minerals, and other nutrients, important for human health and growth. In addition aquaculture contributes to diversification of rural activities, the creation of employment and generation of supplementary income, especially in rural communities, where opportunities for economic activities are limited.

To date, aquaculture in Rwanda is still essentially a rural, secondary and part-time activity taking place in ponds (as individual household or as a cooperative). Extensive to semi-intensive farming systems produce limited fish yields, which are mostly consumed directly, bartered or sold locally as cash crop. Most fish farming is carried out by small-scale operators as a secondary activity to agriculture. Labour (for digging the ponds, for compost making and feeding) is still the main resource used, leaving much room for improvement of farm level efficiency. Development of more commercial fish farming is needed to meet the increasing demand for high quality fish at the urban consumer markets in Rwanda. Commercial fish farming however warrant proper functioning of the supply chains and services as well as skilled human capacity to sustain the value chain.

Current situation

The per capita fish consumption in Rwanda is low, when compared to neighbouring countries. Nevertheless fish is considered a healthy product as it provides high value proteins, which can easily be digested, as well as a number of essential vitamins, minerals, fatty acids and other micro-nutrients crucial to a healthy diet of the people. More critically, the consumption of fish combats stunting and malnutrition, which unfortunately still forms a serious problem in Rwanda. While the demand for fish is increasing, the catches from fisheries are dwindling and markets are largely undersupplied. Fish is mainly sold at the lake shores and farm gates and intermittently reaches the larger domestic markets In Rwanda.

The Paigelac project on Inland lakes integrated development and management support funded by ADB, was implemented from 2006 – 2012. Main objective of the project was to contribute to the strengthening of the food security in all 30 districts of Rwanda. Its specific objective was to improve the incomes of actors in the fishery sector in a sustainable manner. Beside capacity building in lake management, sustainable fishing methods and the construction of landing sites, the project has contributed to the development of fish farming through the renovation of Kigembe fish farm in the south, including a modern fish hatchery, the introduction of improved Tilapia niloticus brood stock, rehabilitation and construction of fish ponds as well as the supply of fingerlings and fish feeds to fish farmers. Due to the Paigelac project, fish production systems are currently viewed as suitable complementary sources of valuable food and income. But despite the favourable conditions and prospects, the development of aquaculture still warrants reinforcement to become resilient, while capture fisheries in the lakes is facing serious problems of overfishing as a consequence of the influx of new entrants from rural areas, searching for alternative livelihoods.

Government policies with respect to fish production

In Rwanda the political will to develop the fish production sector is very positive. The Master Plan for Fisheries and Fish farming in Rwanda, submitted to the Ministry of Agriculture and Animal Resources

(MINAGRI) and adopted by the Rwandese Government confirms the commitment of the government. To advance national food security, the government of Rwanda has adopted a *Master plan for improved utilization of its aquatic resources, fisheries and fish farming*. The master plan was formulated on the request of the Ministry of Agriculture and Animal resources (MINAGRI). The envisaged development trajectory as outlined in the master plan is reflected in the Vision 2020 and the Economic Development and Poverty Reduction Strategy (EDPRS) 2008 – 2012. Both the Vision 2020 and the EDPRS 2008 – 2012 point to transformation of the fish sector from subsistence into a productive high value, market oriented sector including:

- intensification of sustainable fish production systems
- development of an efficient private sector
- building the technical and organizational capacity of farmers
- promoting commodity chains and agribusiness
- strengthening the institutional framework of the fish production sector at central and local level.
- building national capacities in technical supervision, extension and research
- reforming the regulatory framework in order to encourage private investment in fishery and aquaculture
- promoting rural credit in the sub-sector
- improving marketing of fish products.

To achieve these objectives, the master plan is tracking three main thematic routes:

1. Developing knowledge based (private sector driven) aquaculture and fisheries systems.
2. Strengthening the institutional capacity to manage and develop fisheries resources in Rwanda (management and regulations, research, technological development and innovations, training and advisory services).
3. Creating an enabling environment and economic strategies for the private sector to play their role in increased fish production.

Terms of reference of the Quick scan (see Appendix 1.)

In order to support the government of Rwanda with respect to the implementation of its master plan, the Netherlands Embassy in Kigali invited the Centre for Development Innovation (CDI), Wageningen UR in the Netherlands, to carry out a quick scan to:

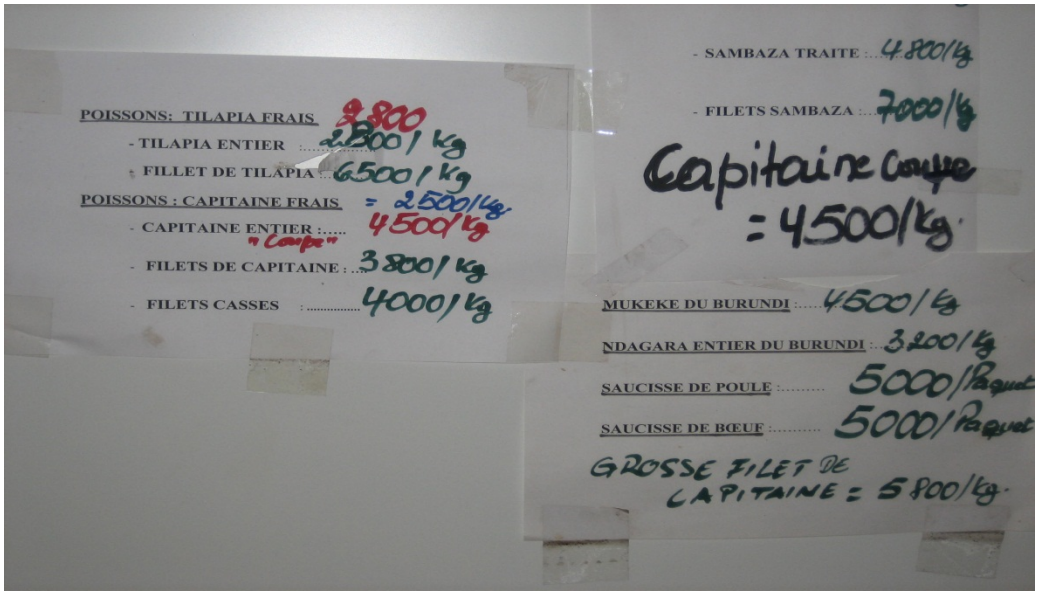
- discuss the master plan with relevant persons and institutions
- carry out a baseline survey to appraise the current production, farming practices and supply chains
- assess the potential for fisheries and aquaculture development and to identify options for strategic interventions and investments
- assess the needs for institutional and technical support

2 Major findings and recommendations

Fish as food

Rwanda has abundant water resources and fish is popular, fetching a good price. The price for fish ranges between the price of chicken and the price of beef. A market survey in Kigali indicated variable but high prices of fish ranging from FRw. 2500 for big Tilapia (~ 2kg) on ice from Uganda, to FRw. 300 – 700 for fresh Tilapia from the lakes. For dried Isambaza (small pelagics from lake Kivu) consumers have to pay RFw. 3000 /kg at the market, while the similar small fishes from lake Victoria and lake Tangayika (so called Dagaa) fetch resp. RFw. 2000 and 5,500 per kg. Small fishes are tasty, can be kept for quite some time, are considered suitable family food and largely contribute to food security and improved nutrition.

Prices in super markets show that the price for fish may go up to RFw. 6500/ kg for Tilapia fillet and to RFw for 4800 for dried Isambaza.



Announcement in a supermarket

Fisheries

Artisanal fishing in the abundant lakes and rivers has been practiced in Rwanda for many years. Fisheries is still considered to be an 'open access' income generating activity. With the increasing splitting up of farm land and the absence of alternative income sources, fisheries became a last resort for food and income for many (fishers, processors and traders). And with the increasing fish demand and price of fish in the country, fishing effort increased and gradually went beyond sustainable levels of harvesting.

Indicators of over-exploitation are the reduced number of larger- sized fish, less catch per unit fishing effort and increased fluctuations in the annual catch volumes. Fishers often react to decreasing harvests, by reducing the mesh size of the nets to catch the smaller sized fish, thus further harming the recruitment of the fish stocks. Without proper fisheries management systems and willingness of the fishers to adhere to the government measures taken to restore the stocks, overfishing becomes a persistent problem to the detriment of many. Conflicts between fishers will increase and ultimately the situation will force fishers, processors and traders to look for alternative livelihood strategies.

Aquaculture

Over the past fifty years, numerous schemes to develop aquaculture have been initiated in Rwanda. In most cases the number of ponds increased and production improved during the project life, but attention generally faded away again, once the projects came to end. It is important to understand the reasons behind this phenomenon, to enable the sector to develop in a sustainable and viable way.

Conditions encouraging agricultural production generally favour aquaculture and vice versa. Agricultural by-products and animal wastes can be a source of fish feed or pond fertilizer, while nutrient rich pond water can be used to grow crops. Fish production has several advantages over land based animal production systems due to the more efficient food conversion rate (FCR) of fish, that is the number of kg of feed to produce 1 kg of fish. On the other hand aquaculture poses a number of specific management problems, which generally do not play a role in land based animal production systems. Also, pond construction changes the nature of the land, making it almost impossible for use by other farming practices because of the expense and difficulty involved in removing dams, levees and drainage structures, once these have been established.

Given the requirements for (flowing) water, the ideal locations for fish ponds will mainly be located below reservoirs (that is, in irrigation schemes or municipal reservoirs) and along perennial rivers and streams. These areas, however, are also suitable agricultural land and fish ponds must earn a revenue, that outweighs or at least compares with the revenue that can be obtained from agriculture (the so called 'opportunity costs'). These opportunity costs may vary over time, as the farmer selects his farming system not only according to soil and rainfall, but also on the basis of market prices.

In this report, the findings of the quick scan will be communicated, with the main intention to share information and to enable stakeholders in the sector to comment and add on. Focus will be on currently felt constraints as well as options for further development of the fish sector. As discussed during the debriefing session in Kigali, the findings can be grouped under three main categories: economics of fish farming, fish feed and governance of the value chain.

Issue	**Effect**
1. Lack of reliable data on economics	Weak farm management and business planning; Unknown economic viability of enterprises; Credit and subsidies limited.
2. Lack of local fish feed production	Imported feeds are major cost factor in fish farming
3. Inadequate institutional infrastructure	Illegal fisheries and high cost for MCS; & governance of the value chain lack of sharing of knowledge and expertise; limited scope for advanced technical innovations

Ad 1) Lack of reliable data on economics

Main question

Is fish farming profitable enough to keep farmers interested and to attract investors? In other words does the fish farming enterprise create enough revenues to develop a sustainable business?

Findings

- Information on investments, cash flow and operational costs in fish farming is barely available. Therefore no clear picture on the economics of fish farming (ponds & cages) exists, preventing banks from investments in the sector.
- Feeds are by far the largest cost factor. The only concrete data in this context were obtained from a private fish farmer in Kibuye (Jerome). He was running a profitable business by producing fish feeds at his premises and fish in ponds (private) and in cages (from the coop). With a FCR of 1.5:1, the costs of the feed to produce 0.8 -1.0 kg fish are ~RFw 900, while the fish can be sold for RFw 2000.
- Benefits may only be accrued after months of investments and intensive labour. Relatively high investment costs for pond lay out and cage construction, plus a delay of about 6 months, till the first harvest, make it hard for farmers to continue, meanwhile hoping for better times to come.
- Successes are based on personal commitment and 'determination', management skills and: intelligent investments to reduce costs.
- No view on the costs involved in the logistical and technical aspects of the supply chain (equipment, fingerlings, feeds etc.)

Recommendations

- Record keeping of the fixed and variable costs of production from both pond and cage culture, is needed to enable farmers to assess the financial viability of fish farming, to adjust farming practices, to monitor strengths and weaknesses in management and to investigate options to improve economic performance.
- A study should be carried out to collect and analyse data and evaluations on the design, investments and durability, financial aspects, socio-economic consequences and environmental impact of fish farming to be compiled in a common knowledge base, to enable critical analyses of the viability and prospects of fish farming practices. Such knowledge base can be developed in collaboration with the private sector and input suppliers.
- Financial implications of setting up a cooperative-driven fish farm including investments required and projection of revenues and return on investment, should be more transparent, to enable members of cooperatives to (re) direct their attention and effort.
- Institutional infrastructure and capacity needs to be strengthened to provide necessary development support and services to achieve the objectives of the master plan (feed and seed supply, infrastructure, market and policy requirements).
- The logistical basis and technical infrastructure for input supplies (fingerlings, feed, equipment) to the fish farmers need to be further developed taking economies of scale into account.
- A pilot project in cage farming is proposed to examine the feasibility of commercial fish farming in cages in the various lakes in Rwanda. The pilot project is meant to test and verify best technologies and farming practices and to record results and other relevant data needed for the development of 'evidence based models' for the introduction and development of cage farming in Rwanda. Special attention will have to be paid for aspects like the impact of temperature and the quality and cost of the fish feeds on the growth of the fish.



Cage culture in lake Kivu

Rationale with respect to the recommendations

Aquaculture development in other parts of Eastern Africa have shown that overly optimistic views on production targets may lead to underestimation of problems and induce a learning curve that may be much longer than expected. For instance, cage culture turned out to be more expensive than anticipated, not so much due to the cost of the structures, as to the expense which the farmer had to pay for reasonably balanced fish feed. In all cases the need for business-like approaches in fish farming and brood stock management was stressed, besides the need for private sector run feed plants and supply chains.

International studies on fish farming in ponds, show that analyses of cost and returns and rate of return, indicate that combinations like fish and pigs, fish and (composted) chicken manure, fish and ducks etc. can be economically feasible (with the exception of fish-cow systems). Often partial harvesting of fish for food or sale and the flexibility in timing complete harvests, allows farmers to schedule harvesting in accordance with labour availability. For instance immediate and continuous cash income may be made available from the sale of eggs, while larger cash incomes rely on xx monthly intervals from the sale of pigs, rabbits, ducks and fish etc.

Pond aquaculture is more cost effective in case of production of smaller Tilapia (up to around 200-300 gr), whereas cage culture is more cost effective, when aiming for the production of larger sized fish. Agricultural by-products and animal wastes can contribute to the fertility of the ponds and increase yields from natural production. In more intensive pond farming, such by-products can reduce feed costs by replacing some of the formulated feeds needed. Consequently the feed conversion (FCR = kg of feed per kg produced fish) will be lower in ponds than in cages.

Economic analysis and planning of fish farm production systems is needed to understand the potential for further development and to balance investments, production cycles and income and to improve the planning and decision making of farm managers. In this context labour needed for feeding, weed and water control, pond management and maintenance, harvesting, marketing and subsequent cycle start-up activities has to be taken into account and be combined with other farm production systems.



Pond fish farm with rabbits

In cage culture, the formulated feed is the sole ingredient food input, whereas in a pond environment fish also feeds on algae, zooplankton and detritus. In cages Tilapia may grow from 15 gr to 500 gr during 6 months. When temperature is low, it may take them longer, even up to a year. The FCR for fish may vary from 2.0 to even less than 1, depending the quality of the feed, the management and the environmental conditions. As the actual costs of the feed largely determine the profitability of fish farming in cages, the FCR should preferably be low, to reduce the costs of production. Sensitivity analyses for instance have shown that FCR in cage culture should be below 2 to be profitable.

In addition to biotic factors like water temperature and the quality of the water, the profitability of cage culture is affected by a host of factors like the quality of investments made, management and operational costs, costs of inputs (feed and fingerling) and the existence of a conducive business environment. At a business level the profitability is determined by:

- sale price (urban retail price)
- feed conversion rate (FCR)
- size distribution
- life span of the equipment
- stocking density

In cage culture the first year of production, the economic profits may be a bit lower than in full production, which can be achieved in year 2-4 onwards. Managers and staff need to learn (through in service training) and to develop their capacity to produce fish efficiently. Inexperienced farmers tend to overfeed or underfeed their fish, whereas experienced farmers have learned to administer the optimal quantity of feed.

With respect to the economics of cage culture, the costs of the structure per m^3 of cage volume can be used as an indication of the costs for investment per kg produced fish. The lifespan of the nets depends on the net quality and may vary from 2 -5 years. Note that cages do not need to be big in size as -in general- the optimum production density decreases with increasing cage volume. Hence smaller cages may be relatively more cost effective.

The relevance of aquaculture economics grows as the farming of fish becomes a more commercial activity. A comprehensive production economic analysis is needed to estimate the feasibility and profitability of (further) investments, to determine the efficiency of land and water use, to improve existing management practices and to evaluate the suitability of new technologies, facilities and infrastructure. A comprehensive data collection and record keeping mechanism needs to be in place, to strengthen farm management and to put commercial aquaculture on a solid profitable footing. Moreover such information

is basic to enable the development of business plans and needed to convince banks to invest in fish farming.

As production increases, marketing becomes more important and it is critical that marketing logistics and consumer preferences be taken into account at an early time in the production cycle.

Ad 2) Lack of local fish feed production

Main Question

How to develop a cost effective animal feed industry?

Findings

The growth of the fish largely depends on the availability and nutritional value of the fish feed. In intensive fish farming, the procurement of fish feed may account for 70-80% of the total costs. While for instance maize bran and agricultural waste products can be used in a pond culture system, where the fish is also feeding on plankton life, high quality floating feed pellets are imperative in the case of cage culture.

Animal feed production in Rwanda is still based on local small scale industries. The only fish feed production unit visited, was located at the premises of a commercial fish farmer in Kibuye. Other fish farmers stated that their feeds came from Paigelac, were purchased either from Israel (expensive but good quality) or from Uganda (less expense but of variable and rather unreliable quality). The mission was informed that several plans (GoR and private sector) exist to develop the animal feed industry in Rwanda, in order to enhance animal production.

According to the Master plan, fisheries and aquaculture are priority sectors with an increased target production of 17.000 tons per year and 112.000 tons in 2020 in order to attain sub-Sahara per capita fish consumption of 6.6. kg. To produce about 100 000 tons of fish through intensive aquaculture systems, a fish feed production of about 200 000 ton per year will be needed.

A pilot survey was made on the availability of agro-industrial by-products and agricultural waste, in order examine the scope for fish feed production in Rwanda. The results of the pilot survey indicates that in Rwanda the production of waste and by-products is more than sufficient to justify the development of a national animal feed industry. (see Appendix 2 for the preliminary findings of the survey). In order to achieve the objectives of the Master plan, the following particulars have to be taken into account:

- Quality (commercial) feed production is key for the aquaculture sector as well as animal production units in general to take off as viable enterprises.
- So far no consistent approach or roadmap exists for the development of animal feed industries in Rwanda, though the urgency for increased animal feed production of standard quality is very well recognized: the targets set for increased animal production cannot be met if no animal feed industry is capable to back up the growth of the animal husbandry sector.
- Better quality feed will increase the growth rate as well as the health of the animal. In this way the availability of improved animal feeds will improve the value chain, increase the availability of good quality food for the consumers and create better incomes and employment for the producers, processors and traders. Moreover offal and waste will be utilized, thus reducing environmental problems.
- The findings of the pilot survey show that the production of animal feeds on the basis of by-products/ waste/ postharvest losses, locally available in Rwanda can be done at a local, district

and national level, thus reducing the transaction costs and the price for animal feeds for the primary producers.
- In the case of cage culture, floating pellets are needed to keep the FCR and the costs of the feed at acceptable levels. Such floating pellets require expensive production technologies, the introduction of which will only become economical attractive, once production of larger quantities of fish feed becomes relevant.

Recommendations

- To establish a number of small to medium scale animal feed plants (10-20 tons / week) processing agricultural by-products and waste locally available, to boost the animal husbandry sector. From the economic point of view a number of feed plants located close to important agricultural production areas, is preferred to one big national feed plant, to keep the transaction costs lowest.
- Capacity building is needed with respect to the operation and management of a feed production unit and how to compose the various feeds on the basis of formulas as well as how to maintain quality of the products.
- There is a need for a national initiative to encourage cooperation between the government, knowledge institutions and the private sector at all levels (Public/ Private Partnerships), to embark on a trajectory to make better use of resources available for the development of animal feed industries including an institutional infrastructure for the supply chain for post-harvest handling and food waste management on the basis of the economics of scale. Such PPP's have proven to be appropriate instruments for investments in waste processing for feeding animals.
- Depending on the demand for quality fish feed, these plants can mix their products with suitable protein rich ingredients and/or imported premix to prepare an acceptable (sinking) fish feed.
- An option to bridge the current lack of good quality, affordable fish feeds in the country, is to discuss possibilities: a) to improve the quality of the fish feed (floating pellets) produced in Uganda and b) to import this improved fish feed at large quantities to be stored at a central place in Rwanda for further selling and distribution.
- In order to enable Rwanda to produce its own fish feed, professional advice is needed to assess the overall feasibility (what production scale is needed to make such an enterprise viable), which technologies, arrangements and investments are needed, economic appraisal: steps wise development on the basis of production units or large scale investments, distribution etc.



Feeding of the fish, lake Kivu

Rationale with respect to the recommendations

Increased fish production through intensive fish farming systems requires good quality fish feed at an affordable price. The production of balanced fish feeds in Rwanda is not planned for nor can be expected in the near future. The farmer, if (s)he wants to go for increased production, will have to purchase / produce feeds on the basis of agro-industrial by-products or agricultural waste. Pilot studies have shown that existing chains and services in support of the development of agricultural & livestock sector can be used more profitable by integrating fish farming in the production systems.

The production of feeds for fish feed is more complicated than for other animals. Costs of fish feeds are high as their production requires expertise with respect to nutritional composition of the feed, quality requirements and production technologies (sinking and floating pellets. The cost of fish feed production are impacted by the following factors:

- Costs related to the (high) nutritional requirements of fish feeds (fry, fingerling, grow out)
- Fish feed/ special premix has to be imported as animal feed plants in Rwanda do not produce quality fish feed.
- Costs related to the technical requirements for fish feed manufacturing (esp. floating pellets

The development of small to medium scale feed production units may hold the key for rural innovation and economic growth. Conducive policies with respect to the utilization of waste/ post-harvest products along with an actively involved private sector may offer opportunities for increased employment and reduction of environmental problems. To this end offal and waste production supplies has to be examined for its suitability for animal feed production, quantity and cost price including collection, storage and distribution logistics.

Ad 3) Governance of the value chain

Main question

What will determine the sustainability of the fish value chain in Rwanda?

Findings

A small market survey showed that although big fish (Tilapia up to 2 kg) from Uganda is favourite in Kigali, consumers also buy smaller sized fresh Tilapia from the lakes. Traders stated that they can smell from which lake the fish was taken. Most catfish is sold smoked. Fish from Uganda including Nile Perch was sold either smoked or dried.

In addition there is a separate market for the small pelagic fishes coming from Lake Kivu (Isambaza) and the smaller sized Dagaa from lake Victoria and lake Tanganyika. These small silver fishes are sold fresh but mostly in dried form (see photo below of drying process) and may fetch a price up to RFw 3000/kg for dried Isambaza from lake Kivu.



Drying of Isambaza in Kibuye

Fish is also sold in food shops and super markets in urban centres either in frozen or dried form. Both fish sellers at the markets and shop keepers confirmed the undersupply to the markets and stated that the demand for fish (250-400 gr) is much higher than the supply. Entrepreneurs purchasing fish from the various lakes in Rwanda, confirmed that it is getting more and more difficult to purchase fish from the fishers cooperatives and complained about illegal fishing practices and trade.

The fisheries resource management regimes imposed by the government/ Paigelac are undermined by fishers and traders alike and the Monitoring Surveillance and Control (MSC) form an increasing cost factor for the government. The lakes are big with numerous bays which makes it almost impossible to control illegal trade routes. Currently most of the lakes are over-fished and only through proper fish stock management and strict control on the value chain (tracking and tracing), an increase in production may be expected.

With respect to the development of fish farming in lakes, the major findings are:

- Government policies with respect to the development of cage culture in lakes is not yet in place (concessions/ property rights, environmental impact)
- Currently there is no institutional infrastructure nor capacity to provide guidance and environmental regulations with respect to technical aspects, infrastructure and facilities, to requirements with respect to record keeping and business administration, to the monitoring of environmental impact etc.
- There is no roadmap for the development of lake-based farms, including the organisation and management of the supply and value chains (quality control/ certification / tracking and tracing) in order to avoid conflicts between fisheries and fish farming.
- The benefits of regional and international networking is not well recognized.

<u>Recommendations</u>

- More support and technical assistance is needed to maintain and enhance the momentum achieved by Paigelac and to strengthen the fisheries sector in resource management by restricting the fishing effort to a level where sustainable harvesting levels are attained (tapping the resource rent). With the licensing of bona fide fishers, a system of tracking and tracing of the catch (name of the fisher, lake of origin, time of catch etc.) in the value chain can be introduced. In this way consumers can be sure that the product they buy, comes from a well-managed lake, caught in a legal way by licensed fishers.

- More support and technical assistance is also needed to strengthen aquaculture development (economics of farming, farm management capacity, cooperation in the governance of supply chain (feeds, seeds, equipment) and value chain (transport, storage, marketing and quality assurance).
- There is a need to strengthen the competences and knowhow of current and prospective fish farmers through in service training, to develop proper curricula at both vocational schools and higher education institutions in Rwanda and to increase the human capacity for the development of fish farming industries including the fish supply and value chains. Capacity building / skills in: technologies, water quality control, diseases, construction and water management, communications, brood stock management and reproduction & hatching techniques, feed production & farm management.
- There is a need for an 'across-the-board' data collection system to support the development of the supply and value chain for the fish production sector. To this end cooperatives may have to be re-structured into entrepreneurial focal units, taking into account that employment not only refers to on farm work but also to post harvest processing and the value chain.
- Capacity building is needed and sharing of knowledge, expertise and relevant information to support the current and emergent fish farmers and other stakeholders.
- Professional Networking and Alliances of investors and entrepreneurs at all levels from the supply side of equipment and services to production with infrastructure and feeds will have to be supported by easily accessible knowledge and information systems and communication channels.
- There is need for Rwanda to actively look to participate in international and regional platforms and organisations in the field of fisheries and aquaculture. Like the Aquaculture Network for Africa: ANAF (www.anafaquaculture.org) or the Sustainable Aquaculture Research Networks for Sub-Saharan Africa: SARNISSA (www.sarnissa.org), and the COMHAFAT\ATLAFCO: http://www.comhafat.org.

Rationale with respect to the recommendations

The master plan indicates the need for increased investments by the private sector and the development of self- sustaining supply and value chains for aquaculture products and inputs. To this end, there are a number of business conditions that need to be fulfilled to create an enabling environment for investments and growth:

- Data and proven evidence on the profitability of fish farming.
- Banks need to be convinced as they are reluctant to provide credits because of issues related to the need for collateral, risk mitigation and unfamiliarity with the sector.
- Fish farms need a grace period sufficiently long to construct the facilities and to produce harvest.
- Infrastructure for equipment and other input supplies and electricity.
- Good quality feed should be available and affordable. Low costs production is possible taking account of economies of scale i.e. existence of fish farming cooperatives or larger scale production farms.

A roadmap for the implementation of the Master plan needs to be developed, describing the opportunities for investors to build aquaculture business infrastructure, including hatcheries, feed mills and to create employment. Networks are needed to enable match making between the GO, private sector, fishers, fish farmers and knowledge institutes like for instance the university of Huye. Networking and collaboration is also needed to encourage the sharing of knowledge, expertise and information with respect to economics and management, to explore markets, to introduce product quality control standards, to carry out collaborative action research to explore alternatives (seed and feed production) or to solve common problems.

3 Stakeholder meeting

At the end of the visit a stakeholder meeting was organised to present and discuss major findings with stakeholders from the Rwandese government, the Royal Netherlands Embassy, the private sector, fishers cooperatives and knowledge institutions.

The debriefing depicted a short overview on the complexity of fish production, supply and value chain and the translation of current constraints into scenarios for development, growth and improved fish supply to domestic markets.

Major findings and recommendations were grouped into 3 main cluster areas and clarified in order to initiate discussions among the various stakeholders:

- Economics of fish production
  Key question: Is fish farming profitable enough to keep farmers interested and to attract investors?

- Feed supply
  How to develop a cost effective animal feed industry?

- Fish value chain
  What will determine the sustainability of the fish value chain in Rwanda?

During the discussions the need for more serious attention for the economics of fish farming was generally confirmed. Without pragmatic and feasible business plans, investments by the private sector will remain rather limited.

Also, it was agreed that the development of a nationwide animal feed industry is urgently needed including the setting of quality control standards in order to boost the animal husbandry sector and fish production from ponds and cages. Discussions also revealed the need for more knowledge sharing, collaboration and the initiation of professional partnerships, to put the sector on a solid economic footing. Capacity building and cooperation in the supply and value chains between the GO, private sector and the knowledge institutions is needed in order to create and foster an enabling environment for further development of the fish production sector.

Appendix 1 – Terms of reference

Objectives and expected outcomes of the quick scan:

- Collect and review recent documents, information, master plans and development programs as related to fish production: a) capture fisheries in lakes and rivers and other the water bodies and b) human controlled fish production (aquaculture) c) related supply chains (feed, fry and fingerlings etc.), services (extension, research, training).
- Meet relevant persons in Rwanda (GO, NGO, the private sector, research and education institutions) to
  - discuss opportunities and challenges to enhance fish farming for improved food security and livelihood
  - identify options for strategic interventions and investments
  - assess the needs for institutional and technical support
- Visit sites and meet with practitioners to identify and discuss constraints with respect to aquaculture development, like the lack of knowledge and poor practices, limited security of land tenures, reluctance to adopt new technologies, labour shortages, lack of suitable fish feed and stocking material, water supply, water turbidity, acid soils, institutional support.
- Collect data and information on the production systems / supply chains and services in the agriculture and livestock sector to enable an appraisal of possibilities and options for linking and integrating fish farming with the agriculture and livestock sector.

Visiting program

Date	Day	Activities
09/01/2013	Wednesday	Arrival in Kigali check-in at the hotel
10/01/2013	Thursday	- Review of the program/agenda - Reviewing the available information and identify the gaps, - Appointment with Bosco Kabagambe (local aquaculture consultant) - Discuss on the checklist for appointments / activities and collection of additional info; Revisit the mission programme - Meeting with Pierre Claver Kayitare of PAIGELAC - Meeting with Teddie Muffels of the Embassy of the Kingdom of Netherlands (*spend the night in Kigali*)
11/01/2013	Friday	- Meet with Esther Van Damme of the Embassy of the Kingdom of Netherlands, - Meeting with Dr. Wilson Rutaganira, the project Coordinator of the PAIGELAC, - Meeting with Hategekimana Dassan, the Chief Nutritionist of FAO, - Meeting with Frank Bakx of RABOBANK Foundation, - Appointments to explore fish markets and fish trading enterprises (*spend the night in Kigali*)
12/01/2013	Saturday	- Visit the popular market in Kimironko neighbourhood (meeting with local and Ugandan fish wholesalers and retailers), - Visit the major supermarkets and butcher shops in Kigali, (*spend the night in Kigali)*
13/01/2013	Sunday	- Meeting with Isaac Nsindabahizi, a locally experienced fish wholesaler and exporter to DR Congo. (*spend the night in Kigali*)

14/01/2013	Monday	- Meeting with Dr. Theogene Rutangwenda, the Director of Animal Resources (MINAGRI) - Visit the aquaculture centre at the Free Trade Zone, - Visiting the Rwanda Agriculture Board, meeting with Alphonse Nshimiyimana, the Head of Animal Production; - Meeting Roger Shaun, the Managing Director of Lakeside Fish farm; - Travel to the Southern Province, (*spend the night in Butare/Huye*)
15/01/2013	Tuesday	- Meeting with Gregoire Dusabeyezu, the Coordinator of Kigembe Fish Farm (RAB) - Visiting the Kigembe Fish Facilities, - Meeting with the Dr. Simon Rukeratabaro, (Department of Agriculture,), National University of Rwanda - Meeting with Dr. Solange Uwituze, Dean of the Faculty of Agriculture, National University of Rwanda. - Travel to Muhanga, (*spend the night in Gitarama/Muhanga*)
16/01/2013	Wednesday	- Travel to lake Kivu, - Visit fish farms, a fish feed factory, and cages in Karongi, - Meeting with Musomandera Gerome, a local fish production entrepreneur - Visit the Karongi Fish Project and fish processing centre, - Meet with Simarinka Celestin, the Chairman of UCOPEVEKA, a local Union of fishermen's cooperatives, (*spend the night in Karongi)*
17/01/2013	Thursday	- Travel back to Muhanga, - Visit to Bahoneza-Nganzo, Meeting with Joseph Harerimana, the coop's Vice-Chairman - Travel back to Kigali; - Meeting with Rurangwa Raphael, the Director of Planning at MINAGRI - Visit to Minimex and meeting with Claude Mansell, Director General (*spend the night in Kigali*)
18/01/2013	Friday	- Workshop with stakeholders (debriefing), - Meeting with Teddie Muffels and Mary Nizeyimana of the Embassy of the Kingdom of Netherlands; - Meeting with Willem Wurdemann, consultant in agribusiness development (*spend the night in Kigali*)
19/01/2013	Saturday	- Visit to Mugesera Lake in the Eastern Province with Jean Bosco Kabagambe, - Talk to a local fisherman at the Landing site of PAIGELAC; - Work on the proposal for the training in fisheries with Bosco Kabagambe, (*spend the night in Kigali*)
20/01/2013	Sunday	- Lunch meeting with Roger Shaun of the Lake Side Fish Farm and Jean Bosco Kabagambe on the way forward. - Departure to NL

Appendix 2 – Pilot Survey on the agricultural waste and by products and other sources of offal

By Faustin Muligo

In the frame of the quick scan on the identification and analysis of options for improved fish production in Rwanda carried by the Centre for Development Innovation, Wageningen UR on the request of the Netherlands Embassy in Rwanda, data and information were collected with respect to the production, use and price setting of agricultural waste which can be used for animal feed production.

The agricultural wastes and by products collected are classified into the following categories:

- Brewery waste, brewery yeast
- Draff from banana beer and sorghum beer
- Slaughter waste (blood, stomach contents and bones)
- Rice bran and rice polishing and wheat bran and regrinding
- Sugar cane waste and molasses
- Cassava waste, soybean cake
- Maize (grains, meal and bran)
- Coffee pulp
- Household waste
- Market waste
- Restaurants, hotels and boarding-schools

The findings of the pilot survey are the following:

	INGREDIENT	AVAILABILITY	PRODUCTION	CURRENT USE	VALUE(RWF)	OBSERVATION
1	Brewery waste Brewery yeast	Available	120 Ton /day 6 Ton/day	✓ Wet Wastes from BRALIRWA are used by local consumer's especially local farmers for animal feeding. ✓ SKOL brewery's wastes. Used by local consumers especially local farmers for animal feeding.	6,000/ 1Ton 10,000 / 1Ton	Wastes from BRALIRWA we can find at Rubavu District 170Km from Kigali. SKOL Factory you can find at Kigali City.
2	Draff from banana beer and sorghum beer	Available		All of wastes are used by the owners as animal feeding and organic manure.	Price can't be determined because the wastes are not sold	No proper Market for draff from banana and sorghum beer in the Country.
4	Rice bran and rice polishing and wheat bran and regrinding	Available		Wheat and Rice Wastes are used by firm for animal feed processing and Local farmers as well as bricks making	✓ Rice bran is 70/kg ✓ Rice polishing is 6000/m^3	But most of the wastes don't have market
5	Sugar cane waste and molasses,	Only molasses is available	5 Ton/day.	Kabuye Sugar Works factory's wastes only molasses are sold but not than 30%.	236/1kg	Big part of the molasses doesn't have a real market/client.
6	Cassava waste, soybean cake,	Available but soybean cake not available		All of wastes are used by the owners as animal feeding and organic manure.	-	No proper Market
7	Maize (grains, meal and bran)	Available	12 tons/day for bran and 3 tons/day of dust	All wastes from MINIMEX factory are exported to Kenya and others are used by local farmers for animal feeding	100-130/kg of bran and dust sold 30-40/kg	

8	coffee pulp	Available	220,000 tons/year	Countrywide 240 coffee washing stations produce 44,000 tons of washed coffee with wastes estimated to 220,000 tons/ year. used for organic manures only.	-	The investment for exploitation of these wastes is needed.
9	Household waste	Available	?	Some are locally used as animal feeding or organic manure others are dumped at the landfill area.	-	Wastes processing mechanism is needed. No proper Market.
10	Market waste	Available	?	Some are locally used as animal feeding or organic manure others are dumped at the landfill area.	-	Wastes processing mechanism is needed. No proper Market.
11	Restaurants, hotels, boarding-schools and prisons.	Available	?	Some are locally used as animal feeding or organic manure others are dumped at the landfill area.	-	Wastes processing mechanism is needed. No proper Market.
12	INYANGE FACTORY Produce Juice and parked Milk	Available	60Ton/month	Some are locally used as animal feeding or organic manure others are dumped at the landfill area.	10/1kg	
13	AZAM produce Wheat Flour	Available	Bran 45/Ton/ Day Pollard 2Ton/Day	Some are locally used as animal feeding at 20% only.	✓ 2,000/30Kg ✓ 4,300/40Kg	No proper Market. No proper Market.

- This study was carried out to examine the scope to increase fish production in Rwanda through commercial more intensive farming systems. Such intensive fish farming practices need quality fish feeds at an affordable price.
- So far no consistent approach or roadmap exists for the development of animal feed industries in Rwanda though the urgency for increased animal feed production of standard quality is very well recognized: the targets set for increased animal production cannot be met if no animal feed industry is able to support the development of the animal husbandry sector
- The findings of the quick scan study show that the production of animal feeds on the basis of the waste/ postharvest losses available in Rwanda can be done at a local, district and national level, thus reducing the price for Animal Feeds for the primary producers. Better quality feed will increase the growth rate as well as the health of the animal. In this way the availability of improved animal feeds will improve the value chain, increase the availability of good quality food for the consumers and create better incomes and employment for the producers, processors and traders Moreover waste will be utilized, thus reducing environmental problems.
- There is a need for joint efforts for cooperation between the government, knowledge institutions and the private sector at all levels to embark on a trajectory to make better use of resources available to develop animal feed industries on the basis of the economics of scale, through Public/ Private Partnership (PPP). Such PPP's have proven to be appropriate instruments for investments in waste processing for feeding animals.

Appendix 3 – List of people visited during the Quick Scan

Name	Organization	Position	Telephone	E-mail
Jean Bosco Kabagambe	Ingege Fish Farm	Managing Director	0788429460	jbkabagambe@yahoo.fr
Dr Wilson Rutaganira	PAIGELAC	Project Coordinator	0788306364	wilsonruta@yahoo.co.uk
Pierre Claver Kayitare	PAIGELAC	M&E officer	0788407059	kayitarepc@yahoo.fr
Dr Theogene Rutangwenda	Minagri	DG Animal Resources	0788303309	rutangwendat2006@yahoo.com
Gregoire Dusabeyezu	RAB	Head of Program/ Fish Farming-Rusoro	0788865653	gregoiredusabe@yahoo.fr
Roger Shaun	Lakeside Fish Farm	Managing Director	0785696606	roger@lakesidefishfarm.com
Isaac Ndindabahizi	Wholesale	Trader	0788565329	
Teddie Muffels	Netherlands Embassy	Agricultural Counsellor	0786790658	teddie.muffels@minbuza.nl
Esther Van Damme	Netherlands Embassy	Head of Food Security Program	0788642454	Esther.van.damme@minbuza.nl
Nizeyimana Marie	Netherlands Embassy	Agribusiness Policy Officer	0788832828	nizemarie.marie@minbuza.nl
Simarinka Celestin	UCOPEVEKA	Chairman/fisherman	0788478425	ukopevekakarongi@yahoo.com
Rukeratabaro Simon	National University of Rwanda	Lecturer	0788450031	Simon.rt@gmail.com
Dr. Uwituze Solange	National University of Rwanda	Dean of Faculty of Agriculture	9788309637	suwituze@nur.ac.rw
Musomandera Gerome	Baraka Coop	Chairman	0788485992	
Alphonse Nshimiyimana	RAB	Head of Animal Production		namumc@yahoo.fr
Raphael Rurangwa	MINAGRI	Director of Planning	0788301498	raphael.rurangwa@gmail.com
Claude Mansell	Minimex ltd	Director General	0786340019	Cmansell1@cs.com dg@minimex-sa.com
Dassan Hategekimana	FAO	Chief Nutritionist	0788850947	hategekimana.dassan@fao.org
Harerimana Joseph	Bahoneza-Nganzo coop	Vice Chairman	0788819061	
Bakx Frank	Rabobank Foundation	Technical Advisor	0783100003	frankbakx@middel.com

Appendix 4 – List of participants to the debriefing meeting on aquaculture

Venue: NINZI Hill Hotel
Date: 18th January 2013

Names	Position	Institution	Tel	Email
Dr Theogene Rutangwenda	DG Animal Resources	MINAGRI	0788303309	rutangwendat2006@yahoo.com
Ben Rutten	Consultant	Alliance Plus	0783224083	rutten.ben@gmail.com
Dr Eugene Rurangwa	Researcher	WRU/ IMARES, Wageningen UR	0785150088/ +31317482045	eugene.rurangwa@wur.nl
Dr Wilson Rutaganira	Coordinator	PAIGELAC	0788306364	wilsonruta@yahoo.co.uk
Gregoire Dusabeyezu	Head of Program/ Fish Farming-Rusoro	RAB	0788865653	gregoiredusabe@yahoo.fr
Vincent Shyirakera	Local Representative	PUM	0788611139	vincemuse@yahoo.com
Roger Shaun	Director	Lakeside Fish Farm	0785696606	roger@lakesidefishfarm.com
Faith Shaun	Director	Lakeside Fish Farm	0785696606	roger@lakesidefishfarm.com
Jean Bosco Kabagambe	Entrepreneur	Lake Mugesera	0788429460	jbkabagambe@yahoo.fr
Nyandwi Theophile	Chairman of federation	FEFICORWA	0788478808	nyatheophile@yahoo.fr
Kavutse Mucyo Emmanuel	Agribusiness Officer	RDB	0782543077	emmanuel.mucyo@rdb.rw
Innocent Byaruhanga	Production Manager	Rwanda Fish Industries Ltd	07822766449/ 0788301966	binnocent88@yahoo.com
Ndinda	Trader Wholesaler	"Kicukiro"	0788565329	-
Murigo Faustin	Director of Operation Fixed Company ltd	Development, planning & marketing	0788520125	murigof@yahoo.fr
Teddie Muffels	Agricultural Counsellor	Embassy of the Kingdom of the Netherlands	0786790658	teddie.muffels@minbuza.nl
Nizeyimana Marie	Agribusiness Policy Officer	Embassy of the Kingdom of the Netherlands	0788832828	nizemarie.marie@minbuza.nl
Petra Spliethoff	Consultant	Centre for Development Innovation, Wageningen UR	+31317486871	petra.spliethoff@wur.nl

Pascal Murasira	Consultant (Network Assistant)	Agri-ProFocus	0786132453	pmurasira.agrihub@gmail.com
Rukundo Jean De Dieu	Professional in charge of Fish & rice farming	MINAGRI	0788550898	rujado@gmail.com
Simarinka Celestin	Chairman UCOPEVEKA/ Fisherman	UCOPEVEKA	0788478425	ukopevekakarongi@yahoo.com
Hubert Kwizera	Managing Director	Enterprise RwaFil / Lake Muhazi	0788307841	hkwizera@gmail.com

Report on the outcomes of the quick scan carried out in January 2013 on the request of the Netherlands Embassy in Kigali, Rwanda to appraise the current situation in the fish production sector.

More information: www.wageningenUR.nl/cdi



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