



RESEARCH PROGRAM ON
Livestock and Fish

Fish value chains in Uganda and Egypt: Background proposals for the CGIAR Research Program on Livestock and Fish

March 2011



ILRI works with partners worldwide to help poor people keep their farm animals alive and productive, increase and sustain their livestock and farm productivity, and find profitable markets for their animal products. ILRI's headquarters are in Nairobi, Kenya; we have a principal campus in Addis Ababa, Ethiopia, and 14 offices in other regions of Africa and Asia. ILRI is part of the Consultative Group on International Agricultural Research (www.cgiar.org), which works to reduce hunger, poverty and environmental degradation in developing countries by generating and sharing relevant agricultural knowledge, technologies and policies.

© 2011 International Livestock Research Institute (ILRI)



This publication is copyrighted by the International Livestock Research Institute (ILRI). It is licensed for use under the Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License. To view this license, visit <http://creativecommons.org/licenses/by-nc-sa/3.0/>. Unless otherwise noted, you are free to copy, duplicate, or reproduce, and distribute, display, or transmit any part of this publication or portions thereof without permission, and to make translations, adaptations, or other derivative works under the following conditions:

- ⓘ ATTRIBUTION. The work must be attributed, but not in any way that suggests endorsement by ILRI or the author(s)
- Ⓞ NON-COMMERCIAL. This work may not be used for commercial purposes.
- ♻️ SHARE ALIKE. If this work is altered, transformed, or built upon, the resulting work must be distributed only under the same or similar license to this one.

NOTICE:

For any reuse or distribution, the license terms of this work must be made clear to others.

Any of the above conditions can be waived if permission is obtained from the copyright holder.

Nothing in this license impairs or restricts the author's moral rights.

Fair dealing and other rights are in no way affected by the above.

The parts used must not misrepresent the meaning of the publication. ILRI would appreciate being sent a copy of any materials in which text, photos etc. have been used.

Download the full Program proposal: <http://cgspace.cgiar.org/handle/10568/3248>

Important note: Full information on references is included in the Program proposal that can be downloaded from <http://cgspace.cgiar.org/handle/10568/3248>

International Livestock Research Institute

P O Box 30709, Nairobi 00100, Kenya
Phone + 254 20 422 3000
Email ILRI-Kenya@cgiar.org

P O Box 5689, Addis Ababa, Ethiopia
Phone + 251 11 617 2000
Email ILRI-Ethiopia@cgiar.org

www.ilri.org

Fish value chains in Uganda and Egypt: Background proposals for the CGIAR Research Program on Livestock and Fish

The focus on only two countries for value chain work in the aquaculture sector acknowledges the challenge of taking a comprehensive value chain perspective and ensuring that a sufficient critical mass of people and resources are devoted to addressing the challenges identified.

We have chosen countries in Africa for three reasons.

First, because Africa is the most food insecure continent and it has the largest and fastest growing gap between fish supply and demand. While average global fish consumption rose from 12 to 16 kg/year between 1973 and 1997, it fell in SSA from 9 to 6.6 kg/year (Fish to 2030).

Second, because the African aquaculture sector has the most urgent need of support to develop at scale. Although growth in aquaculture is essential if Africa is to produce enough fish to feed its people, the sector makes a much lower contribution to fish supply than the rest of the world. African aquaculture currently produces less than 2% of global aquaculture production, representing less than 5% of Africa's fish (FAOStat 2010).

Third, because aquaculture in Asia is much more developed and well served by several national and regional research agencies. As a result, given the likely limits to available funding in the near term, our contribution to Asia is best made through sharing the results of our foundational technology research and the IPGs that arise from our in-country learning.

Our choice of focal countries within Africa was guided by an initial screening to identify those countries where a) fish consumption was high relative to total animal protein consumption, b) there was significant undernourishment in the population and c) the baseline production in the aquaculture sector indicated potential for effective intervention. The Table below summarizes data for the top 8 countries ordered by aquaculture production.

Aquaculture production, the importance of fish in the diet and the level of undernourishment in the population for the top eight aquaculture producers in sub-Saharan Africa

Country	Child stunting ¹ (% of children < 5)	Fish consumption ² (% of total animal consumption)	Aquaculture production ³ (tonnes in 2008)
Egypt	31	38	693,815
Nigeria	41	45	143,207
Uganda	39	63	52,250
United Rep of Tanzania	44	65	11,308
Madagascar	53	33	11,081
Zambia	46	56	5,640
Ghana	29	74	5,594
Kenya	36	38	4,452

1. World Health Statistics (2010); 2. Speedy (2003). Global Production and Consumption of Animal Source Foods. Journal of Nutrition. 133: 4048S-4053S; 3. FAOStat (Online query).

The following criteria were then applied:

1. Markets for fish are developed to a scale that offers potential to support a value chain focus.
2. Potential for aquaculture production to contribute significantly to meeting national or regional fish demand within 5–7 years.
3. Food and nutrition security assessments indicate current situation as low or at risk.
4. National and regional policy environment supports the proposed approach.
5. International development agency policy environment supports the proposed approach.
6. Development Partners also identify aquaculture value chains as a fruitful area for investment.

Using these criteria we concluded that Uganda and Egypt should be our final choices.

An additional important consideration that guided this choice is the potential for learning that comes from working in two countries at contrasting stages in their aquaculture development (see Figure below). These differences will require different kinds of support, thereby offering different opportunities for learning.

A model of the various stages of aquaculture development, showing the current position of Uganda and Egypt

Our broad objective is to work with partners to help move each country to the next stage, thereby increasing the supply of affordable nutrition to poor consumers. (Note: support for countries at Stage 1 will be provided through livelihoods focussed approaches that form part of work under CRP 1.3 on Aquatic Agricultural Systems.

In the case of Egypt, we also took into consideration the opportunity to build on existing WorldFish infrastructure and capability in the country. A more complete rationale for the choosing each country is provided below, along with a description of the work to be undertaken.

	Uganda ↓		Egypt ↓	
Characteristic	Stage 1	Stage 2	Stage 3	Stage 4
Primary focus	Household food security	Supply to immediate local markets. Rudimentary value chains	Supply to local and regional markets. Value chains increasingly well developed.	Supply to local and regional markets and retail chains. Maturing value chains.
Scale of production	On-farm	Small-scale enterprises	Mainly small-scale enterprise, but some MEs emerging.	Medium scale enterprises becoming dominant, some consolidation occurring.
Feed and seed supply	Rudimentary, with supply and quality problems.	Rudimentary, with supply and quality problems.	Functioning, but considerable scope for improvements in quality	Systems well developed and operating at a high standard.
Production Practices	Rudimentary, few adopted norms.	Rudimentary, few adopted norms.	Broadly sound, but considerable scope for improvements.	High standard. Focus on innovation to drive down production costs.
Support services	Poor to basic, farmer to farmer learning networks emerging.	Poor to basic, industry associations emerging.	Basic services available.	Well developed.
Primary Development Benefits	Household food and nutrition security	Household food security Income generation for farmers.	Stable and affordable fish supplies for poor consumers. Employment and income through value chain participation.	Stable and affordable fish supplies for poor consumers. Employment and income through value chain participation.

Tilapia and catfish in Uganda

The aquaculture sector in Uganda

‘With the increasing population, there has been an increasing local demand for fish. With export demand also rising, this has led to over-fishing, a shortage of fish and an approaching collapse of the capture fish industry (see Section 2.2.3). The potential, indeed necessity, to develop aquaculture becomes ever more pressing. There is good potential for this with numerous permanent water sources in the country, soils with high water retention capacities and suitable temperatures all the year round in low altitude areas.’
Government of Uganda (2010)

Albeit from a low base, at an APR between 2004 and 2006 of 142%, Uganda has had among the highest aquaculture growth rates in the world in recent years. Several thousand smallholders are involved, from subsistence levels to small enterprises, growing fish in earthen ponds and stocked community water reservoirs and minor lakes; there are also a few larger farms. The most recent data are from 2005 which indicated an estimated 20,000 ponds in the country with an average size of 500 m². Pond sizes range from less than 100 m² to about 6,000 m². Yields in 2005 ranged between 1,500 kg per ha per year for subsistence farmers to 15,000 kg per ha per year for emerging commercial fish farmers (FAO Country Profile 2005).

Improved market prices for fish have begun to attract entrepreneurial farmers, leading to a progressive increase in pond sizes. The Government of Uganda estimate that 20 to 30% of smallholder subsistence ponds have been transformed into profitable small-scale production units (ref) and that there are 2000 ‘commercial’ farmers who own nearly 5,000 ponds, with an average pond size of 1,500 m². Two species comprise 99% of total production; African catfish accounts for 67% of production while Nile tilapia accounts for 32%. Since growth in aquaculture production of these two species is also fastest they represent an appropriate focus for this program.

Criteria for final country selection and the rationale for choosing Uganda

Criteria	Rationale for Uganda
Markets for fish are developed to a scale that offers potential to support a value chain focus	<p>Second largest farmed fish producer in SSA, accounting for approximately 20% of the total in 2008. (Nigeria largest producer at 55%). (FAOStat 2010)</p> <p>One of the largest gaps between fish supply and demand in Africa. Per capita fish supply declined by 37% between 1973 and 1997. Catches from wild capture fisheries continue to decline</p> <p>A strong fish consumption culture. Supported to date by natural catch fisheries throughout the country, this culture is key to ensuring that value chain development is focussed on meeting a demonstrated demand. The demand for fish is further supported by income and population growth in urban areas, and an increasing and food insecure rural population (Jagger and Pender 2002)</p>
Potential for aquaculture production to contribute significantly to meeting national or regional fish demand within 5–7 years	<p>Significant Growth potential. 83% Average annual growth in production from 2000–2008 (c.f. Nigeria, 26%) (FAOStat 2010). 31 districts identified by government as suitable for fisheries and/or aquaculture development based on both natural and socio-economic factors (FAO Country Report 2005)</p> <p>Potential to support regional fish demand. Uganda borders several countries that also have a high dependence on fish (e.g. DRC, Kenya, Tanzania, see Table above). This offers considerable potential for increased production to meet regional demands</p>
Food and nutrition security assessments indicate current situation as low or at risk	A looming food security crisis. It is predicted that an additional 14 million Ugandans will become food insecure in the next 10 years (Nigeria, 7 m). This is 4th largest projected increase in the world, exceeded only by DRC, Tanzania and Afghanistan. It is also joint 2nd largest in terms of percentage increase (100% increase c.f. Nigeria at 22%) (USDA 2010a). (USDA Global Food Security Assessment 2010–2020)
National and regional policy environment supports the proposed approach	<p>The government of Uganda seeks to make 2.5 m households food secure in the next 5 years. Increased aquaculture production is a priority for helping to achieve this by meeting the local and regional fish supply gap</p> <p>The 2004 National Fisheries Policy commits to increase aquaculture production by 200% from an estimated 2,000 t in 2004 to 100,000 t by 2014. The Ministry's National Aquaculture Development Strategy also provides indicative targets to:</p> <ol style="list-style-type: none"> 1. Increase small-scale aquaculture from 5000 ha to 20,000 ha by 2015; 2. Increase large-scale aquaculture from 5,000 ha to 25,000 ha by 2015, and; 3. Establish functional management systems at some 80% of the existing aquaculture water facilities <p>Regional Trade Policy is developing. Cross-border trade within the East Africa region is likely to improve with the signing of the East Africa Market Protocol. This will allow free movement of people and goods between markets in Kenya, Tanzania, Uganda, Rwanda and Burundi (USAID 2010b) (East Africa Regional Food Security Update, July 2010)</p>
International development agency policy environment supports the proposed approach	<p>USAID Feed the Future Initiative. Uganda is a target country for investment to 'feed and stabilize the region while improving the lives of its farmers'. Aquaculture is a target for scale up investment in 2010 to develop the value chains for fisheries and value-added products that addresses both food security and market development (USAID 2010)</p> <p>NORAD Fishery and Aquaculture Investments. Identified Uganda as a high potential location for investment (NORAD 2009)</p>
Development Partners also identify aquaculture value chains as a fruitful area for investment	<p>USAID LEAD (Livelihoods and Enterprises for Agricultural Development). The LEAD program has undertaken considerable work on Ugandan fish value chains and continues to prioritize this as a focal area for intervention</p> <p>Save the Children. A recent consultancy commissioned by Save the Children recommends aquaculture as a high potential area for intervention. (Save The Children USA 2008)</p>

Research, supporting action and partnership

Although the level of detail that can be provided at this proposal stage is necessarily limited, and notwithstanding the need for further targeted diagnoses, several studies of fish value chains in Uganda (Save The Children 2008; USAID Lead 2010), and our own stakeholder consultations (see Box below) indicate significant constraints that can be overcome and opportunities for improvement. Principal among these, and in common with many other locations in Africa and elsewhere, is the availability of affordable, good quality, seed of improved seed and feed inputs. For the sake of clarity we treat improved strains, feed and fish production as three separate, although interlinked value chains. The following Tables summarize the key constraints, the research and supporting actions and the partnerships needed to deliver desired outcomes along the seed and feed input value chains for both catfish and tilapia. The ensuing Table focuses on the remaining elements of the fish production value chain.

Stakeholder consultation: Entebbe and Kampala 17th–20th August 2010

A stakeholder consultation undertaken in Uganda helped to refine this proposal. The purpose of this consultation was to:

1. Introduce our preliminary thinking to stakeholders and test it through dialogue.
2. Gauge the level of alignment between these ideas and the interests and needs of stakeholders.
3. Seek endorsement and support by relevant government agencies.
4. Identify development, research and policy partners to work with us to co-develop these ideas into a program that will really have impact at scale.

Consultations were held with key departments in the Ministry of Agriculture, Animal Industry and Fisheries, The Aquaculture Sector Working Group of the Plan for the Modernization of Agriculture, national research partners, ASARECA, and representatives from the private sector, NGO other CG centres and donors agencies.

The feedback we received and the endorsement of our ideas by the Minister of State for Fisheries and Ministry officials confirmed the compelling case for focussing on Uganda.


Full details of the consultation can be found at: <http://livestockfish.wordpress.com/>


Based on our initial stakeholder consultations (see Box above), our sense of the priority foci for this program are indicated in bold. Further discussion will be needed, however, to refine this assessment during the early phases of the program. Throughout we will seek to identify where these chains are, or could be, linked to other agricultural value chains to mutual benefit. For example, the existing links between poultry, livestock and fish feed manufacture offers potential for developing further synergies in product development, storage, transport and distribution and marketing.


As with the rest of this program, one important dimension concerns gender. As might be expected research to date indicates highly gender differentiated roles in the aquaculture sector in Uganda—a feature that validates the rationale for an explicit gender focus given earlier in this document (see Part 2: Research Theme 3). We will adopt a gendered approach to value chain analysis in Uganda, seeking improved understanding of current roles and opportunities for creating gender equitable opportunities in the development of the value chain and in deriving an equitable share of benefits among poor consumers. To help achieve this, we will work to develop the skills of program and partner staff to identify and address gender issues, especially those arising from technological innovation and from policy change. We will use the WorldFish framework and toolbox for mainstreaming gender analysis in fisheries and aquaculture research (WorldFish 2010).


Our in-country consultations also helped us begin to develop the partnerships needed for this program and we have had strong expressions of support (see attached letters). At this stage, however, we have indicated these as indicative in the table because further work will be needed to build on our initial partnership discussions to ensure that interests and needs are aligned and roles and responsibilities are clear and capitalize on comparative advantages. We do not see any impediment to achieving this, but wish to be realistic about the level of engagement required and believe that co-development of the work program at its inception is a key to success. Importantly, however, the roles we outline in Tables below draw upon those described in the recent draft Aquaculture Strategy for Uganda that was developed jointly by the Ministry of Agriculture and FAO through a widely consultative process. They also reflect our preliminary discussions.

Opportunities and constraints in the seed value chains and the research and development actions to overcome them

Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>Lack of quality broodstock</p> <p>Genetic improvement</p>	<p>Researchable issues</p> <p>State of genetic resources of Ugandan Nile tilapia and African catfish</p> <p>Breeding program design (including: Synthetic founder population establishment, choice of testing environments, breeding objectives and criteria, genetic evaluation system, selection and mate allocation, monitoring of genetic gain and on farm testing of the improved strains.</p> <p>Risks associated with disseminating genetically improved strains</p> <p>Supporting actions</p> <p>Gender equitable approach to build hatchery broodstock management capacity</p> <p>Build and implement risk management plan for use of genetically improved strains</p> <p>Broker dialogue to determine roles and options for private and public sectors and civil society, especially for women, in dissemination of broodstock</p>	<p>Research</p> <p>Farmers, hatcheries and Producer Organizations to help ensure the breeding program is designed and implemented in a manner that addresses their needs and to partner in relevant activities, including capacity building at all levels</p> <p>NARO to partner on capacity building, developing and implementing breeding program</p> <p>ARIs (Bergen, CIRAD, Dartmouth College, Notre Dame, Stirling, Wageningen) to partner on research, technical backstopping and capacity building</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and incorporate into government planning cycle and devise and implement risk management</p> <p>NAADS to collaborate on gendered approach to capacity building</p> <p>Hatchery owners and managers to partner in use and management of genetically improved broodstock</p> <p>USAID LEAD to partner on disseminating genetically improved broodstock to hatcheries and evaluating their contribution to increased productivity and profits</p> <p>Technical services providers to support use and management of genetically improved broodstock</p> <p>Bilateral donors, microfinance providers and NGOs to support program implementation</p>	<p>Widespread use of productive, fast growing broodstock strains that meets present and future anticipated needs of farmers</p>

Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p> Production</p> <p>Poor hatchery performance</p> <p>Improve hatchery design and management</p>	<p>Researchable issues</p> <p>Hatchery design and gendered staffing and management practices</p> <p>Sources of mortality and mitigation approaches.</p> <p>Seed production technologies for high potential new species (e.g. <i>Barbus</i>, <i>Labeo</i>)</p> <p>Gendered impacts of technological and management changes and mitigation responses</p> <p>Supporting actions</p> <p>Identify priority areas for hatchery development and policy changes and public sector investments that are needed to create an enabling environment for the development of the hatchery sector</p> <p>Develop and disseminate simple guidelines and implement training for fry and fingerling management</p> <p>Develop and promote hatchery business management tools</p> <p>Design and promote gender equitable needs based training for hatchery operatives</p>	<p>Research</p> <p>Farmers, hatcheries and Producer Organizations to partner on improving hatchery design, management and M&E</p> <p>NARO to partner on capacity building, developing and implementing improved seed production</p> <p>USAID LEAD to partner on-hatchery management research</p> <p>ARIs (Stirling, Wageningen) to partner on research, technical backstopping and capacity building</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and incorporate into government planning cycle and devise and implement biosecurity issues associated with use of genetically improved seed and disease</p> <p>NAADS to collaborate on design and implementation of a gendered approach to capacity building</p> <p>Hatchery owners and managers to partner in production and management of genetically improved seed and capacity building</p> <p>USAID LEAD to partner on dissemination of genetically improved broodstock to hatcheries and evaluation of their contribution to increased productivity and profits</p> <p>Technical services providers to support use of genetically improved seed by farmers</p> <p>Bilateral donors, microfinance providers and NGOs to support program implementation</p>	<p>Widespread use of productive, fast growing seed that meets present and future anticipated needs of farmers</p>

Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>High transport associated mortalities</p> <p>Improve fish transport</p>	<p>Researchable issues</p> <p>Transport and post-transport seed mortalities and transport practices</p> <p>Protocols for farmers to assess seed quality on delivery</p> <p>Supporting actions</p> <p>Broker dialogues between farmer/groups, hatcheries/nurseries and transporters</p> <p>Evaluate utility of nursing networks to improve seed transport and stocking practices</p> <p>Develop training materials for sharing with stakeholders (e.g. through adoption by TSPs and incorporation into farmer field schools and other relevant capacity building fora)</p> <p>Identify infrastructure weaknesses in priority aquaculture development areas</p>	<p>Research</p> <p>Farmers, hatcheries, Producer Organizations and transporters to help identify and prioritize critical steps in fish transport, devise effective and economically efficient solutions and build capacity within the transport sector</p> <p>NARO to partner on research, capacity building and implementing improvements in the seed transport sector</p> <p>USAID LEAD to partner on research and implementation of improvements in seed transport</p> <p>ARIs (Bergen, CIRAD, Dartford College Notre Dame, Stirling, Wageningen) to partner on research, technical backstopping and capacity building</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help establish priorities for action, including where infrastructure improvements should be prioritized</p> <p>Hatchery operators, seed transporters and farmers to partner in development and adoption of better seed transport and stocking practices</p> <p>NAADS to collaborate on gendered approach to capacity building among hatchery operators, seed transporters and farmers</p> <p>USAID LEAD to partner on development of improved seed transport and stocking practices and evaluation of their contribution to increased productivity and profits</p> <p>Technical services providers to support adoption and capacity building of hatcheries, transporters and farmers</p>	<p>Reduced seed losses, reduced costs and increased production</p>


Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>Weak markets for quality seed</p> <p>Strengthen demand</p>	<p>Researchable issues</p> <p>Performance and profitability of seed from improved strains</p> <p>Production, economic returns and farmer satisfaction from use of seed from improved strains</p> <p><i>Supporting actions</i></p> <p>Conduct on-farm demonstrations to show impacts of genetically improved strains on production and profitability</p> <p>Formation of business-oriented and sustainable producer organizations</p> <p>Develop and implement a hatchery accreditation scheme in close consultation with relevant stakeholders (e.g. NAROs, hatchery managers, farmer organizations, environmental impact assessment agencies).</p> <p>Identify effective and cost-efficient interventions (e.g. contract growing, access to affordable credit) that will increase the use of quality seed by farmers</p>	<p>Research</p> <p>Farmers, hatcheries and Producer Organizations to help assess impacts of improved seed quality on productivity and profits,</p> <p>NARO to partner on on-farm and on-station research into impacts of improved seed on production and profits</p> <p>Bilateral donors (EC, DFID, NORAD) to help implement program</p> <p>ARIs (Stirling, Wageningen) to partner on market research, technical backstopping</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and develop appropriate policy support</p> <p>NAADS to collaborate on gendered approach to capacity building</p> <p>Hatchery owners and managers to partner in development and adoption of industry standards for producing and transporting of quality seed</p> <p>Aquaculture enterprises to facilitate contract growing</p> <p>USAID LEAD to partner in development of markets for quality seed</p> <p>Technical services providers to support use and management of quality seed</p>	<p>Demand led-increases in development and use by farmers of quality seed from genetically improved strains</p>

Opportunities and constraints in fish feed value chain and the research and development actions to overcome them

	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
<p>Inputs and services</p> <p>Lack of affordable quality feedstuffs</p> <p>Identify materials and remove barriers to their supply</p>	<p>Researchable issues</p> <p>Nutritional content and value of key, especially locally produced, feedstuffs</p> <p>Methods of pre-treatment to reduce anti-nutrients and increase palatability and digestibility</p> <p>Markets, both agricultural and human, for feedstuffs</p> <p>Impacts on ecosystem services (land, water, waste dispersion and assimilation)</p> <p>Use of wastes from pig and other animal production systems as pond fertilizers</p> <p>Supporting actions</p> <p>Identify synergies with other agricultural feed producers</p> <p>Promote best practices in processing and storage of feedstuffs</p>	<p>Research</p> <p>Farmers and feed producers to partner in identification and use of feedstuffs</p> <p>NARO and Ugandan universities and ASARECA partner NARS and universities to carry out research on feedstuffs</p> <p>ARIs (Bergen, CIRAD, Stirling, Wageningen) to partner on feedstuffs related research</p> <p>CG centres to partner on research into markets for feedstuffs and on feedstuff quality and development of pre-treatment methodologies</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and incorporate into government planning and policy making cycles</p> <p>NARO and Ugandan universities and SRO partner country NARS and universities to partner on capacity development for feedstuff producers, transporters, feed producers and farmers</p> <p>Feed producers to partner in developing and using feedstuffs quality standards</p> <p>USAID LEAD to partner on identification of reliable supplies of locally available, affordable and nutritious feedstuffs</p>	<p>Development of affordable nutritionally and environmentally sound, aquaculture feeds</p>

Outcomes	Potential partners and their roles
<p>Reliable supplies of nutritionally sound, affordable and environmentally friendly feeds that meet the needs of farmers</p>	<p>Research</p> <p>Farmers, feed producers and Farmer Organizations to improve the quality and performance of feeds</p> <p>NARO and Ugandan universities and SRO partner country NARS and universities to partner on feed formulation and processing research</p> <p>ARIs (Bergen, CIRAD, Stirling and Wageningen) to partner on research, technical backstopping and capacity development on feed production and on demand for ecosystem services</p> <p>CG centres, feed platform and Ugandan pig value chain MP to partner on feed production technology and related research</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help identify and implement incentives to promote adoption of new feed processing technologies</p> <p>Feed mill owners and managers to partner in production of feed that meets the needs of producers and in capacity development</p> <p>USAID LEAD to partner on trialling development of feeds by local mills and farmers</p> <p>TSPs to develop, promote and collect data on on-farm feed manufacture</p>
<p>Production</p> <p>Nutritionally deficient feeds and poor technical support</p> <p>Identify nutritional requirements and improve feed quality</p>	<p>Researchable issues and supporting actions</p> <p>Researchable issues</p> <p>Effects of feed formulation on pellet stability, palatability, food conversion and profitability</p> <p>Effects of diet on nutritional value of farmed fish</p> <p>Simple least cost formulation tools through farmer field schools and other mechanisms</p> <p>Effects of feed production technologies on feed stability, palatability, food conversion ratio, profitability</p> <p>Development of business case for investment in feeds and feed improvements</p> <p>Advantages and disadvantages of large-scale versus small-scale commercial and on-farm feed production (quality and supply, profits and ecosystem services)</p> <p>Effects of processing technologies on ecosystem services and global warming potential and determine ways to reduce these</p> <p>Supporting actions</p> <p>Broker and catalyse the partnerships needed to ensure uptake of results by feed manufacturers, including farmers</p>


	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
<p>Transport and processing</p> <p>Feed spoilage and poor distribution networks</p> <p>Improve feed distribution and storage</p>	<p>Researchable issues</p> <p>Impacts of storage conditions on nutritional value of feeds and on contaminants</p> <p>Feed transport constraints and methods to address these, including synergies with other agricultural input distribution and storage services</p> <p>Business incentives to make the feed supply/transport system work efficiently at scale</p> <p>Supporting actions</p> <p>Develop effective and cost-efficient interventions to facilitate access to quality affordable feeds</p> <p>Develop storage guidelines for farmers</p> <p>Create gender equitable employment opportunities</p>	<p>Research</p> <p>Farmers, hatcheries, Producer Organizations and transporters to help identify and prioritize critical steps in feed transport, devise effective and economically efficient solutions and build capacity within the transport sector</p> <p>NARO and Ugandan universities and SRO partner country NARS and universities to partner on research on feed storage</p> <p>USAID LEAD to partner on research in feed transport and storage</p> <p>ARIs (CIRAD, Stirling) to partner on research and technical backstopping on feed storage</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help establish and implement priorities to improve feed transport, including infrastructure improvements</p> <p>Feed producers, transporters, farmers and Producer Organizations to help develop and adopt better feed transport and storage practices to improve quality and reduce costs</p> <p>NAADS to collaborate on gendered approach to capacity development among feed transporters and farmers</p> <p>USAID LEAD to partner on brokering improvements in feed availability</p> <p>Technical services providers to support transporters and farmers on best practices for feed transport and storage</p>	<p>Affordable quality feeds available to all producers</p>

	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
 <p>Poorly developed feed markets</p> <p>Improved institutions and information</p>	<p>Researchable Issues</p> <p>Current and future market demand for aquaculture feeds</p> <p>Simple tools that allow farmers to determine the role of feeds in production and profits</p> <p>Roles of private and public sector and civil society in developing markets for feeds</p> <p>Supporting actions</p> <p>Develop Producer Organizations in value chain areas to reduce costs of feed purchases</p> <p>Develop extension materials on feed management for farmers and POs</p>	<p>Research</p> <p>Farmers, hatcheries, Producer Organizations and transporters to help identify constraints to feed use</p> <p>NARO and Ugandan universities to partner on research on feed markets</p> <p>USAID LEAD to partner on research in feed markets</p> <p>ARIs (Stirling) to partner on research into aquaculture feed markets</p> <p>Supporting actions</p> <p>Farmers and Producer Organizations to help develop capacity to purchase and distribute feeds, thereby reducing costs</p> <p>NAADS, TSPs, USAID LEAD and NGOs to co-develop and promote best practices on use of feeds</p>	<p>Strong demand for quality and profitable feeds by farmers</p>

Opportunities and constraints in tilapia and catfish production value chain in Uganda and the research and development actions to overcome them

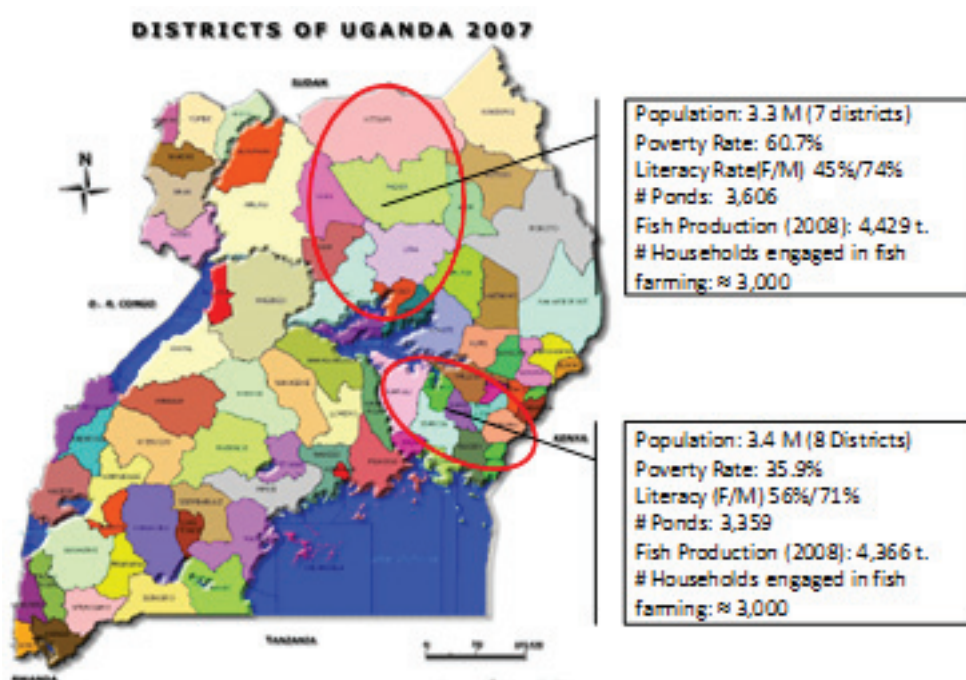
Inputs and services	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p>Lack of quality and availability</p> <p>Improve access to quality business and technical advice, affordable credit, seed and feed and fertilizer</p>	<p>See seed and feed value chains above</p>	<p>See seed and feed value chains above</p>	<p>Farmers able to access quality seed, feed and technical advice that meets their needs</p>
<p>Production</p> <p>Low productivity, poor production practices and marginal profitability</p> <p>Improve production practices</p>	<p>Researchable issues</p> <p>Fertilization regimes</p> <p>System-specific business plans</p> <p>Species and production system-specific feeding and fertilization regimes to maximize productivity and profits</p> <p>Impacts of production intensification on gender and household power relations</p> <p>Feasibility and pro-poor and gender equitable benefits from contract growing</p> <p>Supporting actions</p> <p>Develop record keeping, technical capacity and business skills among producers</p> <p>Develop soft skills (e.g. communication, business, negotiation, gender awareness) among CG staff</p> <p>Develop technical, communications and business skills among NAADS staff and TSPs</p> <p>Develop research skills among NARO and university staff</p> <p>Develop capacity development material for use by NAADS and TCPs</p>	<p>Research</p> <p>Farmers, feed producers and Farmer Organizations to seek gender equitable methods (including contract growing) to increase production and productivity</p> <p>NARO and Ugandan universities and SRO partner country NARS and universities to partner on developing productive and profitable technologies</p> <p>ARIs (Bergen, CIRAD, Stirling and Wageningen) to partner on research, technical backstopping and capacity development</p> <p>Supporting actions</p> <p>Farmers and POs to help identify capacity building needs, develop capacity building materials and participate in capacity building programs, and to participate in technology development</p> <p>Ministry of Agriculture to help identify and implement incentives to adoption of productive and profitable technologies</p> <p>NAADS and TCPs to participate in development of staff communication and gender awareness skills</p> <p>TSPs, USAID LEAD and NGOs to partner on gendered technology development and dissemination to farmers</p>	<p>Increased farmed fish production and consumption by the poor</p>

Outcomes	Indicative partners and their roles	Researchable issues and supporting actions	
Increased quantities of affordable and nutritionally sound fish and fish products in markets	<p>Research</p> <p>Farmers, hatcheries, Producer Organizations and transporters to help identify and prioritize critical steps in fish transport, devise effective and economically efficient solutions and build capacity within the transport sector</p> <p>NARO and Ugandan universities and SRO partner country NARS and universities to partner on research on fish processing and cold chain development</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help establish and implement priorities to improve feed transport, including road and other infrastructure improvements</p> <p>Transporters, farmers and Producer Organizations to help develop and adopt better fish transport practices to improve quality, food safety and reduce post-harvest losses and prices</p> <p>NAADS to collaborate on capacity development among fish transporters</p> <p>USAID LEAD to partner on brokering improvements in fish transport systems</p> <p>Technical services providers to support farmers on development of best practices for harvesting and post-harvest handling</p>	<p>Researchable issues</p> <p>Impacts of harvesting and transport on post-harvest quality, food safety and price</p> <p>Impact of cost-effective cold chain on returns throughout the value chain</p> <p>Options for post-harvest processing to improve storage or add value</p> <p>Supporting actions</p> <p>Develop and deliver training on fish transport</p> <p>Seek synergies with other food, especially livestock, in transport and cold chains</p> <p>Design and implement improvements to road and other infrastructure</p> <p>Create gender equitable employment opportunities</p>	<p>Transport and processing</p> <p>Low quality and limited value adding</p> <p>Improve quality and seek equitable value added opportunities</p>

Outcomes	Indicative partners and their roles	Researchable issues and supporting actions	
<p>Strong demand for—and increased access to—farmed fish products by poor and vulnerable consumers</p>	<p>Research Farmers, consumers and Producer Organizations NARO and Ugandan universities to collaborate on fish market research NGOs to partner on market research and development ARIs (Stirling) to partner on research into marketing of aquaculture products</p>	<p>Researchable issues Present and likely future demand for different farmed fish products among poor consumers New markets for novel products Mechanisms to increase communication between customers and producers to test the hypothesis that farmers will use the information to better target production to market demand Use of ICT to reduce knowledge imbalances and improve value chain efficiency The role of POs in marketing Drivers of competition among local, national and regional markets for farmed fish Impacts of increased fish supply on consumption by vulnerable groups, including women and children Supporting actions Develop capacity to conduct market research Develop capacity to collect human health and nutrition data</p>	<p> Poorly developed markets Awareness raising among poor consumers</p>
	<p>Supporting actions Farmers, Producer Organizations and traders to collaborate on development of marketing skills, use of ICT and collection of data NAAADS, TSPs, USAID LEAD and NGOs to support farmers in adoption of ICT</p>		

Geographic focus

Biophysical analysis shows that fish farming can be undertaken across most of Uganda (FAO Country Report 2005). Our in-country consultations, however, have helped us identify two contrasting areas as the focus for this program (see Figure below). The northern area is one of considerable focus for rehabilitation following the recent period of conflict. Infrastructure investments are now being made and the Ugandan government has identified this as a priority region for aquaculture development. The region is characterized by a very high unmet demand for fish both locally and for cross border trade with southern Sudan. In contrast, the south eastern region has better infrastructure and somewhat lower poverty rates. The market demand for fish from this area comes from local markets the urban markets of Kampala and Entebbe and cross border demand from Kenya. It is also a government priority area for aquaculture development.



We believe these areas provide not only the greatest potential for impact but also that the contrasts between them offer excellent opportunities for learning. The north is one of the poorest and least accessible regions of the country but it is one where local and regional demand for fish is very high. In contrast, the southeast region has good connection to urban centres and there is existing interest by the private sector in investing in fish farming. There is considerable potential for growth in fish production in both regions but the differing contexts should provide greater insights with regard to effective development pathways elsewhere.

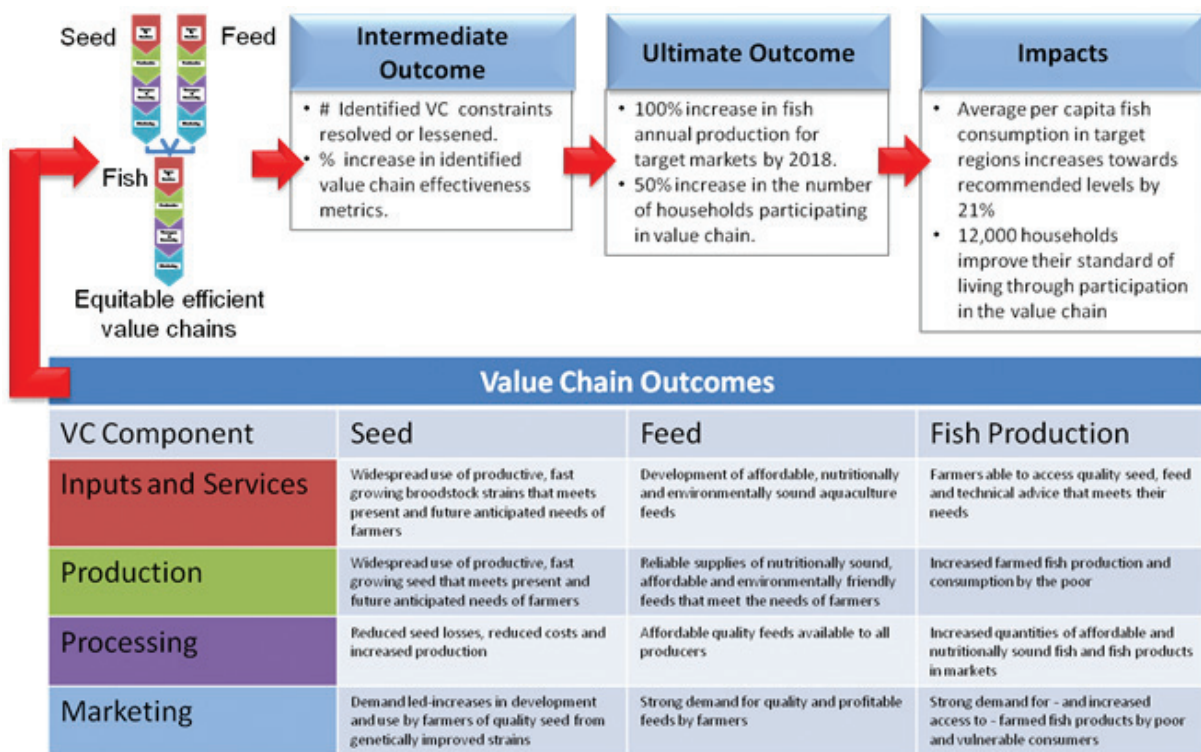
Potential for impact

Production levels from each of our two target regions in 2008 were of the order of 4,500 t. Because annual average growth rates are slowing as value chain barriers have developed we assume baseline (do nothing) growth rates of 3%. Under these assumptions expected production by 2018 would total just over 11,000 t for the two regions combined. If the proposed program is successful, we believe it is possible to double annual production by 2018 to 22,000 t. This will require annual average growth rates of approximately 13.5%—a challenging but achievable target, assuming that the partnerships we have identified are well structured and effective.

Overall, this growth would yield an additional 11,000 t of fish per year over baseline (do nothing) levels, distributed evenly between the two regions. Assuming that 75% of additional production is supplied to consumers within the northern area, with the remainder traded across Uganda’s northern border it would provide an additional 1.5 kg of fish per person per year. Assuming higher (50%) levels of trade in the southeast, increased annual consumption here would be of the order of 1 kg per person. These values represent a 25% and a 17% increase in per capita consumption for the populations in northern and southeastern areas, respectively. This of course ignores the contributions traded fish would make to nutrition outside the target regions.

We estimate that approximately 3,000 households participate in fish production in each of the regions and believe it is possible to increase this total by 50% by 2017. Improving the livelihoods of both current farmers and these 3,000 new entrants would, therefore, reach 9,000 households. In addition, we anticipate benefits to a further 3,000 participants participating in the upstream and downstream linkages in the target value chains.

The Figure below summarizes the pathway from the target outcomes identified in the above three Tables for each component of the value chains through to the impact on food security.

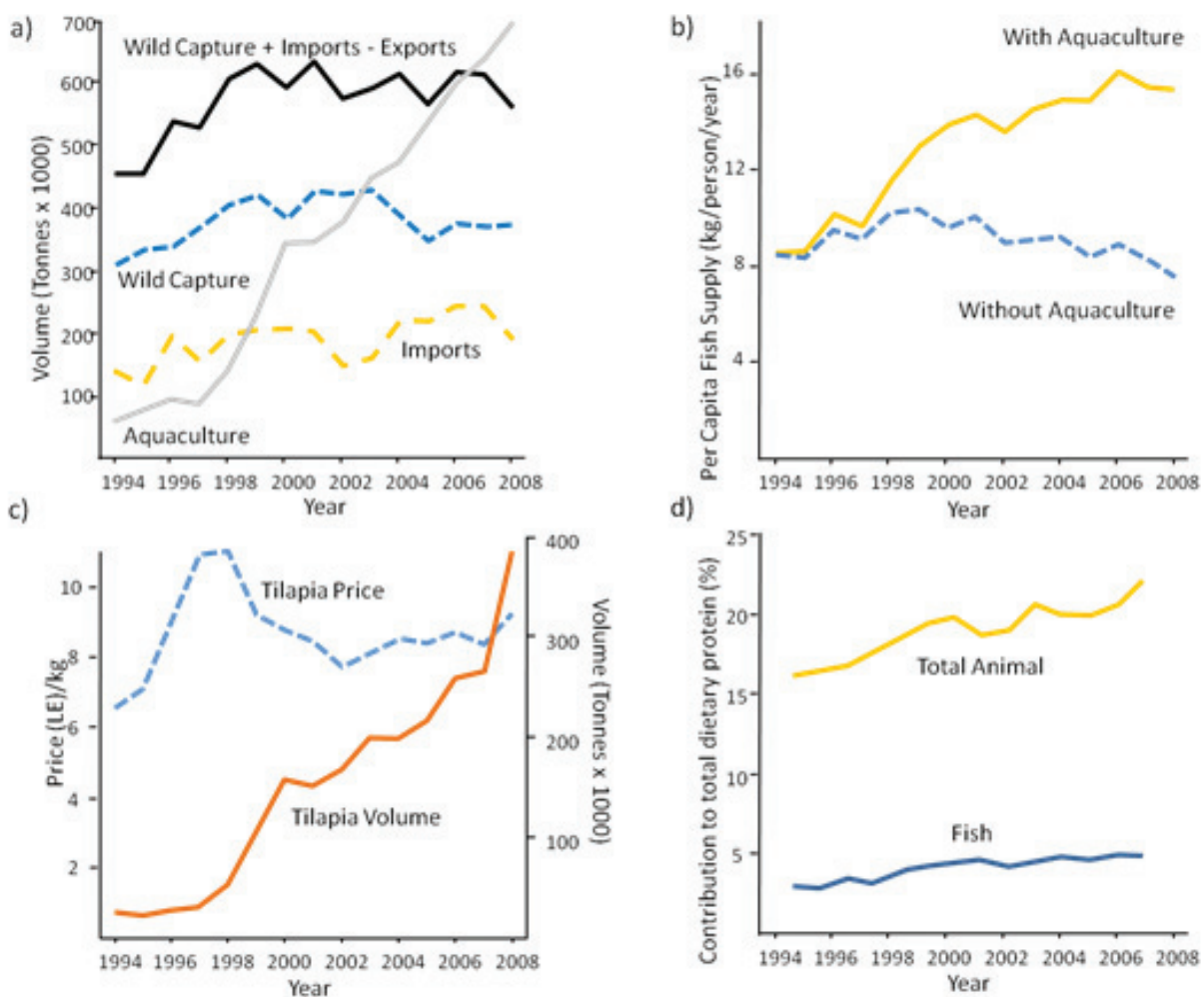


Although these calculations are necessarily crude, and will need to be further refined during the early phase of this work, we believe they offer a realistic picture of the local returns to investment. The impacts of wider capacity building efforts and uptake and scale-out beyond the target region would add to the total benefits that can be expected from this work, but we have made no effort to quantify this.

Tilapia in Egypt

The aquaculture sector in Egypt

Egyptian aquaculture has grown rapidly over the past decade and is an important component of national food supply. Valued at some LE 4.0 billion at first sale, all of which supplies domestic markets, farmed fish now contribute over 65% of total national fisheries production, up from 15% in 1994. Aquaculture production increased from 57,000 t in 1994 to 694,000 t in 2008, an average 21% growth annually. In contrast, wild capture supplies have been stable or declining since 1998, fish imports have remained relatively stable and exports have been minimal (see Figure a below). During the same 1994 to 2008 period the Egyptian population grew by 36%, from 60.1 million to 81.7 million.



Despite the large population increase, the stagnation of wild fish production and the stable trend in imports, per capita fish supply increased from 8.5 kg to 15.4 kg/person/year during this period (see Figure b above). In the absence of aquaculture, but with other supplies remaining the same, this figure would have fallen to 7.6 kg by 2008.

Growth in aquaculture production also affected the affordability of fish for consumers. With tilapia for example, which constitutes over 50% of all farmed fish by weight, a trend of increasing price from 1994 to 1998 was reversed over the next four years. Since then prices have risen slowly, but remain well short of the peak in 1997. Thus, fish farming has increased fish supply for consumers and maintained affordable prices (see Figure c

above). This has contributed to a doubling between 1994 and 2008 of the contribution that fish protein makes to total protein in the Egyptian diet (see Figure d above). Prices for tilapia remain well below those for chicken meat; in urban markets they were 35% lower in 2007 and 42% lower in rural markets.

Despite this impressive growth and current value, however, aquaculture production will need to rise further in coming years to meet growing demand for fish. Even more will be required for fish to continue to be available to people with lower incomes. To meet projected national needs for the next 10–15 years, aquaculture production of some 1.0–1.6 million tonnes will be required. Analysis of the sector indicates that this growth will need to primarily be based on the expansion of tilapia aquaculture in semi-intensive to intensive ponds (WorldFish 2007). To meet this production growth target significant challenges in terms of resources, technology, investment and sector organization must be met. At present the sector's growth is slowing and, together with increasing pressure on land and water resources in the Nile Delta, the principle area of production, improvements in production efficiency are essential if growth is to continue.

Research, supporting action and partnership

The importance and future challenges of the aquaculture sector are widely recognized in Egypt and have attracted considerable response at public and private sector level. A series of workshops and consultations since 2005 has examined the sector, discussed the specific constraints and challenges, and made technical recommendations on issues to be addressed to support successful growth. A comprehensive stakeholder consultation in 2007 facilitated by WorldFish at the request of the Ministry of Agriculture culminated in a detailed sectoral analysis and series of recommendations to support sectoral growth (WorldFish 2007). These recommendations focussed on four essential components that are required for positive development of the sector: (i) production efficiency; (ii) market development; (iii) policy and institutions; and (iv) research, development and capacity building.

Since that time we have worked with the Ministry of Agriculture, the Agricultural Research Council, The General Authority for Fisheries Research and Development and the private sector to gain support to help implement these recommendations. This CRP provides an ideal context for the CGIAR to more fully engage in and support this effort through an enhanced research and capacity building effort that builds on these relationships.

There is limited information at this stage on market chains, volumes and margins, and also on the respective market power. This will have to be built up more strongly for future understanding of the sector's potential. It appears that traditional local and city market structures still represent the bulk of trading, mainly operating through traditional wholesalers. However, contract buying from some fish farms or producer groups has been reported, which is consistent with aquaculture-linked market changes seen in other countries. A large quantity of tilapia is transported to the main national market of El-Obour for auction and further distribution throughout Greater Cairo. Its capacity is estimated from 100 to 150 t per day (~ 30,000–50,000 t per year). This was reported to be similar to the estimated quantities entering the Greater Cairo area from all other sources directly to traders, retailers and hotels (Feidi 2004).


There is also a substantial research agenda concerning access to fish and food choice by poor consumers and the constraints and issues surrounding this. Our hypothesis is that a value chain approach to supporting development of the sector can drive positive development impacts for poor consumers. Testing this will require research effort to better understand the relationships between increases in production, availability and price for poor consumers, the food choices they make and resultant health and nutrition outcomes. The gender dimensions of these topics are of considerable importance and will receive particular attention. Here, linkages with CRP will be explored and elaborated at an early opportunity.


Criteria for final country selection and the rationale for choosing Egypt


Criteria	Egypt
Markets for fish are developed to a scale that offers potential to support a value chain focus	<p>Largest farmed fish producer in Africa (650,000 t), accounting for approximately 70% of production</p> <p>Large increase in projected demand. If consumption is maintained at the 2002 level of more than 14 kg per capita, domestic demand would be 1,148,300 t and 1,369,900 t in 2010 and 2025 respectively. This would require increases of 20.5% and 43.7% above 2002 supply levels</p> <p>A strong fish consumption culture. The expansion of aquaculture has succeeded in reducing and stabilizing the cost of fish in Egypt allowing accessibility to the poorer rural population to healthy and affordable animal protein</p>
Potential for aquaculture production to contribute significantly to meeting national or regional fish demand within 5–7 years	<p>Required growth achievable, but only through sustainable intensification of production. The average annual growth required for aquaculture to double in output in 10 years would be 7.2%. According to national statistics, this compares with 24.4% over the last 10 years, 16.1% over the last 5, and 12.0% over the last 2 years. This suggests that doubling is not unreasonable, but the sector will need specific attention to reduce costs and increase resource use efficiencies. (Egyptian Aquaculture Strategy 2008)</p>
Food and nutrition security assessments indicate current situation as low or at risk	<p>Egypt is a low-income, food-deficit country, with 19.6% of the population – almost 14.2 million people—living below the lower poverty line on less than USD 1/day</p> <p>Malnutrition and undernutrition is common. In 2008 29% of children under 5 were ‘stunted’, 6% were ‘underweight’ and 7% were ‘wasted’ (Egyptian Ministry of Agriculture and Land Reclamation 2010)</p> <p>‘Stark geographical disparities exist between the region of Upper Egypt, desert areas in Sinai and the Red Sea—which are some of the country’s poorest areas with high levels of food insecurity and malnutrition’ WFP (2010)</p>
National and regional policy environment supports the proposed approach	<p>The General Authority for Fish Resources Development (GAFRD) has set a goal of 1.1 million tonnes of farmed fish, equivalent to around 75% of total fish production, by 2012. It hopes to increase average annual production of freshwater fish farms to 5 t per acre, up from an average of 1–3 t per acre (2.5–7 t per hectare)</p> <p>Development of the 2008 Egyptian Aquaculture Strategy was supported by WorldFish. This proposal aligns fully with the country strategy</p>
International development agency policy environment supports the proposed approach	<p>Egypt has a regional role to in capacity building and sharing lessons as a member of the African Union and COMESA, and as the continent’s leader in aquaculture. WorldFish facilities at Abbassa and the training programs it provides are a key element in this capacity building capability</p> <p>Egypt is not currently a priority country for many development agencies, but some see it as of considerable strategic importance</p> <p>Canadian CIDA, have small and medium enterprise development as one of two thematic program pillars in their Country Development Programming Framework (CDPF) for Egypt (2001–2011)</p> <p>USAID support to Egypt is greater than for all other countries except Israel. IFAD supports Egypt with a priorities to both ‘encourage private sector development and enhance agricultural competitiveness’, and ‘promote innovative research and extension systems that respond to the need of small farmers and rural women’</p>
Development Partners also identify aquaculture value chains as a fruitful area for investment	<p>The Netherlands Government invested in development of SME aquaculture through the agribusiness sector between 2005 and 2009</p> <p>FAO and JICA have funded a large number of regional and national capacity building courses at the WorldFish Abbassa centre and at public and private sector partner training facilities</p> <p>The private sector has invested in the development of high quality, low fishmeal and fish oil feeds</p> <p>The EC and Government of Egypt have invested in the development of genetically improved strains of tilapia and African catfish, the former now being ready for large-scale multiplication and dissemination to farmers</p>


In the Tables below, we summarize the conclusions from our research and consultations to date on the research foci for this work, using the value chain framework adopted throughout this CRP.

Opportunities and constraints in the seed value chains and the research and development actions to overcome them


Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p data-bbox="288 1944 587 2074">  Inputs and services </p> <p data-bbox="603 1944 655 2074">Broodstock performance</p> <p data-bbox="794 1944 847 2074">Genetic improvement</p>	<p data-bbox="280 1671 301 1879">Researchable issues</p> <p data-bbox="333 1267 448 1879">Breeding program evaluation and adaptation (including: breeding objectives and criteria, genetic evaluation system, selection and mate allocation, monitoring of genetic gain and on farm testing of the improved strains).</p> <p data-bbox="477 1285 529 1879">Risks associated with disseminating genetically improved strains</p> <p data-bbox="724 1682 745 1879">Supporting actions</p> <p data-bbox="777 1346 798 1879">Develop industry wide breed improvement strategy</p> <p data-bbox="834 1285 887 1879">Gender equitable approach to build hatchery broodstock management capacity</p> <p data-bbox="916 1285 968 1879">Broker dialogue to determine roles and options for private and public sectors in dissemination of broodstock</p>	<p data-bbox="280 1155 301 1256">Research</p> <p data-bbox="333 461 448 1256">Farmers, hatcheries and Producer Organizations to help ensure the breeding program is designed and implemented in a manner that addresses their needs and to partner in relevant activities, including capacity building at all levels</p> <p data-bbox="477 461 529 1256">Private sector to partner on capacity building, developing and implementing breeding program</p> <p data-bbox="558 723 579 1256">CLAR to help develop genetically improved strains.</p> <p data-bbox="616 495 700 1256">ARIs (Bergen, CIRAD, Dartmouth College, Notre Dame, Stirling, Wageningen) to partner on research, technical backstopping and capacity strengthening</p> <p data-bbox="729 1061 750 1256">Supporting actions</p> <p data-bbox="786 506 839 1256">Ministry of Agriculture to help prioritize actions and incorporate into government planning cycle and devise and implement risk management</p> <p data-bbox="868 539 920 1256">Hatchery owners and managers to partner in use and management of genetically improved broodstock</p> <p data-bbox="949 483 1002 1256">Technical services providers to support use and management of genetically improved broodstock</p> <p data-bbox="1031 517 1083 1256">Bilateral donors, microfinance providers and NGOs to support program implementation</p>	<p data-bbox="333 185 509 461">Widespread use of productive, fast growing broodstock strains that meets present and future anticipated needs of farmers</p>

Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>Hatchery performance</p> <p>Improve hatchery design and management</p>	<p>Researchable issues</p> <p>Hatchery design and gendered staffing and management practices</p> <p>Sources of mortality and mitigation approaches.</p> <p>Gendered impacts of technological and management changes and mitigation responses</p> <p>Supporting actions</p> <p>Facilitate new models for hatchery development and policy changes and public sector investments that are needed to improve the quality and service level of the hatchery sector</p> <p>Develop and disseminate best practice guidelines and quality standards.</p> <p>Backstop training for fry and fingerling management</p> <p>Develop and promote hatchery business management tools</p> <p>Design and promote gender equitable needs based training for hatchery operatives</p>	<p>Research</p> <p>Farmers, hatcheries and Producer Organizations to partner on improving hatchery design, management and M&E</p> <p>Private sector to partner on capacity building, developing and implementing improved seed production</p> <p>ARIs (Stirling, Wageningen) to partner on research, technical backstopping and capacity building</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and incorporate into government planning cycle and devise and implement biosecurity issues associated with use of genetically improved seed and disease</p> <p>Hatchery owners and managers to partner in production and management of genetically improved seed and capacity building</p> <p>Technical services providers to support use of genetically improved seed by farmers</p> <p>Bilateral donors, microfinance providers and NGOs to support program implementation</p>	<p>Widespread use of productive, fast growing seed that meets present and future anticipated needs of farmers</p>


Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p> Transport and processing</p> <p>High transport associated mortalities and deterioration in seed quality</p> <p>Improve fish transport</p>	<p>Researchable issues</p> <p>Transport and post-transport seed mortalities and transport practices</p> <p>Protocols for farmers to assess seed quality on delivery</p> <p>Performance of stocked seed as a function of size, health and strain</p> <p>Supporting actions</p> <p>Broker dialogues between farmer/groups, hatcheries/nurseries and transporters</p> <p>Identify infrastructure weaknesses in priority aquaculture development areas</p> <p>Identify infrastructure weaknesses in priority aquaculture development areas</p>	<p>Research</p> <p>Farmers, hatcheries, Producer Organizations and transporters to help identify and prioritize critical steps in fish transport, devise effective and economically efficient solutions and build capacity within the transport sector</p> <p>ARIs (Bergen, CIRAD, Dartford College Notre Dame, Stirling, Wageningen) to partner on research, technical backstopping and capacity building</p> <p>Supporting actions</p> <p>Hatchery operators, seed transporters and farmers to partner in development and adoption of better seed transport and stocking practices</p> <p>Technical services providers to support adoption and capacity building of hatcheries, transporters and farmers</p>	<p>Reduced seed losses, reduced costs and increased production</p>

Constraints	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>Business case for genetically improved seed widely appreciated</p> <p>Improve evidence and marketing</p>	<p>Researchable issues</p> <p>Performance and profitability associated with use of seed from improved strains</p> <p>Production, economic returns and farmer satisfaction from use of seed from improved strains</p> <p>Supporting actions</p> <p>Conduct on-farm demonstrations to show impacts of genetically improved strains on production, productivity and profitability</p> <p>Develop traceability systems and standards</p> <p>Develop and implement a hatchery accreditation scheme in close consultation with relevant stakeholders (e.g. Ministry of Agriculture, hatchery managers, farmer organizations)</p>	<p>Research</p> <p>Farmers, hatcheries and producer organizations to help assess impacts of improved seed quality on productivity and profits,</p> <p>CLAR to partner on on-farm and on-station research into impacts of genetically improved seed on production and profits</p> <p>Bilateral donors to help implement program</p> <p>ARIs (Stirling, Wageningen) to partner on market research, technical backstopping</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and develop appropriate policy support</p> <p>Hatchery owners and managers to partner in development and adoption of industry standards for producing and transporting of quality seed</p> <p>Technical services providers to support use and management of quality seed</p>	<p>Demand led-increases in development and use by farmers of quality seed from genetically improved strains</p>


Opportunities and constraints in fish feed value chain and the research and development actions to overcome them

	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
 <p>Inputs and services</p>	<p>Researchable issues</p> <p>LCA analysis of feed industry, identification of reliable supplies of affordable and nutritious local feed ingredients</p> <p>Competition between feed producers and poor consumers for feed ingredients and effects on prices</p> <p>Tailored feeds for key production stages</p> <p>Quality control and testing approaches</p> <p>Development, costing and adoption of traceability processes in feed manufacture</p> <p>Benefits of probiotics</p> <p>Supporting actions</p>	<p>Research</p> <p>ARIs (Bergen, CIRAD, Stirling and Wageningen) to partner on research, technical backstopping and capacity development on feed production</p> <p>CLAR and other Egyptian agriculture research centres to collaborate on research into locally produced feedstuffs</p>	<p>Development of environmentally sound aquaculture feeds, based on local ingredients, that meet international standards of traceability</p>
<p>Reliance on imported feedstuffs, with large ecological foot-print</p>	<p>Supporting actions</p> <p>Disseminate results to industry, producers and policymakers</p>	<p>Supporting actions</p> <p>Ministry of Agriculture to help prioritize actions and incorporate into government planning and policy making cycles</p> <p>Capacity enhancement of public and private sector trainers</p>	
<p>Improved LCA values and traceability</p>		<p>Development and adoption of environmental criteria for feed production</p>	

	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
<p>Production</p> <p>Expensive, energy-intensive feeds</p> <p>Profitable, nutritionally sound and environmentally friendly feeds</p>	<p>Researchable issues</p> <p>Effects of diet on nutritional value of farmed fish</p> <p>Effects of feed production technologies on feed stability, palatability, food conversion ratio, profitability</p> <p>Supporting actions</p> <p>Broker and catalyse the partnerships needed to ensure uptake of results by feed manufacturers, including farmers</p>	<p>Research</p> <p>Farmers, feed producers, Farmer Organizations and CLAR to collaborate to improve the quality and performance of feeds</p> <p>ARIs (Bergen, CIRAD, Stirling and Wageningen) to partner on research, technical backstopping and capacity development on feed production</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help identify and implement incentives to promote adoption of new feed processing technologies</p> <p>Feed mill owners and managers to partner in production of feed that meets the needs of producers and in capacity development</p> <p>TSPs to develop, promote and collect data on on-farm feed manufacture</p>	<p>Reliable supplies of nutritionally sound, affordable and environmentally friendly feeds that meet the needs of farmers</p>
<p>Transport and processing</p> <p>Inefficient feed distribution chains</p> <p>Improved feed distribution and storage</p>	<p>Researchable issues</p> <p>Impacts of transport on feed costs and performance</p> <p>Impacts of storage conditions on nutritional value of feeds and on contaminants</p> <p>Supporting actions</p> <p>Disseminate best practice guidelines</p>	<p>Research</p> <p>CLAR and Egyptian universities and to partner on research on feed storage</p> <p>ARIs (CIRAD, Stirling) to partner on research and technical backstopping on feed storage</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help establish and implement priorities to improve feed transport, including infrastructure improvements</p> <p>Feed producers, transporters, farmers and Producer Organizations to help develop and adopt better feed transport and storage practices to improve quality and reduce costs</p> <p>Technical services providers to support transporters and farmers on best practices for feed transport and storage</p>	<p>Affordable quality feeds available to all producers</p>


	Researchable issues and supporting actions	Potential partners and their roles	Outcomes
 <p>Poorly developed feed markets</p> <p>Improved understanding by producers of feed quality issues</p>	<p>Researchable issues</p> <p>Current and future market demand for aquaculture feeds</p> <p>Impacts of feed formulations and production methods on feed performance and environmental impacts</p> <p>Supporting actions</p> <p>Develop Producer Organizations in value chain areas to reduce costs of feed purchases</p> <p>Develop extension materials on feed management for farmers and POs</p>	<p>Research</p> <p>CLAR, Egyptian universities and private sector feed companies to partner on research on feed markets</p> <p>ARIs (Stirling) to partner on research into aquaculture feed markets</p> <p>Supporting actions</p> <p>Farmers and Producer Organizations to help develop capacity to purchase and distribute feeds, thereby reducing costs</p> <p>NAADS, TSPs, and NGOs to co-develop and promote best practices on use of feeds</p>	<p>Strong demand for quality and profitable feeds by farmers</p>

Opportunities and constraints in tilapia production value chain in Egypt and the research and development actions to overcome them

	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
 <p>Lack of quality and availability</p> <p>Improved access to quality business and technical advice, affordable credit, seed, feed and fertilizer</p>	<p>See seed and feed value chains above</p>	<p>See seed and feed value chains above</p>	<p>Farmers able to access quality seed, feed and technical advice that meets their needs</p>

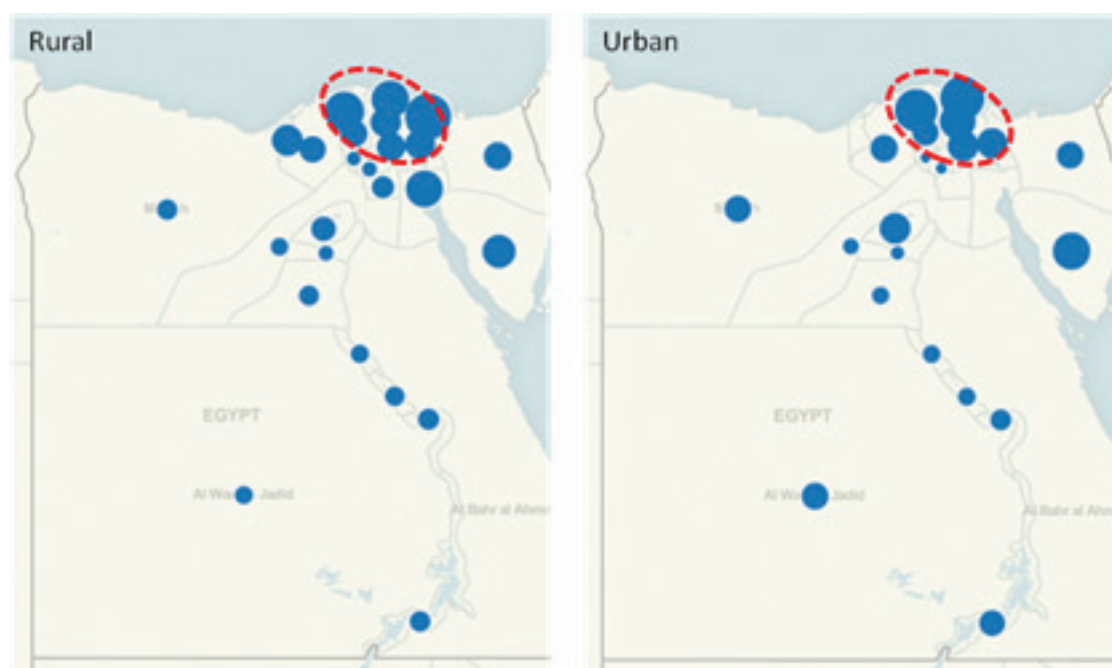
	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p>Production</p> <p>Low productivity, poor production practices and marginal profitability</p> <p>Improved productivity, profitability and production and reduced ecological footprint</p>	<p>Researchable issues</p> <p>Production system-specific feeding regimes to maximize productivity and profits in the production of fish that target pro-poor markets</p> <p>Improved land use and water management</p> <p>Integration with crop production</p> <p>Development of recirculation aquaculture systems and their associated impacts on LCA</p> <p>Aquaculture waste treatment/use</p> <p>Supporting actions</p> <p>Develop record keeping, technical capacity and business skills among producers</p> <p>Develop soft skills (e.g. communication, business, negotiation, gender awareness) among CG staff</p>	<p>Research</p> <p>Farmers, feed producers and Farmer Organizations to seek gender equitable methods (including contract growing) to increase production and productivity</p> <p>CLAR and Egyptian universities to partner on developing productive and profitable technologies</p> <p>ARIs (Bergen, CIRAD, Stirling and Wageningen) to partner on research, technical backstopping and capacity development</p> <p>Supporting actions</p> <p>Farmers and POs to help identify capacity building needs, develop capacity building materials and participate in capacity building programs, and to participate in technology development</p> <p>Ministry of Agriculture to help identify and implement incentives to adoption of productive and profitable technologies</p> <p>NAADS and TCPs to participate in development of staff communication and gender awareness skills</p> <p>TSPs, USAID LEAD and NGOs to partner on gendered technology development and dissemination to farmers</p>	<p>Increased farmed fish production and availability to the poor</p>

	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p>Transport and processing</p> <p>Variable quality of limited range of products</p> <p>Improve quality and seek equitable value added opportunities</p>	<p>Researchable issues</p> <p>Impacts of harvesting and transport on post-harvest quality, food safety and price</p> <p>Impact of cost-effective cold chain on returns throughout the value chain</p> <p>Options for post-harvest processing to improve storage or add value</p> <p>Supporting actions</p> <p>Develop and deliver training on fish transport</p> <p>Seek synergies with other food, especially livestock, in transport and cold chains</p> <p>Design and implement improvements to road and other infrastructure</p> <p>Create gender equitable employment opportunities</p>	<p>Research</p> <p>Farmers, hatcheries, producer organizations and transporters to help identify and prioritize critical steps in fish transport, devise effective and economically efficient solutions and develop capacity within the transport sector</p> <p>CLAR and Egyptian universities to partner on research on fish processing and cold chain development</p> <p>Supporting actions</p> <p>Ministry of Agriculture to help establish and implement priorities to improve feed transport, including road and other infrastructure improvements</p> <p>Transporters, farmers and Producer Organizations to help develop and adopt better fish transport practices to improve quality, food safety and reduce post-harvest losses and prices</p> <p>With NARS develop capacity among fish transporters</p> <p>Technical services providers to support farmers on development of best practices for harvesting and post-harvest handling</p>	<p>Increased quantities of affordable and nutritionally sound fish and fish products in markets</p>

	Researchable issues and supporting actions	Indicative partners and their roles	Outcomes
<p></p> <p>Poorly developed markets</p> <p>Awareness raising among poor consumers</p>	<p>Researchable issues</p> <p>Impacts of increased fish supply on consumption by vulnerable groups, including women and children</p> <p>Present and likely future demand for different farmed fish products among poor consumers</p> <p>The role of gender in demand patterns among poor consumers and barriers to consumption as part of a balanced diet</p> <p>New markets for novel products that are attractive and affordable to poor consumers</p> <p>Mechanisms to increase communication between customers and producers to test the hypothesis that farmers will use the information to better target production to market demand</p> <p>Use of ICT to reduce knowledge imbalances and improve value chain efficiency</p> <p>The role of POs in marketing</p> <p>Drivers of competition among local, national and regional markets for farmed fish</p> <p>Supporting actions</p> <p>Develop capacity to conduct market research</p> <p>Develop capacity to collect human health and nutrition data</p>	<p>Research</p> <p>Farmers, consumers and Producer Organizations, ARC and Egyptian universities to collaborate on fish market research</p> <p>NGOs and health sector to partner on market research and development</p> <p>ARIs (Stirling) to partner on research into marketing of aquaculture products</p> <p>Supporting actions</p> <p>Farmers, Producer Organizations and traders to collaborate on development of marketing skills, use of ICT and collection of data</p>	<p>Strong demand for—and increased access to—nutritionally sound farmed fish products by poor and vulnerable consumers</p>

Geographic focus

The key to increasing tilapia production in Egypt lies primarily in supporting farmers in existing growing regions, although there is some potential to expand to new areas. Most tilapia production is concentrated in the Nile delta, close to the Northern Lakes, with some in Fayoum. In 2004¹ about 96% of total production was in the delta, while Fayoum accounted for 3.3%, farms south of Fayoum 0.3%, and farms near Cairo around 0.1%. In the delta area Kafr-El Sheikh governorate produced most tilapia followed by Damietta and Sharkia, at 88,079 t, 36,319 t and 30,186 t respectively. About 89% of tilapia production derived from earthen ponds, the remaining 11% being from intensive production in cages and tanks. These regions and production systems will be the focus for work on the production elements of the fish value chains. With respect to downstream linkages, however, the major markets in Egypt, both urban and rural will be the focus.



Source: Galal (2007).

Map showing the main tilapia producing region and the relative contribution (by weight) of fish to the diet of rural and urban populations in each Egyptian Governorate

Potential for impact

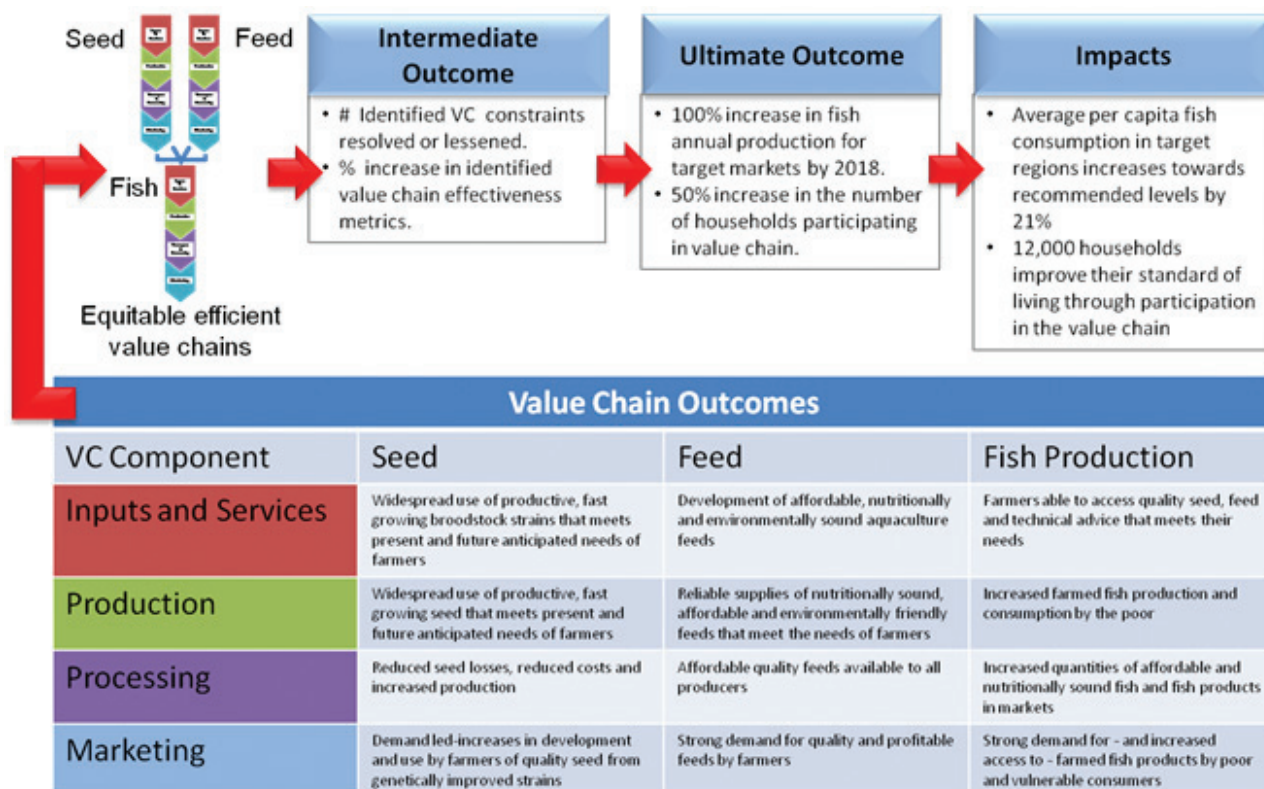
Annual average production growth rates for tilapia between 2003 and 2008 were approximately 16%. In the absence of further investment in innovation, this growth is unlikely to be maintained. Optimistically, one might expect an average of about 5% growth annually until 2017, which would yield an additional 213,000 t over 2008 levels. Through support to this program we believe a combination of upgrading farmers to produce at the level of the current best producers, expanding areas under production and technical innovation could increase annual average production growth rates to 10%, yielding an additional 615,000 t by 2017. At current population growth rates, and assuming all other sources of fish supply remain static, this increase in tilapia alone would bring per capita fish supply from 15.4% in 2008 to 18.6% in 2017.

Given trends observed elsewhere, we would also expect this increase in production to stabilize or reduce prices for consumers. Since low grade tilapia is the principle source of fish for the poorest sector of society in many

1. Data obtained from the General Authority for Fisheries Resources Development (GAFRD) statistics.

regions this could have significant role in ensuring adequate levels of fish consumption. Significant research will be needed however to understand links between production increases food consumption and ultimately health and nutrition impacts among the poor in target markets. Establishing baselines and structured approaches for monitoring and evaluating outcomes will be a vital early investment for this CRP.

The Figure below summarizes the pathway from the target outcomes identified in the three Tables above for each component of the value chains through to the impact on food security.



Important note: Full information on references is included in the Program proposal that can be downloaded from <http://cgspace.cgiar.org/handle/10568/3248>.