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VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

Aquaculture value chain analysis in Zambia

Value chain analyses assist in informing policy dialogue and investment operations. They help the understanding of how agricultural development fits within market dynamics. They permit an assessment of the value chains' impact on smallholders and businesses.

The European Commission has developed the VCA4D methodological framework for analysis. It aims to understand to what extent the value chain allows for inclusive growth and whether it is both socially and environmentally sustainable.

The value chain context

Although Zambia is endowed with natural water resources that offer significant opportunities, about 50% of the estimated fish demand is unmet. Zambian capture fisheries are operating at a fully exploited or over-exploited level. Aquaculture production is beginning to respond to the ever-increasing demand for fish, along with imports that have increased markedly.

The European Union intervention

An interest in the development of the emerging aquaculture sector is rising in Zambia. The Ministry of Fisheries and Livestock developed a National Aquaculture Development Plan 2015-2020 with the support of FAO. The African Development Bank (AfDB) is supporting a project on aqua-parks following an approach promoted by the FAO.

In addition, the European Investment Bank (EIB) has been identifying a possible blending operation with the European Union (EU) in the field of aquaculture. The EIB and the EU Delegation to Zambia aim to test-out different inclusive and bottom-up approaches.

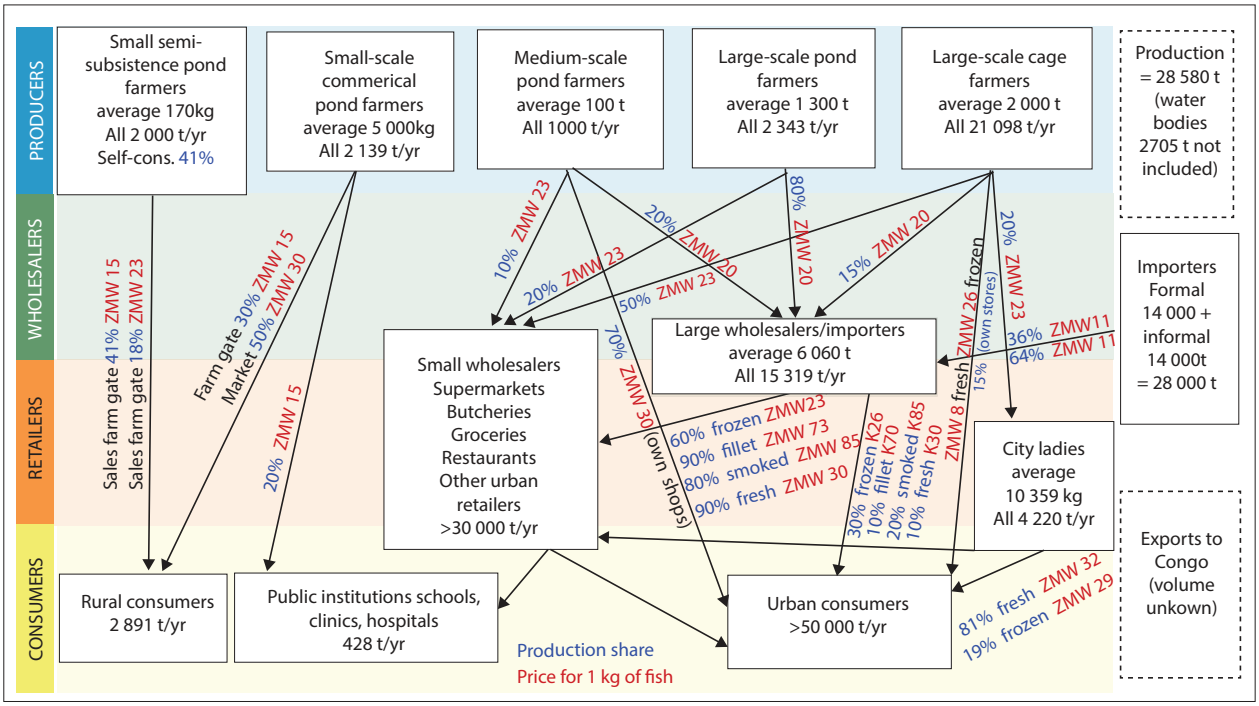

Figure 1 : The main flows of the aquaculture value chain in

Functional analysis

Production growth

According to the official statistics, aquaculture production in Zambia **has grown steadily in recent years, to more than 30 000 t in 2016**. Large and medium farms, especially cage farms, have been mainly responsible for this growth. These have achieved a higher level of productivity because of their use of high-quality seed, commercial feeds, good management practices and employment of farm labour. These farmers currently supply the majority of domestically-produced farmed fish in the country while the small semi-subsistence farms mainly produce for home consumption and some sales (Figure 1).

Consumption and external trade

Fish provides 55% of the animal protein consumed by Zambians and is an important source of micronutrients. The price of fresh fish has become the lowest among animal-sourced foods in Zambia. Often it is the only accessible or affordable source of animal protein for resource-poor people in rural areas. An increase in the annual production of farmed tilapia by commercial enterprises and an increase in imports (Figure 2), have resulted in an increase in fish supply per capita (from 5.6 kg per capita in 2006 to 14.5 kg in 2016). This is still significantly below the world's average of 19.2 kg/year, but well above the sub-Saharan average of 8.9 kg/year.

Zambia's market is supplied by a large volume of imported wild capture fish from other African countries, **and by imported farmed tilapia**, coming mainly from Asia (especially China). There is anecdotal evidence that suggests that exports of feed to Malawi and Angola are beginning to happen and there is also informal cross border trade of farmed fish to the Democratic Republic of Congo, including re-exports of imported frozen Chinese tilapia.

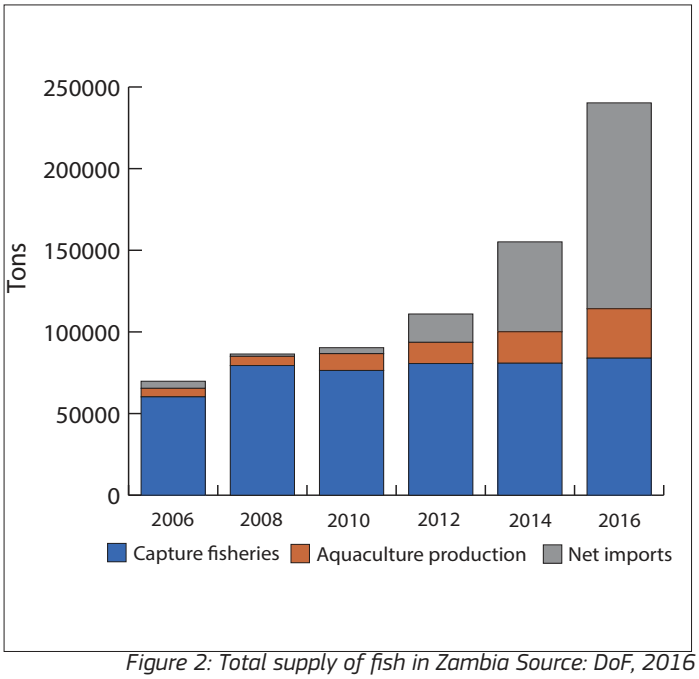

Figure 2: Total supply of fish in Zambia Source: DoF, 2016

Markets and networks

Markets differ across geographic locations, rural and urban localities and consumer wealth strata. Small semi-subsistence farmers sell a small portion of their harvest either at farm gate or at local markets. "City Ladies" in Lusaka operate in wet markets, conducting mobile vending; whilst there are also dedicated fish stores and butcheries, as well as supermarkets, other grocery stores, hotels and restaurants that sell farmed fish. **There is one large company that has taken on the role of wholesaler with a vast distribution network throughout the country** supplying to, amongst others, supermarkets. Some large farmers also operate their own outlets. **Fish differentiation is mainly based on size** (small 100-200 g, medium 200-400 g or large 400-600 g) **and product** (fresh or whole frozen), although other types of product such as fillets are found in supermarkets, packaged and supplied.

Constraints to the development of aquaculture

Major constraints in the enabling environment of the farmed fish (VC) in Zambia include: low availability of quality fingerlings, in particular in the northern parts of the country; inadequate extension services; low availability of good quality, affordable feed, and severe lack of technical knowledge and business management skills among small farmers (both commercial and semi-subsistence); lengthy and costly licensing processes and competition with cheaper legal and (allegedly) illegal imports, for the medium and large companies.

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Economic analysis

Profitability for the actors and competitiveness

The VC can be defined as economically sustainable, given that its activities create incomes for the actors who are partially or totally dedicated to it. The net operating profits (including the value of self-consumption) range from 33 € per year for the small semi-subsistence pond farmer, 3 538 € for the small commercial farmer, 74 809 € for the medium pond farmer, 204 420 € for the large pond farmer to 468 000 € per year for the large cage farmer. The range can also be wide for traders.

Despite sufficiently high margins generated at the production level, prices in the chain (from 1.28 to 2.72 € per kg for fresh fish) make farmed fish less competitive compared to imported farmed fish (0.9 €/kg). This is measured through the Nominal Protection Coefficient (NPC = 1.9). Domestic Resource Cost Ratio (DRC = 1.2) greater than 1 also indicates a poor remuneration of domestic factors, thus a **non-competitive VC into the international economy.**

Contribution to growth

The contribution of the VC to the Gross Domestic Product (GDP) was of **0.32% in 2016** and of **6.1% to the agricultural GDP**. The **rate of integration** into the national economy (total value added / production) amounts to **65%** (Figure 3). This rate has improved in the past years, as Zambia has developed its own feed production industry. Nevertheless, this could be further improved with the development of the aquaculture sector through a possible limitation of the rising fish/tilapia imports that are currently needed by traders to satisfy consumers' demands.

The Government of Zambia does not provide direct subsidies to companies in the VC, but the sector has benefited from several aquaculture support projects involving international and national public funds. The **total taxes** paid to the Zambian state by the actors in the VC are estimated at **6.8 million €** (corporate taxes, import duties and indirect taxes).

The contribution to the balance of trade is negative as the country's imports are high and exports are low. Imports of tilapia currently account for around 50% of the farmed fish consumed in Zambia.

Income distribution and employment creation

30% of the direct value added is net income and profit for the value chain actors (57% if depreciation of equipment is included), **17% are wages to workers**, while the other main components are financial charges to banks (14%) and taxes to the government (12%) (Figure 4).

Large farmers contribute consistently to jobs creation, they share 49% of the net operating surplus and 84% of the wages. In contrast, the contribution of traders to employment is limited. They share 35% of the net operating surplus and 4% of the wages.

Direct employment in the VC (including part-time and self-employment) is estimated at **around 20 000 jobs**, of which the vast majority is at farm-level and unskilled labour.

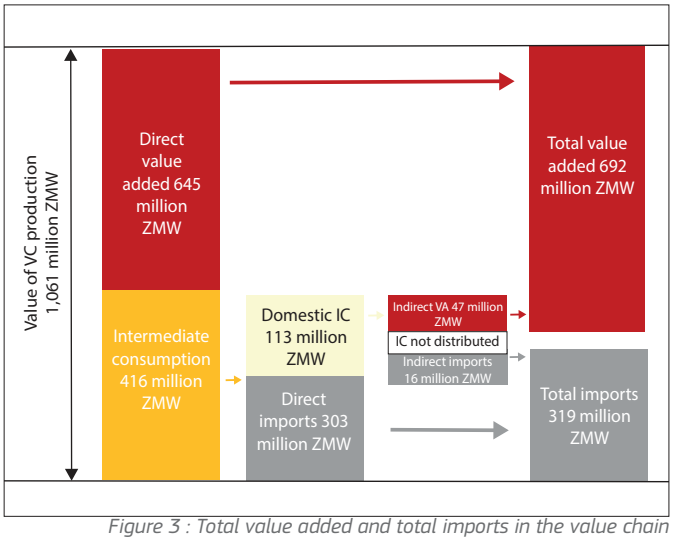

Figure 3 : Total value added and total imports in the value chain

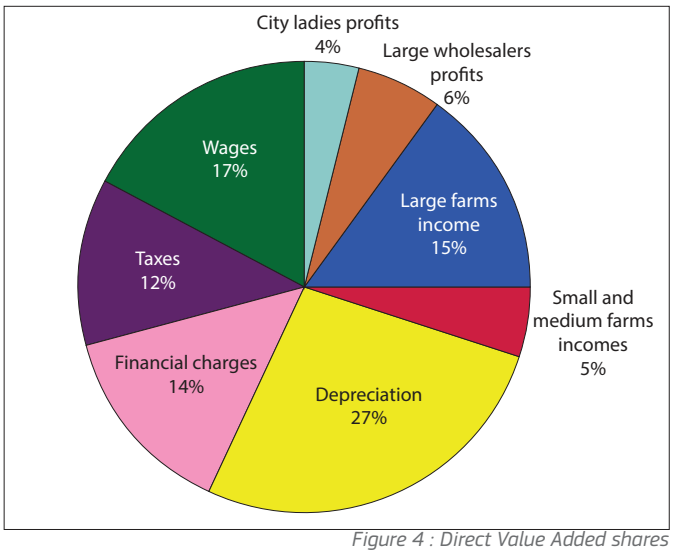

Figure 4 : Direct Value Added shares

WHAT IS THE CONTRIBUTION OF THE VALUE CHAIN TO ECONOMIC GROWTH ?

The aquaculture value chain activities seem profitable and economically sustainable. However, in the long-term, sustainability for small semi-subsistence farmers will depend on labour productivity and access to markets. Also, for all producers, long-term economic sustainability will depend on the competition with imports and consumers' recognition for quality.

Social Analysis

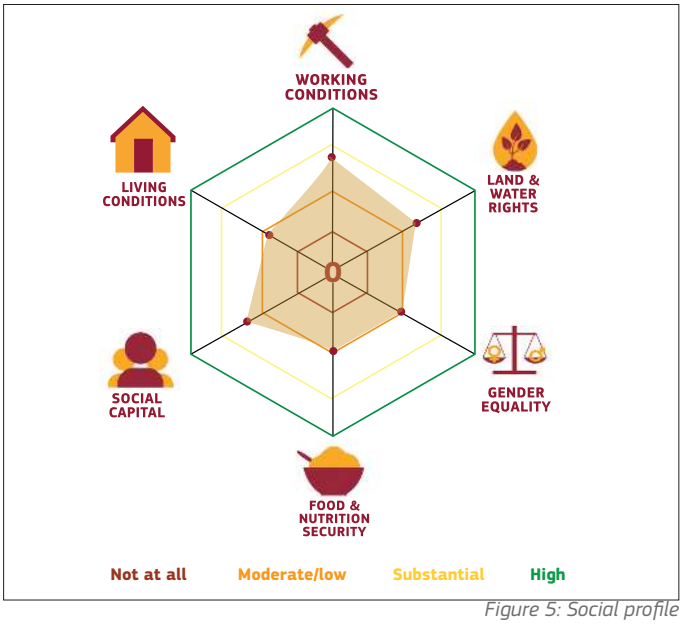

Figure 5: Social profile

IS THIS ECONOMIC GROWTH INCLUSIVE?

From an economic perspective, economic growth appears inclusive at farm-level and large farms provide many jobs. Nevertheless, the profits earned by small-semi subsistence farmers are low and the relative-weight of small farms in the production is decreasing. At the value chain level, economic growth appears less inclusive. There is a concentration of wholesale activities, with a very limited number of traders buying a large portion of the tilapia, alluding to a monopolistic position in the VC. Wholesalers benefit from comfortable margins when importing but they provide few jobs.

From a gender equality/social inclusion perspective, the economic growth through the VC is not very inclusive. Small farmers lack of access to microfinance, key inputs, extension services and vocational training, and to more vibrant output markets has inhibited them from moving from a subsistence production system to one that enhances their productivity and sustainably increases their incomes.

IS THE VALUE CHAIN SOCIALLY SUSTAINABLE?

The VC faces several social issues. Employee bases at larger fish farms are male-dominated. Whilst youth (males) are employed as general workers on larger farms, it appears their participation in rural fish farming is limited. Farmed tilapia produced for urban markets is cost-prohibitive for poor consumers. Social capital throughout the aquaculture VC seems low. Extension support and training opportunities are few. Group fish farming seems to be highly problematic.

Nevertheless, the current production systems employed by rural people enable them to access fish for food and nutrition security purposes and to generate small amounts of income. However, hunger still exists during the rainy season. This is of great concern as rural farmers become targeted by new and existing feed mills for food crops as the main ingredients in aquafeeds.

Working conditions	• Good conditions for people working in formal employment. • Labour laws in line with international instruments on labour and human rights. • Job safety practices used at larger farms and feed mills and wholesale centres. • Youth employment on larger farms. • Child employment in rural families and informal labor in urban markets.
Land and water rights	• The Lands Act of 1995 recognizes two land tenure systems: state and customary. • Larger fish farms adhere to the Voluntary Guidelines on Good Governance and Tenure (VGGT). • Requirement of an Environmental Impact Assessment (EIA) to large farms.
Gender equality	• Women comprise only 8% of the workforce in the VC. • Gender discrimination on larger farms. • In rural areas, key aquaculture assets limited for women. • Women very active in farmers associations and cooperatives and as leaders.
Food and nutrition security	• Food crop production and incomes are increasing in rural areas, yet seasonal hunger still exists. • Child malnutrition (stunting) rates are still very high. • Fish is a widely-consumed source of animal protein. • Although farmed fish from larger farms is cost-prohibitive for rural people/urban poor, rural farmed fish play a significant role in providing enhanced nutrition to many rural people.
Social capital	• Trust, reciprocity, solidarity, and group cohesion not as vibrant as in other VC. • In rural settings, high levels of social capital exist. • Knowledge in rural areas is shared mostly through “learning by doing”. • Women’s groups, clubs, and farmer associations and cooperatives exist to help organize people, pool resources or labour, build social cohesion, access services. • Groups may be a good channel for farmers to share knowledge and learn together, but not as a means of production or fish farming as a business.
Living conditions	• Primary education and health services are adequate in rural areas. • Poor roads make linking rural people to input and output markets very difficult. • Very little training in aquaculture reaches the rural areas. • Very few aquaculture VC activities contribute to improving the living conditions of rural people. • Own-production by rural people increases their consumption of fish and/or provides some source of cash (or barter opportunities).

Environmental analysis

Comparison between farming systems

Small semi-subsistence systems have higher environmental impacts per tonne (t) of fish due to their lower yields (associated to a large extent with the applied management type). **Small commercial systems,** on the other hand, feature the best environmental performance, and thus a shift from small semi-subsistence to commercial systems (small or medium), would considerably lower the negative impacts per tonne of fish produced. **Large cage systems** are more efficient than **large pond systems**, due to **comparative** feed conversion ratios (FCRs), and both systems are notably more environmentally efficient than poorly managed ones of all sizes. Only large pond systems treat the polluted waters by means of constructed wetlands and other mechanisms, but small semi-subsistence systems dispose part of the polluted water without treatment (Figure 6).

Potential impact on the areas of protection

The impacts on **human health** from small systems are mainly due to the provision of feed by agricultural by-products, while from large systems are due to the provision of commercial feed. These impacts mainly correspond to climate change, particulate matter formation and toxicity, due to fuel use and emissions associated with agricultural activities.

Ecosystem quality is negatively affected by the activities of the VC, mainly regarding soil and water degradation driven by agricultural activities (feed) and to a lesser extent water use (both consumption and pollution of water). Large producers are either next to main rivers or in lakes, where water availability is not a problem, but potential impacts on water quality may increase as more producers get established. On the other hand, extensive systems (waterbodies, dams) can improve underground water reserves and fish stocks.

For small pond systems, the main contributor to **resource depletion** is the provision of nets, followed by consumption of fuel and other resources during agricultural activities (Figure 7). For large cage systems, the provision of feeds dominates all areas of protection, being driven by agricultural inputs in the case of resource depletion. Water resources are a key limiting factor for aquaculture in Zambia. Occasionally, access to water is so limited that farmers producing fish at the smallholder level need to prioritise between the irrigation of their crops or the refill of their fish ponds. Fish production in situations where water is not amply available adds additional stress on the resource.

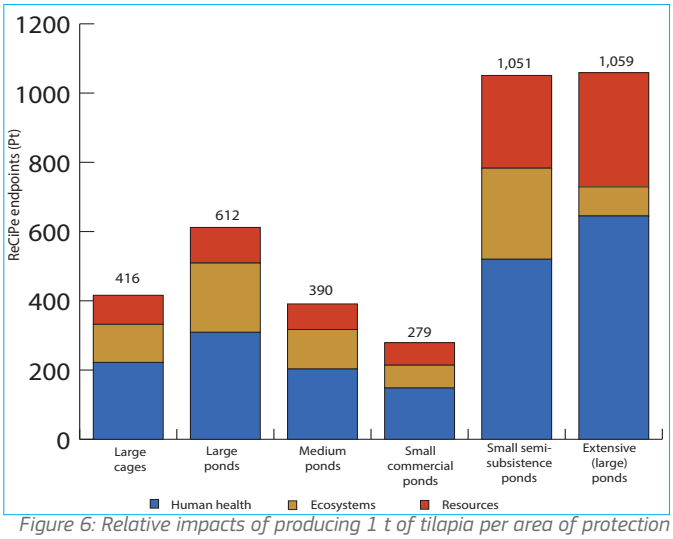

Figure 6: Relative impacts of producing 1 t of tilapia per area of protection

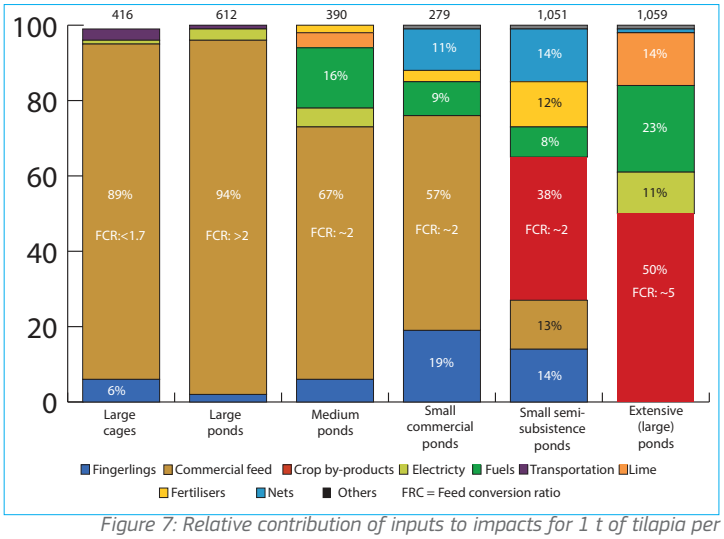

Figure 7: Relative contribution of inputs to impacts for 1 t of tilapia per system type

IS THE VALUE CHAIN ENVIRONMENTALLY SUSTAINABLE?

The environmental impacts are explained mainly by the phase of feed production for all systems. Small semi-subsistence and extensive systems have higher impacts per produced tonne of fish due to low yields. Small commercial systems, on the other hand, feature the best performance among all systems, and thus a shift from semi-subsistence to commercial systems (small or medium), in terms of management, would considerably lower the mean impacts per tonne of fish. Large cage systems are more efficient than large pond systems, and both systems are notably more environmentally-efficient than poorly-managed ones (extensive, smallholder subsistence). Only large pond systems treat the polluted waters by means of constructed wetlands and other mechanisms, but small systems dispose part of the polluted water without treatment. Finally, the environmental performance of certain well-managed systems in Zambia (control of water, feed and seed) can be considered as acceptable. The poorly managed ones are currently environmentally unsustainable, while economically they presently generate small profits.

Main findings

The supply chain contributes in general to sustainable development in Zambia, yet various economic, social, environmental and technical challenges remain to be overcome.

Comparison of farming systems sustainability

Producer type	Economic performance	Social performance	Environmental performance
Smallholders semi-subsistence pond	*	*	*
Smallholders commercial pond	**	***	***
Medium-scale pond farmers	**	**	**
Large-scale pond farmers	**	**	**
Large-scale cage farmers	**	**	**
Extensive ponds / stocked water bodies	*	**	*

* Less sustainable to ***more sustainable

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Both smallholders and large producers could contribute more and better to the sector, the economy and society in general, by overcoming these issues and limitations (see table below). Based on this assessment, several recommendations are offered in the report. They are related in priority to promoting innovations and strenthening aquaculture development policies and strategies, capacity development, and gender and youth.

Major issue and risks

Economic	Social	Environmental
• Competition with imports. • High costs of feed (in particular for small-scale farmers). • High costs and lack of access to good quality seed. • Poor roads, expensive transport. • Uncontrolled imports with associated reductions in import duties. • Imported fish of poor quality. • Long and complicated licensing processes for medium/ large-scale farms. • Lack of water and shorter production cycles.	• As larger-scale operations continue to grow and become the dominant player in the VC, smallholder/rural farmers could get excluded. • Gender stereotypes are adhered to and promoted • Limited roles for youth. • Rural people could be displaced off their lands as the sector grows. • Capital intensive water-based systems could exclude smallholder farmers lacking the required initial and working capitals. • Few rural people have access to labor-saving technologies. • Possible impacts on staple food prices due to high demand for feed and negative effect on food and nutrition security among the rural and urban poor. • Group fish farming does not lead to productive results. • Inadequately-trained personnel or farmers available.	• Indirect environmental impacts due to commercial feed based on dedicated crops which exert themselves impacts on the environment. • Water pollution by aquaculture effluents.

Value Chain Analysis for Development (VCA4D) is a tool funded by the European Commission / DEVCO and is implemented in partnership with Agrinatura.

Agrinatura (http://agrinatura-eu.eu) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development.

The information and knowledge produced through the value chain studies are intended to support **the Delegations of the European Union** and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions. VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

This document is based on the report "Aquaculture Value Chain Analysis in Zambia", by Froukje Kruijssen (KIT), Angel Avadí (CIRAD), Steve Cole (World Fish), Charles Mungule (national expert). Only the original report binds the authors.