



**JOBS  
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# JOBS IN VALUE CHAINS ZAMBIA

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**Opportunities in Agribusiness**



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## ABBREVIATIONS

DFID .....	United Kingdom Department for International Development
DOCS .....	Day-old chicks
DRC.....	Democratic Republic of Congo
FAO .....	Food and Agriculture Organization
FCR.....	Feed conversion rate
FISP.....	Farmer Input Support Program
FRA.....	Food Reserve Agency
FTE .....	Full-time equivalent
GM.....	Genetically modified
GMO .....	Genetically modified organism
IAPRI.....	Indaba Agricultural Policy Research Institute
ILO.....	International Labour Organization
LWP.....	Let's Work Partnership
LCF.....	Large commercial farm
MAL .....	Ministry of Agriculture and Livestock
MDM.....	Mechanically deboned meat
MT.....	Metric ton
PAZ.....	Poultry Association of Zambia
POL.....	Point of lay
SACU.....	Southern African Customs Union
SSF .....	Small-scale farmer
UK.....	United Kingdom
USD .....	United States Dollar
VC .....	Value chain
WBG.....	World Bank Group
ZMW .....	Zambian Kwacha



Photo: WorldFish Center



# EXECUTIVE SUMMARY

**This study analyzes from a jobs perspective two high potential value chains (VCs) in Zambia's agribusiness sector poultry and aquaculture.** With more than 50 percent of workers and over 80 percent of poor Zambians recording themselves in agriculture in the 2010 population census, raising agricultural productivity is a determinant to reduce poverty. Yet small-scale farmers (SSFs) and modern commercial operations in large farms exist in parallel, as SSFs typically use backward production systems with scant capitalization. Zambia's challenge is to overcome the persistent disconnect between low productivity smallholder agriculture and high productivity modern agribusiness firms.<sup>1</sup> Developing market linkages will enable the agribusiness sector to meet the growing urban demand for food products, while connecting more people to jobs.

## JOBS IN ZAMBIA'S POULTRY VALUE CHAIN

**The poultry VC is characterized by a dichotomy between a traditional and a modern production and marketing system.** In the traditional production model, SSFs rear birds<sup>2</sup> and sell them with little value addition to individual customers on the live market. The process is labor intensive and relatively unproductive, which leaves many farmers with meager incomes. In the modern production model, large commercial farms (LCFs) optimize margins through economies of scale, up-to-date technologies, and high productivity agricultural techniques that result in feed efficiency—a key variable in profitability. Unlike SSFs, large producers benefit from linkages with processors that allow for adding value to their products, which are sold to off-takers such as supermarkets and restaurants and on the informal export market. The anticipated growth of the sector is based on expansion of the modern production model with opportunities for jobs in broiler rearing, feed production, and value addition, which will require additional labor for consumer-ready products.

**From a jobs perspective, there is a need to examine how more SSFs can benefit from the supply chains of relatively few LCFs that are often vertically integrated in terms of production and marketing.** This analysis focuses on the broiler subsector due to its labor intensity. It is estimated that the broiler VC currently provides approximately 31,000 jobs, of which over 25,500 are in the traditional model dominated by SSFs and over 5,500 in the modern model with LCFs. In the traditional production model, most jobs are on broiler farms. In contrast, the lion's share of jobs in the modern production model is not in rearing birds, but in feed production. The development of the sector with good, or productive, jobs for SSFs will hinge on expansion of feed production linked to the supply chains of LCFs that will rear and process the bulk of broiler chickens.

**Two scenarios for job creation by 2022 highlight the jobs potential of the broiler VC, assuming natural population growth and increasing per capita consumption.** In the first scenario, which assumes constant market shares between the traditional and the modern production system, the broiler VC could create an additional 16,000 jobs. Over 80 percent of these jobs would be located in the traditional production model, primarily as low-skill employment on small broiler farms. A second scenario assumes all additional demand is captured by LCFs of the modern sector, and shows that the VC has the potential to create 8,500 additional jobs in the modern production model. Many of these new jobs would be created on maize and soy producing farms through backward linkages to the feed sector. Almost one third of the additional jobs are created on large broiler farms and may be considered better quality employment in the formal sector. Since the relatively unproductive traditional

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<sup>1</sup> In Zambia "smallholders" are defined as cultivating up to 20 hectares [ha] of land. The category of smallholder is the sum total of small-scale farmers (SSFs), defined as cultivating less than 5 ha of land, and emergent farmers, defined as cultivating 5–20 ha.

<sup>2</sup> This analysis focuses on the broiler and layer subsectors, and does not include the value chain for indigenous village chickens.

model is unlikely to sustain competition with more industrialized production, a shift towards the modern production model is expected.

**It is important to adopt 'job-friendly' policies that will support the integration of smallholder farms in this increasingly industrializing sector in terms of broiler and feed production.** Promoting outgrower and aggregator schemes in broiler production is one way to realize this, as smallholders receive the training and capital necessary to integrate into the supply chains of larger farms. Mozambique provides a lesson in developing such models where LCFs enter into contract with large numbers of smallholder broiler producers. Another priority policy area to support agricultural production is improving electricity access and investing in alternative power sources, as frequent load shedding reduces productivity on small farms that cannot afford generators. Reducing exchange rate volatility is also needed to stabilize input costs, particularly of feed pre-mixes and additives that are imported, which will help SSFs better plan their investments and production cycles. Further, more efficient agricultural policies can reduce distortion on the maize market and thus lower the costs of feed production.

## **JOBS IN ZAMBIA'S AQUACULTURE VALUE CHAIN**

**The aquaculture sector has a large demand gap that is currently filled by imports, despite Zambia's abundance of water resources.** Fish is a popular staple and the second most affordable animal protein source after poultry. Production of fish (mostly tilapia) from aquaculture (i.e., farmed in floating cages or in purpose built ponds) is largely for the domestic market. It is estimated that there is unmet demand of over 77,000 metric tons (MT) per year.<sup>3</sup> Trends in import data reinforce this finding, as the trade statistics show a more than 15-fold increase in fish imports to Zambia over the last 10 years. Yet production and competitiveness in the sector are constrained by raw material costs. High feed prices and insufficient supply of fingerlings, or juvenile fish, are resulting in poor quality and productivity among SSFs.

**Expanding the Zambian aquaculture VC holds potential to promote job creation, particularly among small-scale fish farmers.** The estimated number of jobs in the sector is approximately 13,000, which are primarily on-farm jobs and often low-skilled. Due to the relatively large number of small aquaculture farms and relatively lower efficiency (compared to the one LCF located in Lusaka), SSFs provide the bulk of the jobs in rearing fish. SSFs sell about 80 percent of their production to individual customers or collectors in local markets (i.e., farm-gate sales), in the absence of linkages with large buyers, such as processors. Two job growth scenarios showcase the potential for additional job creation in the sector. In the first scenario, it is assumed that increasing urbanization and a rising middle class will lead to a 25 percent increase in per capita consumption of fish. In combination with continuous population growth at current rates, this could lead to a total of almost 22,000 jobs by 2022 (of which 8,600 would be new jobs). In the second scenario, if Zambia could increase domestic production to substitute 30 percent of current import volumes, an additional 13,000 jobs could be created. In both cases, the vast majority of these jobs would continue to be on-farm and low-skilled, and thus provide job opportunities for vulnerable groups with little skills or formal training.

**Strengthening the input supply chain, expanding extension services, and improving access to capital are main priorities to unlock growth in the aquaculture VC.** The input supply chain, especially for feed and fingerlings, needs to be strengthened to improve the quality and volumes produced by SSFs. Additional investments in hatcheries can help meet demand for high quality fingerlings. Expanding extension services for SSFs to learn feeding and farming best practices can support greater yields and profitability. SSFs could benefit from greater financial access through funding schemes, contingent upon participation in training programs and use of quality fingerlings from formally registered hatcheries. For collectors and traders, many of whom are women and informal, the need is for working capital to expand activities in rural areas that are challenging to reach.

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<sup>3</sup> Ministry of Fisheries and Livestock. 2016. 2015 Fisheries Statistics Annual Report.





# 1. INTRODUCTION

## OBJECTIVES OF THE JOBS IN VALUE CHAINS ANALYSIS

**This study identifies two agribusiness value chains (VCs) with high potential for employment creation and analyzes how their potential can be unlocked.** The analysis is based on the notion that in VCs, as a given product or service moves through the different stages of production, value is added and jobs are created. Market and institutional failures, however, can constrain the development of VCs by reducing investments, precluding linkages, and thereby lessening the potential for job creation.<sup>4</sup> The following analysis identifies the constraints that need to be addressed in the identified VCs, and outlines the extent of job growth potential and the nature of jobs that may be created. This analysis, accompanied by further dialogue with the key public and private sector actors, can serve to inform the prioritization of Zambia's jobs-focused policies and programs.

## SELECTION OF VALUE CHAINS

A starting point to selecting VCs for this study was to review the basic economic structure of Zambia in order to understand which industries currently provide the majority of employment. The recently completed Zambia Jobs Diagnostic<sup>5</sup> notes that most Zambians are still farmers, as shown in Figure 1. The economy has been growing rapidly but failing to create enough good jobs in high productivity sectors, and poverty headcount has not improved.<sup>6</sup> The jobs created in this period have been mostly in low productivity sectors, as the economy remains largely rural, agricultural, and informal. Figure 2 shows that most of Zambia's increases in labor productivity between 2000 and 2014 came from the shifts of labor out of informal and rural agriculture and into formal and urban employment in industry and services. Nonetheless, the rural economy seems to be formalizing, with an increase in formal jobs in agriculture, presumably on commercial farms and in agro-processing. The key policy question from a jobs perspective for Zambia is how to enable productivity growth in smallholder farming whilst encouraging commercialization and links to agribusiness supply chains.

Initial consultations and secondary research identified a 'shortlist' of sectors which have job-creating potential. These included ten main agricultural subsectors that account for over two-thirds of agricultural output.<sup>7</sup> The shortlist of VCs was assessed through a set of selection criteria that provided a high-level evaluation of each sector in terms of: i) existing scale, sustainability, and competitiveness; ii) potential jobs impact (quantity and quality) of growth in the sector; and iii) readiness of the sector to engage in upgrading and the degree to which an initiative would offer additionality with respect to recent and ongoing donor initiatives. Table 1 summarizes the assessment of the four agricultural sectors that stood out: poultry, aquaculture, dairy, and soy.

Following a series of consultations with stakeholders in Government, the private sector, and donors in the Let's Work Partnership (LWP) in 2016, the decision was taken to focus the initial jobs-focused VC analysis

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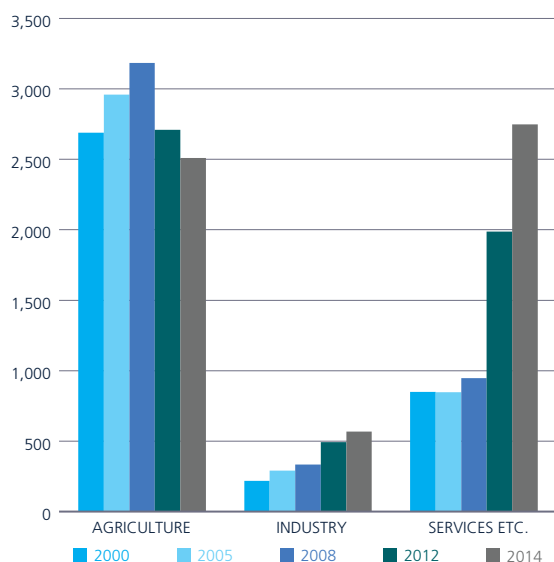
<sup>4</sup> World Bank. 2015. Jobs in VCs: A Guidance Note for Assessing the Opportunities and Requirements for Job Creation and Earnings Growth in VCs. Washington, DC: World Bank.

<sup>5</sup> World Bank. 2017, forthcoming. Zambia Jobs Diagnostic. Washington DC: World Bank.

<sup>6</sup> Despite a rapidly growing workforce and unprecedented economic growth from 2000 to 2013 of nearly 9 percent annually, the proportion of people falling below the international poverty line rose to 64 percent in 2010.

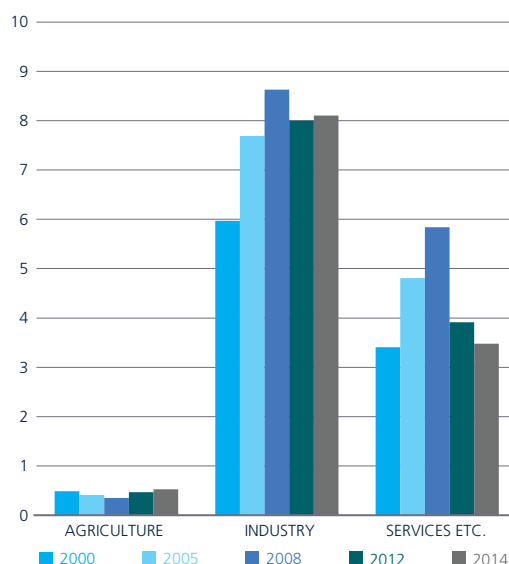
<sup>7</sup> The subsectors are poultry, aquaculture, soy, dairy, beef, leather, maize, groundnut, cotton, and sugar.

**Figure 1**  
Total employment by sectors of economic activity,  
Zambia 2000–2014



Source: Zambia Jobs Diagnostic.

**Figure 2**  
Value added per worker by sector, Zambia 2000–2014  
(US\$ thousands, constant 2005)



on poultry and aquaculture. Poultry was selected primarily because of the sector’s rapid growth potential domestically and in regional export markets. Aquaculture has been identified by Government as a high priority sector due to the demand for fish that exceeds current production levels. With capture fisheries at their limit, there are increasing opportunities for small-scale farmers (SSFs) to work in aquaculture production, particularly in rural areas. In addition, both livestock subsectors provide the possibility for significant positive spillovers into animal feed production where SSFs, particularly in maize, can benefit from job opportunities through linkages into the supply chains of Zambia’s growing commercial agribusinesses. The team determined that productivity-enhancing engagements in the dairy and soy subsectors were largely covered under the LWP by the UK’s Department for International Development (DFID) and the International Labour Organization (ILO).<sup>8</sup>

### This review focuses on the following dimensions of the poultry and aquaculture VCs:

- **Domestic and trade markets.** Analysis of consumption, production and trade patterns in the VC.
- **VC and employment structure.** Estimates on the number of firms, with a breakdown based on firm typology and employment range according to size and position in the VC.
- **Description of the skill sets** most commonly in place among firms (by typology and position in VC).
- **Strategic segmentation of the VC.** Description of the business segments identified in each VC.
- **Assessment of microenterprises and the self-employed in the VC.** Identification of opportunities and requirements for deepening their integration and raising their return to participation.

Note that analysis of the two selected VCs is intended to serve as an initial pilot to illustrate opportunities and challenges for private sector-led job creation and earnings growth, which may be relevant across a number of sectors in the region using a similar approach.

<sup>8</sup> The Musika program [supported by DFID and the Swedish International Development Cooperation Agency] has largely focused on supporting ‘value added’ commercial relationships between companies and farmers, particularly in the dairy sector, and the ILO’s YAPASA program focuses on sustainable livelihoods for rural youth through SME development in key VCs, such as soybeans.

**Table 1**  
Summary results from the value chain selection assessment

	Scale, sustainability & competitiveness	Jobs impact	Readiness & additionality	OVERALL	COMMENTS
<b>Poultry</b>					<p><b>Intervention can catalyze productivity, linkages:</b></p> <ul style="list-style-type: none"> <li>• Main source of meat consumption, rising domestic demand</li> <li>• Economic activity favors women, rural smallholders</li> <li>• Significant recent investment the sector through large commercial (often integrated) farms (e.g., Zambeef – Novatek, Zamchick, Eureka Chickens, Hybrid Poultry, Ross Breeders, etc.)</li> </ul>
<b>Aquaculture</b>					<ul style="list-style-type: none"> <li>• Value chain shows readiness to expand and cover large demand gap</li> <li>• Potential for job inclusiveness, particularly among youth, women and workers in remote rural areas</li> <li>• Strong linkages to labor-intensive crops, such as inputs into feed</li> </ul>
<b>Dairy</b>					<ul style="list-style-type: none"> <li>• Recent private sector investment in the sector (e.g., Zambeef, Varun Beverages, Parmalat)</li> <li>• Growing middle class will create demand with job impacts for SSFs</li> <li>• Opportunity to improve sector yields by catalyzing adoption of emergent farmer practices</li> <li>• Opportunity for impact on target groups by catalyzing linkages to formal sector/ large processors</li> </ul>
<b>Soy</b>					<ul style="list-style-type: none"> <li>• Synergies between animal feed and growing consumer demand for cooking oil, opportunity for productivity gains</li> <li>• Rising domestic demand, can incorporate large number of smallholders into value chain if profitability can be reached</li> <li>• Integrated value chain, including value-added processing, exists</li> </ul>

## METHODOLOGY

The jobs-focused VC analysis was carried out through a combination of structured surveys, semi-structured interviews, and secondary research. The surveys piloted the 'Jobs in Value Chains' survey instrument and approach.<sup>9</sup> Structured surveys were administered to actors across all nodes of the VC, with the objective to be representative at each node as well as (in some nodes) between large and small firms (farms). The jobs estimation data requires a number of underlying assumptions that are elaborated on in Annex A as illustrative of potential for employment growth as the sectors develop. Including use of the survey instruments and complementary semi-structured interviews, 220 data points were gathered in the poultry VC, and 119 in the aquaculture VC. Annex B provides the breakdown of the samples by VC node across sectors.

The remainder of the paper is structured as follows: Sections two and three describe the structure and current jobs profile of the poultry and aquaculture VCs in Zambia, examine the potential for additional job creation, and outline the policies required to unlock job growth from a sectoral perspective. This report accompanies the Zambia Jobs Diagnostic<sup>10</sup> and the Jobs Action Plan.<sup>11</sup> The Jobs Diagnostic provides an overview of jobs challenges in terms of the macroeconomic conditions, supply side of the labor market, including education and patterns of labor market participation, and the demand side by looking at firm investment and hiring decisions. The Jobs Action Plan addresses the conclusions of these analytical works and next steps for prioritizing jobs-focused policies and programs.



Photo: World Bank

<sup>9</sup> Zambia is one of two country pilots for this tool. The first pilot was conducted in Lebanon in 2016.

<sup>10</sup> World Bank. 2017, forthcoming. Zambia Jobs Diagnostic. Washington DC: World Bank.

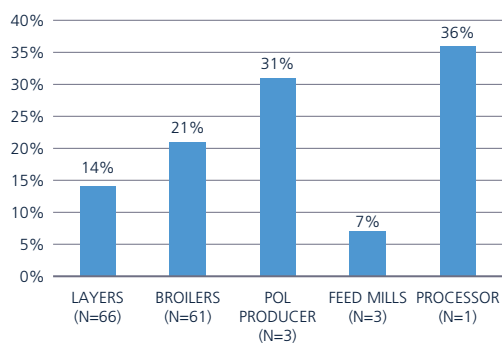
<sup>11</sup> World Bank, 2017, forthcoming. Zambia: Jobs Action Plan. Washington DC: World Bank.

## 2. JOBS IN ZAMBIA'S POULTRY VALUE CHAIN

### POULTRY SECTOR OVERVIEW

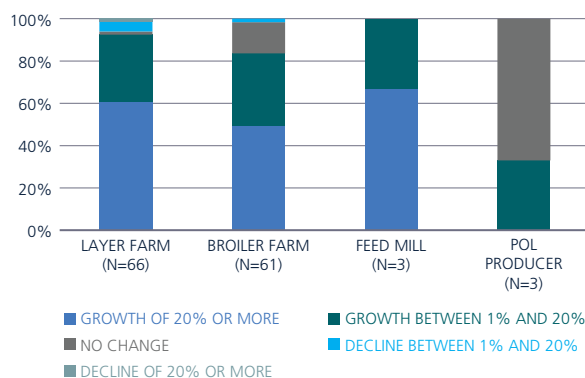
The poultry sector consists of two subsectors: broilers and layers. Broilers are raised specifically for chicken meat and layers are used primarily to produce eggs, although hens are sold for their meat at the end of the productive cycle. In Zambia, the poultry sector contributes 4.8 percent of agricultural GDP and accounts for 48 percent of livestock value addition as the largest livestock sub-sector.<sup>12</sup> Drawing on the survey data, the analysis is focused on Copperbelt and Lusaka provinces, which are the leading commercial poultry farming and processing regions in Zambia. Lusaka Province has Zambia's highest concentration of broiler production while Copperbelt Province is the center of egg production. Stakeholders across the VC including agribusiness small and medium enterprises (SMEs) and SSFs, large commercial farms (LCFs), point of lay (POL) producers, feed mills, and processors have shown positive growth trends in recent years. Yet significant variation in firm/farm performance exists across nodes of the VC. In comparison to the 21 percent average annual growth rate in the surveyed sample of broiler farmers (see Figure 3), the Lusaka broiler subsector alone experienced a 38 percent average growth rate per annum between 2013 to 2015. In addition, farmers are expecting strong growth in the upcoming year (see Figure 4).

Figure 3  
Average annual growth rate (2013–2015)



Source: Global Development Solutions, LLC.

Figure 4  
Twelve-month sales growth outlook



### PRODUCTION, CONSUMPTION, AND TRADE OF POULTRY PRODUCTS

**Production: The broiler sector, which accounts for 80 percent of poultry products in Zambia, has seen continuous growth in recent years.** Between 2010 and 2013, Zambian production increased steadily, achieving growth of about 8 percent (Figure 5). This is fairly similar to the increase in global production of about 10 percent during the same period. Studies indicate that expected growth of the sector is continuing, as Zambia produced 75 million broilers in 2015.<sup>13</sup> SMEs operate 60 percent of poultry production

<sup>12</sup> AgriProFocus Zambia. 2015. *Market Study Poultry: Investment Opportunities in the Zambian Poultry Sector [and in the Katanga Region of the DR Congo]*.

<sup>13</sup> Ibid.

Figure 5  
Broiler production in Zambia (MT), 2010–2013



Source: FAO Statistics

farms,<sup>14</sup> but more than 90 percent of smallholder households own poultry (typically the indigenous variety), although frequently for own consumption rather than commercial purposes. The Zambian broiler industry faces competition from South Africa, which accounts for 80 percent of total broiler production in the region.<sup>15</sup> In addition, South Africa is the largest supplier of imported feed ingredients and premixes for Zambia's production.

**For the layer subsector, Zambia exceeded the average rate of growth in global egg production during 2010–2013.** On a global basis, the growth rate was 6.4 percent, while in Zambia it was 11.1 percent—a rate significantly exceeding that of Nigeria, the largest egg producer in the region, with just over 4 percent growth in the 2010–13 period.<sup>16</sup> Recent estimates are that Zambia's egg production could increase from 1.1 billion eggs in 2014 to 1.7 billion in 2019.<sup>17</sup> The market structure is fundamentally different from broilers as layer production is dominated by LCFs. Less than 10 percent of surveyed farms keep more than 10,000 birds,<sup>18</sup> but they collectively account for more than 70 percent of national egg production. Furthermore, these large companies continue to expand. For instance, Zambeef's ZamChick operation is establishing a 160,000-layer facility in the Copperbelt. The largest layer farm in Lusaka has set up a new farm with 200,000 birds and plans to ramp up to 600,000 birds within the next five years. As effective modern poultry operations develop and consolidate, competitive smallholders in production are increasingly rare without supply chain linkages.

**Consumption: Demand for poultry products has been growing on the back of rising household incomes and an expanding middle class.** Poultry is the main source of meat consumption in Zambia, accounting for 50 percent of all meat consumed (followed by beef at 28 percent). Estimated consumption in 2015 was 76,000 MT, and the consumption has experienced sustained growth since 2000. The steady growth can be attributed to poultry's lower unit price compared to beef, lamb, fish, and pork. Similarly, consumption of eggs has risen from a low basis: at 66 eggs consumed per capita per year, consumption is less than half of that in South Africa.<sup>19</sup> Egg consumption is projected to grow to 77 eggs per capita by 2019 in line with growing demand for cost-effective protein-rich diets.

**Trade: Informal exports compensate for Zambia's policy challenges related to formal exports.** Informal exports to the Democratic Republic of Congo (DRC) are plentiful at an estimated 20 percent of production,<sup>20</sup> though there are no official records to track them. The challenges to formal exports faced by broiler farmers are

<sup>14</sup> Ibid.

<sup>15</sup> Department of Agriculture, Forestry, and Fisheries. 2015. *A Profile of the South African Broiler Market Value Chain*. Pretoria: South Africa.

<sup>16</sup> FAO 2013b. FAOSTAT database collections. Food and Agriculture Organization of the United Nations: Rome.

<sup>17</sup> AgriProFocus Zambia, 2015.

<sup>18</sup> Of the layer farms surveyed, approximately 10% kept more than 10,000 birds. The Poultry Association of Zambia notes that a farm with up to a capacity of 10,000 birds [layers or broilers] is small scale, 10,000–20,000 is considered medium scale, 20,000–50,000 birds is large scale, 50,000–100,000 birds is a commercial farm, and more than 100,000 is considered a corporate farm [of which there are less than ten in the country].

<sup>19</sup> Poultry Association of Zambia [PAZ].

<sup>20</sup> Ibid.

partly attributable to the fact that by law, Zambia is a genetically modified organism (GMO)-free country, whereas the largest producer in the region, South Africa, is not. As a result, Zambian feed is more expensive than feed produced in South Africa.<sup>21</sup> Furthermore, neighboring Namibia and Botswana are Southern African Customs Union (SACU) members. Thus, in addition to the higher production cost of Zambian broilers, tariff barriers and operational changes required to meet the SACU sanitary standards further reduce Zambia's price competitiveness.

**Despite a steady increase in the demand for broilers in Zambia, the local industry has had to compete with growing imports.** The sustainability of the local industry has been threatened by chain stores and traders electing to import processed frozen chickens. As a result, Zambia's broiler imports increased 173 percent between 2010 and 2013 (Table 2).

**Table 2**  
Zambia's broiler imports and exports, 2010–2013

Year	Import			Export		
	Quantity (MT)	Value (1,000 USD)	Unit value (USD/MT)	Quantity (MT)	Value (1,000 USD)	Unit value (USD/MT)
2010	558	564	1,020	8	43	5,380
2011	967	815	840	50	160	3,200
2012	1,606	1,653	1,030	33	121	3,670
2013	1,522	1,608	1,060	15	66	4,400
% change 2010–2013	172.8	185.1	3.9	87.5	53.5	–18.2

Source: FAO 2013b.

**This increase in imports led to the enactment of the Goods and Control Act Cap 421 statutory instrument number 40 of 2011, which bans dressed broiler imports in order to protect the local industry.** The ban still allows the importation of mechanically deboned meat (MDM) as well as live grandparent and parent stock.<sup>22,23</sup> While legally imported MDM and grandparent stock accounted for some of the imports after the ban, the majority of the increased imports were of banned chicken meat due to inadequate enforcement of the ban. In 2015, the government made a pronouncement banning the import of all domestically produced commodities in an effort to save the devaluing Kwacha, which re-emphasized the ban on importing dressed, frozen broiler chickens.

## THE POULTRY VALUE CHAIN

**The Jobs in VC analysis of the broiler and layer VCs is complex due to the broad range of stakeholders providing employment.** Figures 6 and 7 illustrate the broiler and layer VCs, respectively, based on the sector mapping conducted as part of this study. The VC components mapped include the input supply, production, processing, distribution (including transport), and sales/marketing stages.

**The key components of the two subsectors are discussed below with reference to their jobs potential.**

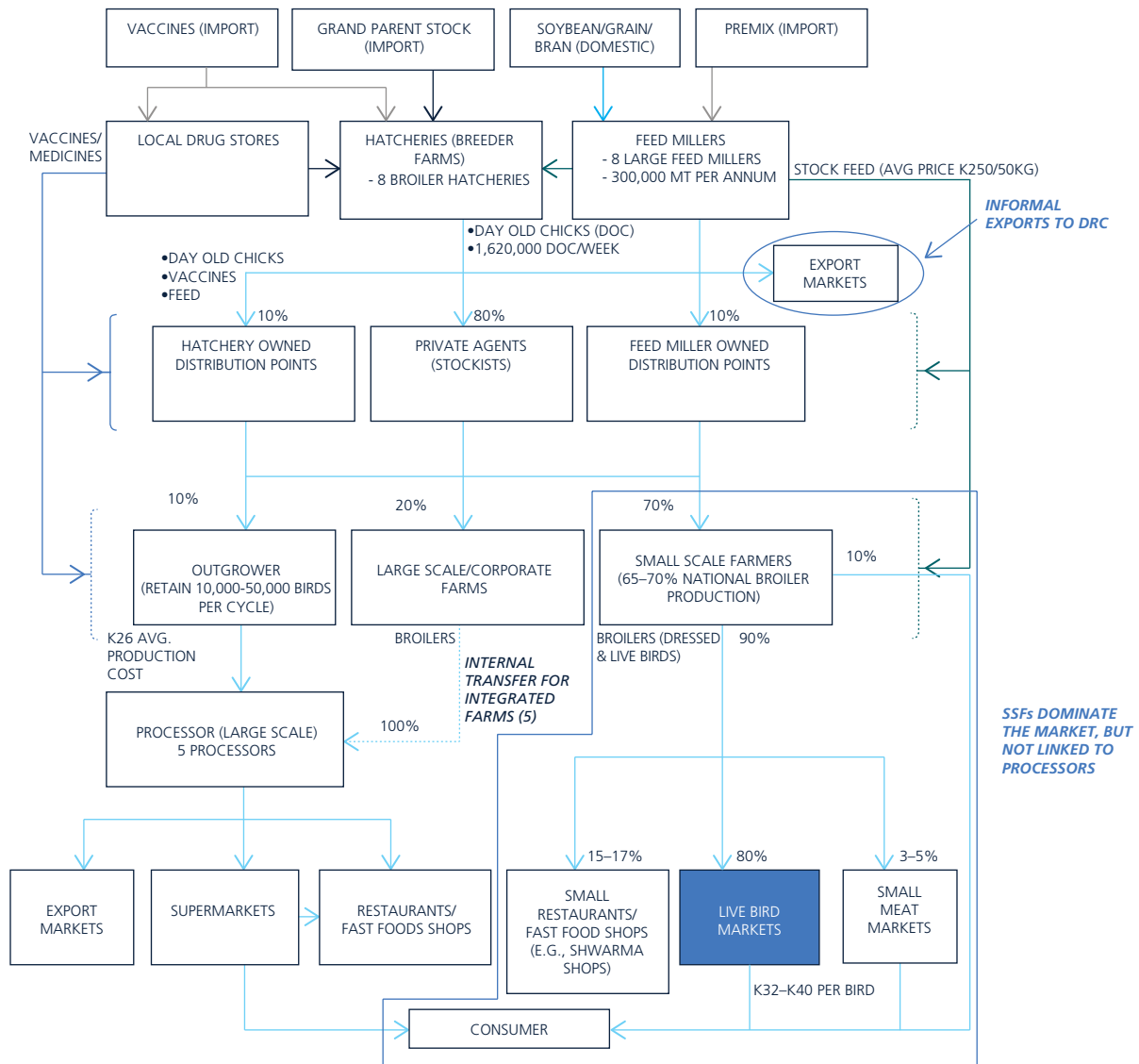
- **Inputs – Hatcheries:** For both the broiler and the layer VCs, hatcheries import vaccines and grandparent stock for breeding:
  - **Broiler subsector:** Zambia has eight hatcheries producing broilers and two hatcheries for layers. Layer hatcheries also produce day-old chicks (DOCs) for the broiler VC. In general, the amount of DOCs

<sup>21</sup> For example, the average cost per 50 kg bag of South African broiler grower feed in 3rd quarter 2015 was the equivalent of USD19, while the Zambian broiler grower feed in 3rd quarter 2015 was the equivalent of USD22.3, more than 17% higher cost than the South African feed.

<sup>22</sup> Chicken MDM is an ingredient in many processed meat products.

<sup>23</sup> Grandparent stock is the pedigree stock bred by the original founding hatcheries. These birds are imported by the main breeders/hatcheries in various countries, e.g., Zambia. Eggs from the grandparent stock are bred by the key hatcheries to produce the parent stock [which may also be imported] used by the local hatcheries. Eggs from parent stock are the source of the day-old chicks sold to the public.

Figure 6  
Zambia – Broiler Value chain



Source: Global Development Solutions, LLC and Poultry Association of Zambia.

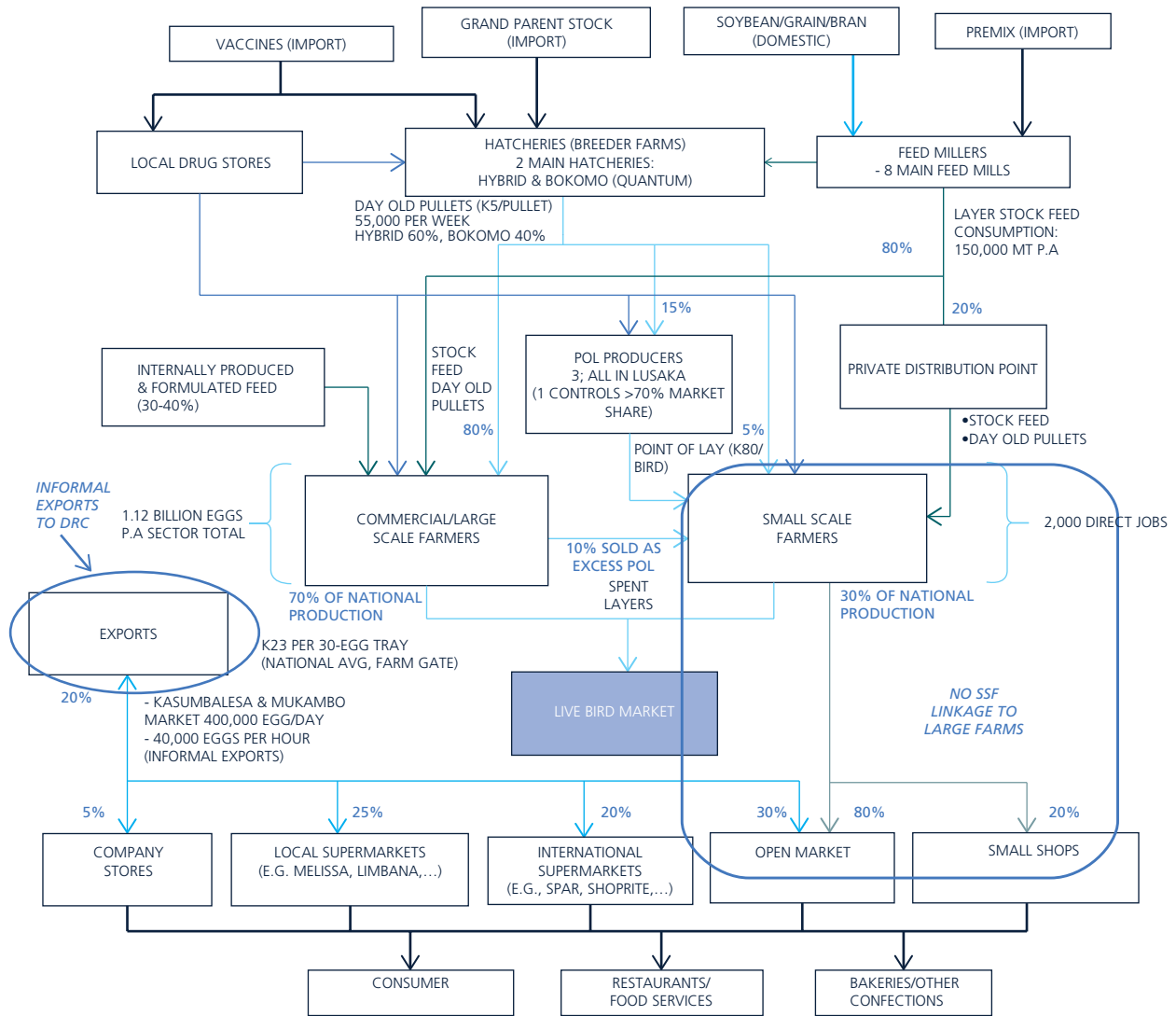
produced is adequate and delivery is timely as reported in survey data. Distribution of DOCs is through distribution outlets owned by the hatcheries, feed mills, or through independent stockists. Farmers place their orders for DOCs two or three days in advance, pay for half of the cost at the time of order, and the remaining balance upon collecting the DOCs from the distribution outlet.<sup>24</sup>

- **Layer subsector:** Although there are two hatcheries producing layers, SSFs do not typically purchase from the hatchery since layers need to be reared for six months to the point of lay (POL). There are three POL producers, all located in Lusaka, who purchase DOCs from hatcheries and rear the pullets for six months from DOC to POL. SSFs may choose to purchase DOCs and rear them themselves, as this is the cheapest means of acquiring POL pullets. However, the large capital outlay often cannot be recovered until the DOCs have matured to POL. The tendency is for SSFs to purchase POLs from

<sup>24</sup> Quick, efficient delivery of DOCs was not always the case. In the recent past, farmers used to wait up to a month for delivery. The growth of the sector has resulted in increased efficiencies for DOC delivery.



Figure 7  
Zambia – Layer Value Chain



Source: Global Development Solutions, LLC and Poultry Association of Zambia.

large farms, which typically rear about 10 percent more pullets to POL than required for their own operation.

- Inputs – Feed Mills:** The production and distribution of poultry feed is the same for the broiler and layer subsectors. There are eight large feed mills in Zambia, whose estimated annual production of poultry feed has fallen significantly in the past two years. The installed capacity of the feed mill sector is in the range of 450,000–500,000 MT. Prior to Zambia’s economic downturn, production peaked at 425,000 MT–450,000 MT per annum, but is now reported to be closer to 300,000 MT.<sup>25</sup> The depreciation of the Kwacha has led to an increase of imported inputs, such as drugs, vaccines and stock feed ingredients of approximately 20 percent. While significant price increases pose a challenge for farmers, the availability of feed in required quantities does not appear to be a binding constraint. With independent stockists across the country and sales outlets of companies, the distribution system is well established.<sup>26</sup> Inputs

<sup>25</sup> Allied Industries Subcommittee, 2016.

<sup>26</sup> National Milling [Namfeed], for example, has 45 sales outlets across the country; Ross [Nutrifeed] has 72 agents and sales outlets nationwide.

such as soy and maize are domestically sourced from local farmers. While an in-depth look at necessary agricultural policy reforms is outside the scope of this analysis, Box 2 provides a brief overview of current agricultural policies, including large subsidies, which distort the market.

- **Production:** There are significant differences between the structure of the broiler and layer subsectors.
  - **Broiler subsector.** According to the Poultry Association (PAZ) of Zambia, there are almost 35,000 small-scale and over 180 large commercial broiler farms in Zambia. Smallholders have a market share of around 65 percent, whereas LCFs capture 35 percent of the market. While LCFs make use of technologies to optimize lighting and rearing cycles, SSFs tend to operate a traditional production model that requires little technology and capital equipment.
  - **Layer subsector.** The layer sector is highly concentrated among a few large farms that produce 70 percent of total eggs. In fact, one large producer with over 700,000 layers provides about one-fifth of the country's entire annual egg consumption. SSFs produce about 30 percent of eggs.
- **Processing and Distribution:** In both subsectors, there is hardly any linkage between SSFs and processors, due to scant capitalization among smallholders who often rely on backward production systems. Without the ability to meet the quantity and quality requirements of processors and food retailers, SSFs sell 80 percent of their birds on the local live market. The Jobs in VC Survey indicates that sales are primarily to either individual consumers or to traders of varying size. Most commonly, these are small traders who are mostly women and work individually with their own transportation.

In contrast, LCFs have a production model that optimizes margins by butchering the birds at the right age and selling frozen meat to supermarkets. This requires precise feeding regimes, good quality feed, abattoirs, pack houses with flash freezers, and purchase agreements with buyers. LCFs operate at a large scale with 25,000 or more birds per cycle and can therefore work on tight margins. As such, LCFs do not compete in the same distribution channels as SSFs (refer to the VC diagrams). In addition, LCFs tap into the regional export markets, predominantly through informal cross-border exports to the DRC and Angola.



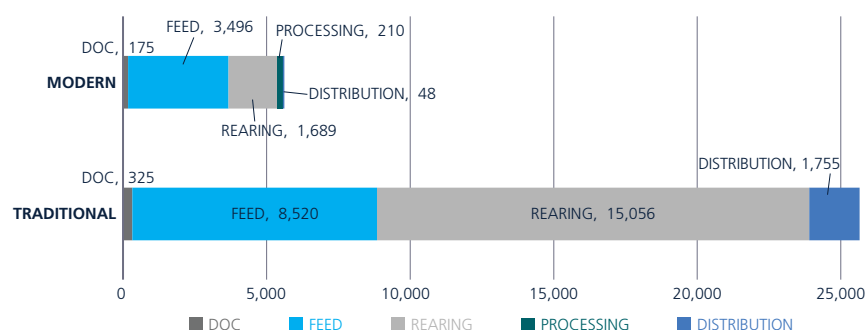
Photo: International Livestock Research Institute

## JOBS IN THE POULTRY VALUE CHAIN

**Zambia's poultry sector, especially the broiler subsector, provides a significant number of jobs.**

According to 2014 data from PAZ, the sector provides direct and indirect employment to 80,000 people through 50,000 permanent and 30,000 seasonal jobs.<sup>27</sup> The largely informal nature of the sector may question the accuracy of such estimates, particularly when disaggregated by broiler and layer farmers. The focus of this jobs estimation analysis is on broiler farms, due to their labor intensity as compared with layer operations. By drawing upon estimated labor productivity and the average number of broilers from reported in PAZ data, it is possible to calculate the jobs at baseline in traditional and modern production models across nodes of the VC (Figure 8).

**Figure 8**  
Estimated jobs across traditional (SSF) and modern (LCF) models of broiler production



Source: Adapted from Poultry Association of Zambia data.

**A larger number of jobs are in the traditional production model, primarily in rearing chickens and feed production.** Figure 8 shows 31,000 jobs currently in the broiler subsector, with over 25,000 in the traditional model (small broiler farms) and over 5,000 in the modern model (large commercial broiler farms). The distribution of jobs across the nodes of the VC is particularly striking, with a significant concentration of employment among SSFs in rearing broilers. In the modern model, LCFs are employing far less labor at the rearing stage, and the largest concentration of jobs is in feed production. This indicates the ability of LCFs to rear birds more efficiently due to superior technology and on-farm practices. The efficiency advantage is further reflected in the relatively lower amounts of feed needed per bird in the modern model. The estimation is based on a feed conversion ratio (FCR)<sup>28</sup> of 1.5 for the modern production model and 2.0 for the traditional production model. The mortality rate for both SSFs and LCFs was assumed to be 5 percent.<sup>29</sup> The absence of jobs in processing is noted in the traditional model, as opposed to the modern model that employs over 200 workers. The potential for job growth in processing is discussed in the next subsection based on Zambia's expected broiler consumption and population growth.

**The majority of employment in the poultry VC is low-skilled, on-farm work** (Table 3). As reported in survey data, over half of employees on broiler farms and over three quarters of employees on layer farms are permanent low-skilled workers. Seasonal or temporary workers comprise 15 and 8 percent in the broiler and layer subsectors, respectively. The average wage for permanent high-skilled workers was approximately double

<sup>27</sup> AgriProFocus Zambia 2015.

<sup>28</sup> The feed conversion ratio (FCR) is a measure of how efficiently animals convert feed into desired output. The FCR indicates the amount of feed required [in kg] to produce 1 kg of meat. Assuming an average weight of 2.1 kg per bird, and FCRs of 1.5 and 2.0 on LCFs and SSFs, respectively, the total amount of feed required per bird is 3.2 kg and 4.2 kg.

<sup>29</sup> The same mortality rate for SSFs and LCFs was assumed for the sake of simplicity. However, this does not reflect the likely difference in farming practices that affect productivity.

that among permanent low-skilled workers, and five times higher than that for seasonal/temporary workers who are hired to perform very short-term, menial jobs (e.g., catching chickens overnight at the end of each broiler cycle).<sup>30</sup>

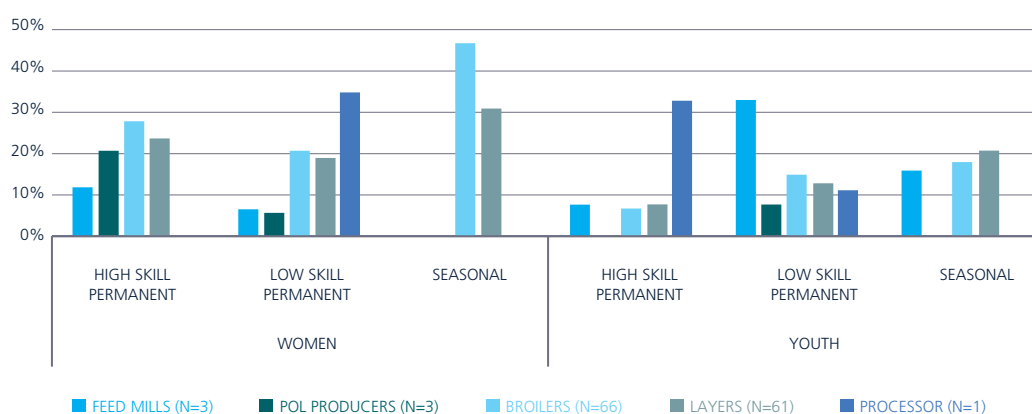
**Table 3**  
Distribution of jobs by type across value chain nodes<sup>31</sup>

	Distribution of jobs by type across poultry value chain nodes	Share of total jobs		Share of permanent	
		Permanent	Seasonal	High skill	Low skill
Feed mills (n =3)	1.4%	90%	11%	31%	69%
POL producers (n =3)	0.3%	99%	2%	14%	86%
Broilers (n =66)	Broilers + layers on farm:	85%	15%	40%	60%
Layers (n =61)	95%	92%	8%	16%	84%
Processor (n =1)	3.4%	95%	4%	2%	98%
Total	100%	89%	11%	27%	73%

Source: Global Development Solutions, LLC.

**Women and youth<sup>32</sup> are predominantly employed on-farm** (Figure 9). The Jobs in VC Survey points to most opportunities for women in terms of both permanent high- and low-skilled work in (i) broiler subsector, particularly in Lusaka; and (ii) POL production for off-farm employment. Survey data further suggests that youth are benefiting from opportunities in the broiler subsector, primarily in Copperbelt, in terms of both high- and low-skill jobs. In addition, processing offers opportunities for permanent high-skill jobs and in feed mills for low-skill jobs.

**Figure 9**  
Share of jobs in poultry among Women and Youth, by node and type<sup>33</sup>



Source: Global Development Solutions, LLC.

<sup>30</sup> The average annual wage for permanent low-skilled workers was Zambian Kwacha [ZMW] 8,178 in the broiler and ZMW 8,804 in the layer sub-sector. The average annual wage for permanent high-skilled workers was ZMW 17,919 in the broiler and ZMW 18,871 in the layer subsectors.

<sup>31</sup> Note that there is only one commercial fish processor in Zambia, Capital Fisheries. The company declined to participate in the full survey but did answer specific questions.

<sup>32</sup> Government definition of youth in Zambia is less than 36 years old. The survey captured data regarding youth as defined by less than 25 years old.

<sup>33</sup> Only one processor agreed to participate in the survey, and interpreted the question of high-skill workers to be the upper management and chief technicians of the company, which may not be representative of other processors in the poultry sector.

**Employment opportunities for women are limited in the absence of linkages to processors.** Value addition activities are limited in the sector thus far, which limits employment opportunities for women. On the other hand, selling in the live bird market provides job opportunities for female small-scale traders. As more large farms consolidate, processing is likely to expand, while the number of individual traders is expected to decrease. Additional employment opportunities for women in value addition could therefore be contrasted with fewer jobs for female collectors and traders in the live market.

**There is considerable potential for indirect job creation in the feed sector.** About one third of jobs in the traditional broiler production model and about two thirds in the modern broiler production model are in feed production. Poultry feed is comprised of 65 percent maize and 30 percent soya. About 60 percent of maize and 10 percent of soya is produced by SSFs. For maize, average yields among SSFs are 2.1 MT per hectare, and 50 person-days are required per hectare. Among large farms, yields are assumed to be 9 MT per hectare, and 30 person-days are assumed to be necessary per hectare. For soy, workers on small-scale soy farms are assumed to produce around 3.7 MT per year and workers on large, heavily mechanized soy farms are assumed to produce around 2,000 MT per year. A full-time equivalent (FTE) job is assumed to consist of 300 days of work in one year. Table 4 shows how the potential to create jobs on small maize farms has been calculated.

**Table 4**  
Jobs in maize cultivation for poultry feed in traditional and modern broiler production models

	Traditional	Modern	Total
Total amount of feed required at baseline (MT)	204,887	84,056	288,943
Amount of maize required (MT)	133,176	54,636	187,813
Amount of maize produced by small maize farms (MT)	79,906	32,782	112,688
Ha of maize required to grow feed on small maize farms	37,479	15,376	52,855
Total person days required	1,873,962	768,805	2,642,767
Total Number of FTE jobs in maize cultivation	6,247	2,563	8,809

Source: Adapted from Poultry Association of Zambia and Ministry of Agriculture and Livestock (MAL) data.

**Productivity in the broiler subsector is significantly higher for LCFs, as is profitability.** The proportion of feed utilized by SSFs versus LCFs varies based on data from PAZ that 3.2–4.2 kg of feed are required to crop a chicken in the range of 35–42 days. The underlying estimations of productivity are based on SSFs requiring more feed, contributing to higher per unit costs as compared to LCFs. Table 5 shows the labor

**Table 5**  
Labor profile, small broiler farm

Broiler production, 2015	78,788,000
Labor productivity per cycle (broilers/worker)	810
No. of production cycles/year	4
Labor productivity/year (broilers/worker)	3,240
Estimated number of permanent employees	24,317
Average no. of broilers/farm	1,320
Estimated number of broiler farms	14,922

Source: Adapted from Poultry Association of Zambia data and Jobs in Value Chains Survey results.

profile of small broiler farms, and highlights the labor productivity estimated from survey data at about 3,200 broilers per worker. This figure may be contrasted with a productivity of 15,500 broilers per worker on LCF, a nearly five-fold difference.<sup>34</sup> According to survey results, SSF workers operate significantly below their capacity as the average farm has 1,320 broilers, or only about 40 percent of the 3,240 estimated capacity per worker.

**The productivity differential constitutes a major challenge for small broiler producers.** The difference in productivity is further reinforced by the high degree of vertical control (ownership) that LCFs have over their supply chain.<sup>35</sup> Zambeef is the most well-known example among many LCFs that continue to modernize and benefit from efficiency gains, value addition, and demand for processed meats like drumsticks, chicken wings, and chicken breasts. LCFs also benefit from the application of best practices in breeding, feeding, and disease management, among other techniques to maximize technical efficiency. The trends in Zambia mirror the sectoral development in countries such as Brazil with a massive commercial poultry sector presence. Companies involved in processing have invested in feed mills as a mitigation measure against supply fluctuation risks that can impede their ability to meet demand.

## **JOB GROWTH SCENARIOS IN THE POULTRY VALUE CHAIN**

**This section provides a brief overview of two job growth scenarios in Zambia's broiler sector.** Future growth will most likely be based on rising domestic demand, due to large expected growth as well as difficulties in tapping into formal export markets for poultry. As noted earlier, competition with the established South African industry and non-adherence to the SACU makes it difficult for Zambian producers to compete on the regional market. Domestically, however, the rise in total broiler consumption is driven by two factors. First, Zambia's population is growing rapidly at over 3 percent per annum. Second, rising incomes and increasing urbanization are expected to lead to a shift in people's diets, substituting animal proteins for starches. The high expenditure elasticity in poultry relative to other livestock products indicates that the broiler sector is expected to be the primary beneficiary. Both scenarios, therefore, assume a 25 percent increase in per capita consumption in addition to continuous population growth at 3.1 percent annually.<sup>36</sup>

**Scenario 1: Job creation potential at constant market shares.** The first scenario assumes market shares remain constant, with SSFs and LCFs producing 65 and 35 percent of broilers, respectively. In this scenario, the broiler VC has the potential to create a total of 48,000 jobs by 2022, of which 16,000 jobs are additional, over and above the baseline amount of employment. Given the constant market share and the lower productivity on small broiler farms, over 80 percent of these additional jobs are in the traditional production model (see Figure 10—note the different scales of the two graphs). Of these jobs in the traditional production model, over 23,000 or over half are on small broiler farms, constituting low-skill employment, while over 13,000 or 30 percent are in the feed sector on maize and soy farms. Since maize is the most important feed ingredient and smallholders dominate maize production, these additional jobs support primarily smallholders. In the modern sector, over 5,000 jobs, constituting over 60 percent, are in the feed sector, on maize and soy farms.

**Scenario 2: Job creation potential with all additional broiler production being captured by LCFs in the modern sector.** In the second scenario, the modern production sector benefits from all additional growth, while production in the traditional production sector remains constant at the baseline level (Figure 11). In this scenario, 8,500 additional jobs are created in the modern production sector, leading to a total of over 14,000 jobs. Almost 9,000 of these jobs, or over 60 percent, are in the feed sector, primarily on maize farms and thus

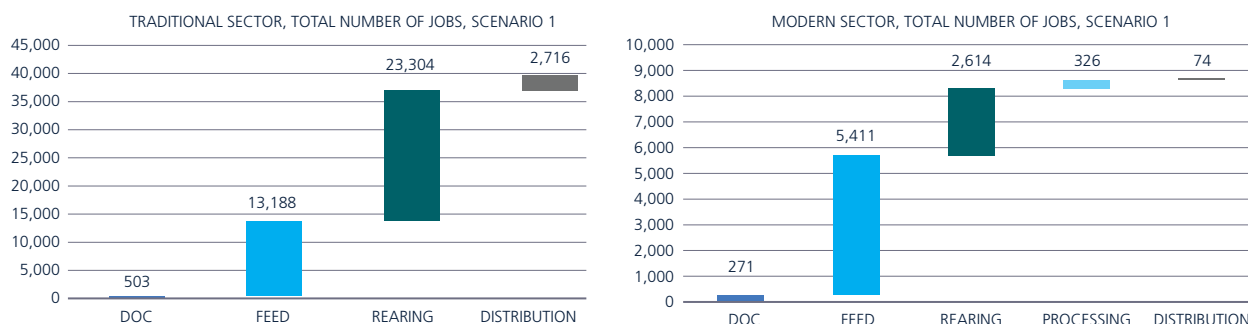
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<sup>34</sup> According to PAZ, LCFs rear over 26 million birds per year and employ 1,650 workers.

<sup>35</sup> Narrod, C., Tiongco, M., and A. Costales. Global Poultry Sector: Trends and External Drivers for Structural Change. Food and Agriculture Organization of the United Nations, 2009.

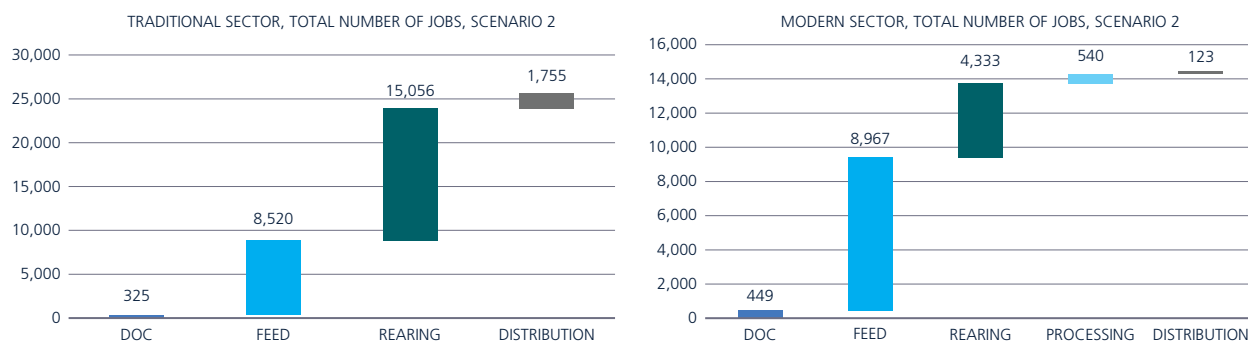
<sup>36</sup> In addition, both scenarios assume full capacity utilization at baseline.

**Figure 10**  
Scenario 1 – Job creation potential in broiler production at current market shares



Source: Adapted from Poultry Association of Zambia data.

**Figure 11**  
Scenario 2 – Job creation potential where all additional growth is captured by LCFs



Source: Adapted from Poultry Association of Zambia data.

support smallholders. Over 4,000 jobs, or over 30 percent, are on large broiler farms, which is comprised of mostly permanent wage employment.

**Comparing the two scenarios, fewer jobs are created in Scenario 2 but they are expected to be of higher quality.** The lower number of jobs created is attributable to the higher labor productivity in the modern production model that captures all additional demand, which is increasingly likely as Zambia’s sector moves towards an industrialization pattern observed in other countries with similar growth rates. More productive jobs on large farms are likely to be better paid and with better benefits than the jobs on small farms created in Scenario 1. Moreover, the increased activity in the modern production sector leads to larger employment gains in the processing node of the VC. Yet under the modern production model, investment in equipment and mechanization may weaken the potential for job growth. The concern that output growth may not have a significant impact on labor growth is discussed in more detail in Box 1.

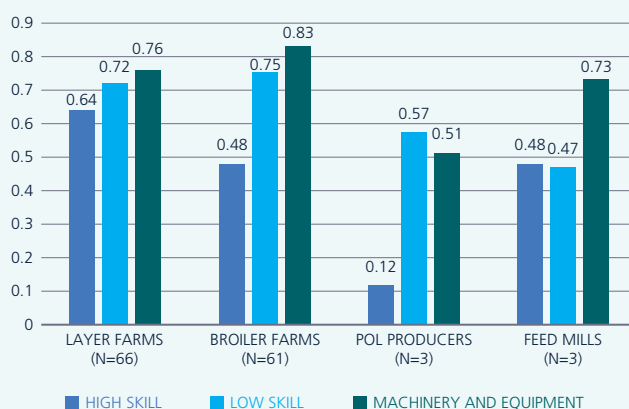
## CONSTRAINTS TO GROWTH AND JOBS

**Zambia’s small broiler farmers must overcome a range of constraints in order to benefit from growth in the poultry VC.** As noted earlier, the current market structure where there are few linkages from LCFs to SSFs through the supply chain reinforces inadequate business profitability and earning potential among smallholders. This lack of integration affects competitiveness and potential for productivity growth in terms of access

## BOX 1: CONSIDERING THE IMPACT OF OUTPUT GROWTH ON LABOR GROWTH

Jobs potential through sectoral growth is dependent on how farms are likely to react to growth. The central question is whether firms will increase labor or substitute labor with capital through enhanced technology. The Jobs in VC Survey helps understand further the capital-output and labor-output ratios. The survey asks farmers about their marginal investments in capital and labor use in a scenario where output is doubled. Comparing worker requirements and machinery required suggests that the nodes along the VC will predictably increase investments in equipment over labor. Figure 12 below shows differences within the VC. Feed mills and to a lesser extent broiler farms indicate particularly high ratios of increasing equipment.

**Figure 12**  
Increase in input factors required to respond to doubling in demand



(Y-axis indicates percent increase in production factor. N refers to the number of data points.)  
**Source:** Adapted from Global Development Solutions, LLC.

While increased demand will stimulate growth across the sector, the data suggests that a doubling of output is not likely to lead to a doubling of employment, in part due to idle capacity in the sector. Feed mills and POL producers are more conservative in their hiring expectations,<sup>37</sup> but low-skilled work is likely to be in demand on an ongoing basis. This finding makes sense in the context of the low productivity in Zambia's small farms, especially compared with regional leaders such as South Africa,<sup>38</sup> and that expansion of market opportunities in the sector will require increased labor – though greater increases in mechanization.

Analysis adapted the Jobs in Value Chain Survey pilot in Lebanon.

Source: *North Lebanon Potato Value Chain Assessment*. Lebanon Jobs Program Technical Assistance [P155546]. Washington, D.C.: World Bank, June 2016.

<sup>37</sup> Feed mills and POL producers are much more conservative in their hiring expectation as they have been operating below capacity as a result of the economic downturn. In interviews with feed mill managers, for example, it was revealed that the feed industry overall is operating at about 65 percent capacity, down from over 90 percent prior to mid-2015.

<sup>38</sup> Compared to South Africa, with its well-developed, more efficient, and more consolidated poultry sector (more than 900 million birds are produced by only nine companies, which represents approximately 90% of national production), Zambian broiler productivity is quite low; productivity level in South Africa is about 65,470 broilers/worker annually.

Sources: "A Profile of the South African Broiler Market Value Chain", Department of Agriculture, Forestry & Fisheries (DAFF), 2012 and 2014; and South Africa's poultry sector supports approximately 120,000 direct and indirect jobs. "South Africa: The Cost to Farmers of Cheap Meat Imports." The Poultry Site. N.p., n.d. Web. 15 Jan. 2017.

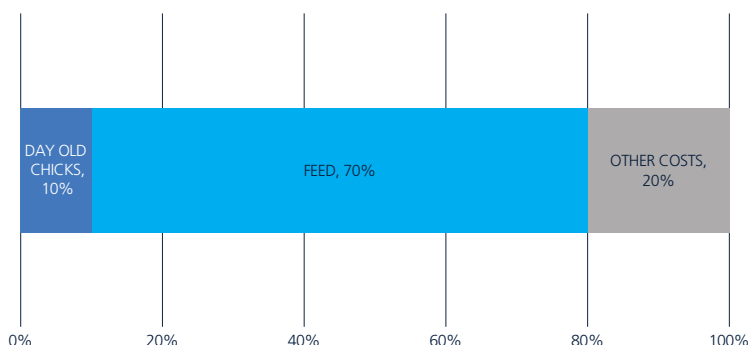


to affordable financing, technical knowledge in on-farm management, utilities such as electricity. Results from the survey reveal further details on each issue:

- **Insufficient access to affordable financing:** The lack of available financing is cited by SSFs as the greatest current obstacle to growth.<sup>39</sup> This can be attributed to the large amount of working capital required to initiate each production cycle, as upfront investments are needed for procuring DOC, feed, vaccinations, medicines, etc. Moreover, the limited access to financing constrains smallholders opportunities to invest in quality control mechanisms required to meet the standards of larger buyers. Further exacerbating the situation, farmers resist increasing their price out of fear of compromising sales. As a result, costs rise faster than sale prices. In terms of on-farm training, processors that may be working with SSFs have limited capacity to monitor a large number of outgrowers to ensure that stringent quality standards and regular volume requirements are met.
- **Inadequate on-farm management practices:** Due to limited exposure to extension services, many small broiler farmers do not adhere to optimal on-farm practices (e.g., regarding feed, and lighting management, which reduces productivity and can adversely affect product quality). Challenges persist in terms of disease control that can lower efficiency, but SSFs often lack sufficient technical knowledge in vaccinations, nutrition, and biosecurity. A key implication of inadequate technical support is the inability to meet quality standards required by formal retail chains, including supermarkets.
- **Unreliable electricity supply:** The increasing frequency of load shedding has adverse effects on the broiler industry overall and SSFs in particular.<sup>40</sup> On small broiler farms, who cannot afford a generator to kick in during the periods of electricity rationing, the lighting cycle is frequently disrupted. The longer hours of darkness result in a higher FCR, which increases the amount of feed required. This shrinks already slim profit margins, as feed is the largest input cost driver. While LCFs operate generators to prevent disruptions of the lighting cycle and higher FCRs, they do incur additional costs for diesel and the maintenance of generators. In addition, all broiler producers have to bear higher input costs for feed and DOCs, as millers and DOC producers pass on additional costs for purchasing, operating, and maintaining generators.<sup>41</sup>

**Further, feed plays a crucial role for the broiler VC, as noted, not only by linking poor households to earning opportunities, but also through its influence on sectoral competitiveness and fueling further demand.** An analysis of the poultry industry’s cost structure shows that feed is the primary driver of overall expenses (Figure 13).

Figure 13  
Cost structure in the Zambian broiler industry



Source: Adapted from Poultry Association of Zambia data.

<sup>39</sup> In a rating of 1 to 3, with 3 indicating a major obstacle, the average cited among broiler farmers was 2.7.

<sup>40</sup> Zesco, Zambia’s state-owned company producing about 80 percent of electricity consumed in the country, introduced rationing in 2015. Poor rains contributed to low water levels and a power deficit causing load shedding of up to eight hours. As a result, many industries downsized their operations.

<sup>41</sup> Samboko et al. 2016. *The Impact of Power Rationing on Zambia’s Agricultural Sector*. Lusaka, Zambia: IAPRI.

This suggests that increasing the efficiency of feed production, and thus lowering feed prices, is a key element for improving competitiveness along the poultry VC in Zambia. Lower costs could be passed on to consumers through lower prices, which would further spur demand. Box 2 looks at Zambia's policy challenges in the agricultural sector to maximize efficiency gains, particularly in the animal feed subsector where more SSFs could benefit. In addition to these policies, the ban on the use of genetically modified crops also has far-reaching impacts on the productivity of maize and soybean cultivation, and thus on the competitiveness of the Zambian poultry sector.<sup>42</sup>

## BOX 2: POLICY CHALLENGES TO MAIZE PRODUCTION IN ZAMBIA

Many of Zambia's current agricultural policies were introduced to improve the performance of the grain sector, including maize and soya, in order to improve food security and reduce poverty. However, the current system, consisting primarily of the Farmer Input Support Program (FISP) and the Food Reserve Agency (FRA), is largely not achieving this objective. Current targeting practices are suboptimal, as subsidies fail to reach the poorest smallholder households and are disproportionately captured by larger, wealthier farmers.

While most Zambian farmers cultivate less than two hectares of land and poverty rates within this group are over 80 percent, wealthier households that cultivate larger plots of land are more likely to receive subsidized fertilizer through FISP. In addition, farmers with more land receive greater absolute quantities of FISP fertilizer (IAPRI, 2013). Since better-off farmers could afford to buy inputs at market prices, FISP crowds out purchases from the private sector distributors.

The FRA was initially established to hold maize reserves in order to smooth out price fluctuations, but it has become increasingly involved in purchasing maize from smallholders and supporting output prices. World Bank analysis shows that FRA purchases are disproportionately captured by larger, better-off farmers with over five hectares of land, as poorer farmers with less than two hectares of land supply only 11 percent of maize purchased by FRA. Further, issues regarding maize procurement, crop diversification, spoilage, and marketing persist in terms of the role of the FRA. Commercial mills' access to maize directly from the market may be limited and contributing to bottlenecks in the maize supply chain.

Maize production, in terms of area planted and tonnes harvested, has risen somewhat as a result of FISP subsidies, but productivity remains low (30–50 percent of global averages for most crops). Though most farmers now use more fertilizer in production—which is certainly a positive outcome—FISP subsidies have not increased the productivity of farmers. Maize yields for small and medium farmers are just over two tons per hectare. The potential yield for most hybrid varieties in Zambia is about 6 tons per hectare. The main reason behind increased maize output has been growth in the area under cultivation.

In addition to not reaching the poorest farming households, the FISP and FRA prove to be costly. Between 2009 and 2015, the two programs consumed on average 44 percent of the agricultural budget. This indicates that public resources were diverted from providing public goods with clearer pro-poor implications, including extension services, irrigation, livestock development, and rural infrastructure (feeder roads and rural electrification). These are productive areas that could support SSF participation in commercial VCs through productivity, quality, and efficiency gains in maize production. From a jobs perspective, reducing distortions in grain markets can increase efficiencies and lower the price of a major input for broiler production.

Sources: Indaba Agricultural Policy Research Institute (IAPRI): *How can the Zambian Government improve the targeting of the Farmer Input Support Program* (2013); *An In-depth Analysis of Zambia's Agricultural Budget: Distributional Effects and Opportunity Cost* (2016); World Bank Agricultural Policy Note, 2014: *Agricultural Policy Reform in Zambia: Perspectives and Options*; The World Bank Group. 2016. *Breaking down barriers: unlocking Africa's potential through vigorous competition policy*. Washington, D.C.: World Bank Group.

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<sup>42</sup>Recent WB research notes that productivity improvements may be enhanced by enabling adoption of genetically modified (GM) foods. Specifically, removing regulatory obstacles to the development of GM crops can help smallholders withstand stresses like drought, pathogens, and pests. The use of GM crops requires adequate biosafety controls, but external political pressure has induced overreaction against GM seed adoption in the region, including in Zambia, with adverse consequences for competitiveness of livestock and related economic sectors (Paarlberg 2002). The need for GM options will increase in the years ahead, especially in the face of climate change. While Zambia like many other countries in the region will require responsible, rigorous biosafety measures in place, the gains are potentially huge for SSFs that can overcome financial liquidity constraints, such as those plaguing Zambian farmers, in terms of yield increases that support earnings growth. (Qaim and Zilberman 2003; Qaim 2015). Source: Barrett, Christopher B.; Christiaensen, Luc; Sheahan, Megan Britney; Shimeles, Abebe. 2017. *On the structural transformation of rural Africa*. Policy Research working paper; no. WPS 7938. Washington, D.C.: World Bank Group.

**Given differences in productivity and economies of scale in a context of narrow margins per bird, it is hard to see a positive outlook for independent small broiler producers in the absence of market linkages.** LCFs operate nearly five times more productively than SSFs under the traditional production model, which inevitably translates into a significant price differential. In contrast to contract producers linked to lead firms' supply chains, small broiler producers operating independently are subject to greater risk and potential for economic losses due to price volatility. As the Zambian economy continues to urbanize, more people will have access to the distribution channels of the modern production system, such as supermarkets, and LCFs are likely to capture larger market shares. As the sector overall expands, the number of small broiler producers may, in fact, decline with an increase in the average size of farms. Experience from countries such as Brazil and Thailand confirms that the largest farms registered the largest increases in production as the sector expanded and changed the distribution of poultry farms from small to large.

## CONCLUSIONS AND THE WAY FORWARD

The analysis presented on Zambia's poultry VC shows significant potential for jobs, and many of these opportunities will be low-skilled, on-farm. The sector provides an important source of income for many smallholders, through broiler production as well as the growing of maize and soy used in feedstock. However, it is increasingly unlikely that small broiler producers can continue sustainable, profitable operations without participating in commercial markets. Ensuring that more SSFs can access good jobs will require overcoming constraints to competitiveness. The following are high-priority areas for 'job-friendly' policy interventions to strengthen the ability to integrate SSFs into the supply chains of lead firms through contract growing of broilers and producing inputs to animal feed.

**Promoting outgrower and aggregator schemes.** Outgrower schemes enable contract SSFs to overcome constraints to access financing for inputs and technical knowledge on best practices in on-farm management. In outgrower schemes, contract SSFs supply labor, land, sheds, water, and electricity, while receiving inputs and



Photo: WorldFish Center

technical assistance from LCFs to maximize performance and efficiency for reliable quantities.<sup>43</sup> The importance of access to skills development and learning of technical best practices in farming techniques cannot be overstated, as SSFs can benefit from information and service delivery by lead firms. Mozambique provides a regional example of how expansion of the modern poultry sector may include outgrower models in urban and peri-urban areas where broiler production is effectively outsourced (see Box 3). While the specific modalities through which outgrower and aggregator schemes can be implemented in Zambia may vary, the primary beneficiaries are likely to be current and potential small broiler producers located in peri-urban areas in the proximity of the LCFs.

**Improving supply and affordability of electricity.** As the sector shifts towards modern production models and becomes increasingly technology-intensive, providing access to affordable electricity is a prerequisite for commercially viable poultry rearing operations. Expanding connections to the main grid or separate mini-grids is an important aspect of supporting small broiler producers to meet quality and quantity requirements. Among smallholders in more dispersed areas, independent off-grid systems, for instance through solar energy, can supply electricity needed to lower operating costs and improve profitability.

**Streamlining agricultural policies to support animal feed production.** Agricultural policy reforms to enable SSF productivity growth will facilitate linkages between commercial broiler farms and smallholder producers of feed input. As Scenario 2 shows, the majority of newly created jobs will be in the feed sector. Since 60 percent of maize is produced by smallholders, a large share of these jobs are located on small farms in rural areas. Developing Zambia's feed sector will require reforming inefficient policies, that currently drive up input prices for feed.

### BOX 3: THE DEVELOPMENT OF MOZAMBIQUE'S POULTRY SECTOR

Mozambique's poultry sector provides an important case study on improved job quality and inclusiveness for smallholders. Like Zambia, the Mozambican poultry sector is highly concentrated among a few large, vertically integrated companies. In the early 2000s, an analysis by TechnoServe found that contracting outgrowers to raise broilers instead of raising broilers in-house would be more efficient for the lead firms. First, smallholder households can more flexibly respond to the variability of labor requirements. While at times very little labor is required apart from feeding the birds, other times more people are necessary to comply with health standards. Smallholder households can adapt to this variability more easily than large corporations that would have to hire additional workers. Secondly, smallholders can construct improvised chicken sheds made of recycled materials that are significantly cheaper than commercial shacks, reducing fixed costs significantly. TechnoServe provided a large operator with a grant conditional on assisting smallholders in building the chicken shed and further provided the large farms with the amount of working capital required for chicks, feed, and vaccines for SSFs. Moreover, SSFs were trained in best practices in poultry rearing techniques.

Novos Horizontes, a leading poultry operator, provides more detail on how outgrower models can work. The vertically integrated company controls feed production and abattoirs, yet leaves the rearing of birds to outgrowers. The smallholders build their own chicken sheds and receive DOCs and feed from Novos Horizontes on credit. Extension workers from the LCF visit outgrowers in their villages to provide training and monitor the growing process. Fully grown birds are picked up by Novos Horizontes and then processed in the company's processing plant.

Another critical aspect of the poultry industry's growth was the development of the animal feed sector, with tens of thousands of small maize and soy farmers growing more crops to supply the expanded market. TechnoServe provided credit and technical assistance to the SSFs in crop production. These efforts contributed to the Mozambican poultry sector's six and a half-fold growth to a \$165 million industry in 2010, and attracted \$125 million in investment. Growth has created over 3,000 direct jobs in hatcheries, abattoirs, and feed mills. Per one million birds produced locally, about 9,000 SSFs are indirectly supported by raising chickens and crops for feed, which excludes further indirect impacts in equipment and packing materials. The Mozambican soybean sector has grown to 30,000 farmers and has stimulated an expanded domestic vegetable oil industry.

Sources: Extracted from Karnani, A. and K. McKague. *Job Creation in the Mozambican Poultry Industry*. The European Financial Review, 28 February 2014; and FAO 2013. *Poultry Sector Mozambique*. FAO Animal Production and Health Livestock Country Reviews. No. 5. Rome.

<sup>43</sup> FAO 2013. *Poultry Sector Mozambique*. FAO Animal Production and Health Livestock Country Reviews. No. 5. Rome.



## 3. JOBS IN ZAMBIA'S AQUACULTURE VALUE CHAIN

### AQUACULTURE SECTOR OVERVIEW

**Aquaculture is a rapidly growing livestock subsector as fish is a popular animal protein source in Zambia where there is large unmet demand.** Government has prioritized the sector in Zambia as a source for sustainable livelihoods for SSFs through greater use of the country's abundant water resources and production capacity. The country has 15 million hectares of water in the form of rivers, lakes and swamps, which provide the basis for extensive freshwater fisheries. As of 2011, the contribution to GDP of fisheries and aquaculture averaged 3 percent out of the 18 percent share contributed by agriculture, forestry and fishing.<sup>44</sup> Trends in import and consumption data show that growing demand remains unmet by domestic production, and regional markets show strong import-substitution possibilities. The popularity of fish can be partly attributed to the fact that it is the second most affordable animal protein after poultry. An increase in aquaculture production translates to increased need for inputs, including fish feed, and supporting infrastructure, with implications for job creation along the VC.

**Revenues from aquaculture have been growing in recent years, and farmers are optimistic about the sector's development.** Recent investments by major aquaculture companies have led to large-scale, cage fish farming facilities. This is confirmed by the Jobs in VC Survey, which focused on Lusaka and Northwestern provinces.<sup>45</sup> Northwestern Province has grown particularly strongly, up 185 percent in 2015 from 2013. This strong growth could be attributed to increased mining activity in the region, bringing in improved wages and increased disposable incomes. Lusaka also posted a strong, though lower, growth of 147 percent. Average annual growth for SSFs in both provinces is 59 percent, as shown in Figure 14, which depicts recent revenue growth across the VC. Given that the average age of SSFs is well under a decade, part of this growth rate may be explained by the growing customer base and reputation in their respective regions during the previous three years. Approximately 63 percent of farmers surveyed anticipate demand growth of more than 20 percent, while another 35 percent of farmers surveyed anticipate demand growth of at least 1–20 percent over the next 12 months (Figure 15).

### PRODUCTION, CONSUMPTION, AND TRADE OF AQUACULTURE PRODUCTS

**Production: In Zambia, given that capture fishery<sup>46</sup> production is at its limit, developing the aquaculture sector is key to increasing domestic fish production.** Although it represents a small share of global production, Zambia is the largest producer of aquaculture fish among neighboring Zimbabwe, Tanzania, and Malawi.<sup>47</sup> Yet aquaculture production volume is more than three-fold less than capture fisheries with just over 20 percent of overall market share, and approximately 30 percent of its production is attributed to SSFs using pond systems.

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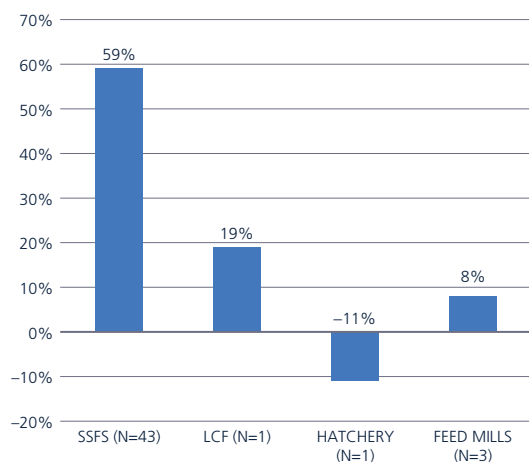
<sup>44</sup> Zambia Development Agency 2011. *Zambia Agriculture Sector Profile*.

<sup>45</sup> The two provinces were selected due to their production potential and proximity to markets.

<sup>46</sup> A *capture fishery* is defined as an aquatic area that is harvested for its commercial value. Also referred to as wild fisheries, a capture fishery refers to catching or capturing fish that are naturally present in uncontrolled waters, as opposed to aquaculture, in which the fish are raised in confined areas [fish farming].

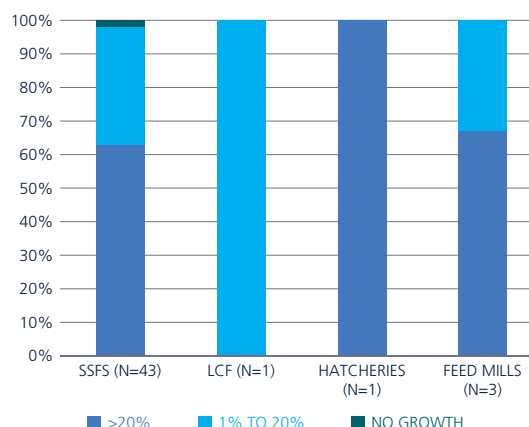
<sup>47</sup> As of 2014, Zambia produced about 19,000 MT compared to roughly 10,500 in Zimbabwe and Tanzania and 4,700 in Malawi. FAO Fisheries and Aquaculture Department, Fishery Statistical Collections, 2016.

**Figure 14**  
Average annual growth rate (2013–2015)



Source: Global Development Solutions, LLC.

**Figure 15**  
Twelve-month growth outlook



**There is scope to increase productivity and pond capacity utilization among SSFs.** Production cycles vary, but SSFs harvest after approximately 8 or 9 months, whereas LCFs can achieve two harvests per year. The longer cultivation period and resulting lower yields among SSFs are in part due to non-adherence to a best practice feeding regime, in-pond breeding, and mixed-sex ponds. According to survey data, the pond capacity utilization rate is low in both Lusaka and Northwestern Province (60 percent and 49 percent, respectively), which suggests that farmers are capable of producing considerably more fish with existing capacity. Low capacity utilization rates are linked to the increase in feed costs following the weakening of the Kwacha. Survey data suggests that cost increases have led to farmers stocking their ponds with fewer fingerlings; feeding fish below the recommended rate; and/or substituting high quality feed produced by a mill with manure, crop residues, and food scraps.

**Consumption: Consumption of fish (mostly tilapia) has risen steadily over the last decade, but the current selling price restricts potential growth in the market.** According to the Department of Fisheries, domestic consumption has increased 2.6 times between 2006 and 2015.<sup>48</sup> As noted in the analysis of the poultry sector, further increase in consumption of animal protein is likely in line with rising incomes and shifting dietary patterns. Independent, semi-structured interviews with consumers overwhelmingly indicate a desire to consume more fish (Table 6). Fish is not considered cheap by the majority of the population, as reflected by the

**Table 6**  
Changes in household fish purchases due to changes in price

	NW province		LSK province	
	kg	% increase	kg	% increase
Current weekly household purchase (kg)	3.3		4.2	
Weekly HH purchase if price dropped 10%	9.3	180%	15.7	276%
Weekly HH purchase if price dropped 25%	32.9	889%	33.8	710%

Source: Global Development Solutions, LLC.

<sup>48</sup> Department of Fisheries [2016] 2015 Fisheries Statistics Annual Report.

low average per capita consumption of about 8.7 kg per annum, and the current selling price restricts potential growth in the market. However, it is unclear if consumers would indeed buy seven times more fish if prices dropped by 25 percent, the data suggests that unmet demand for fish exists.

**Trade: While many fish importing countries have experienced declines in quantities imported, Zambian imports of fish increased more than four-fold from 2011 to 2015.** As of 2015, imports covered the gap between domestic demand and production of approximately 77,000 MT, primarily from African countries but increasingly also from China.<sup>49</sup> In terms of exports, formal exports as a percentage of total fish production were only 0.3 percent in 2015. However, informal exports far exceed formal exports and mostly from capture fisheries, with the main destination being DRC.<sup>50</sup>

## THE AQUACULTURE VALUE CHAIN

**The aquaculture VC covers a broad range of stakeholders, including hatcheries, feed producers, farmers, processors, distributors, and retailers.** The focus of this analysis is contrasting production and marketing systems of large scale and small scale growers (SSFs). Figure 16 illustrates the main actors in the aquaculture VC, based on the mapping conducted as part of this study.

**The current aquaculture VC is structured as follows:**

- **Inputs – Hatcheries: There are eight private and nine public hatcheries in Zambia that breed and raise fingerlings.** Of the private hatcheries, four operate in Lusaka, three in Copperbelt, and one in Southern

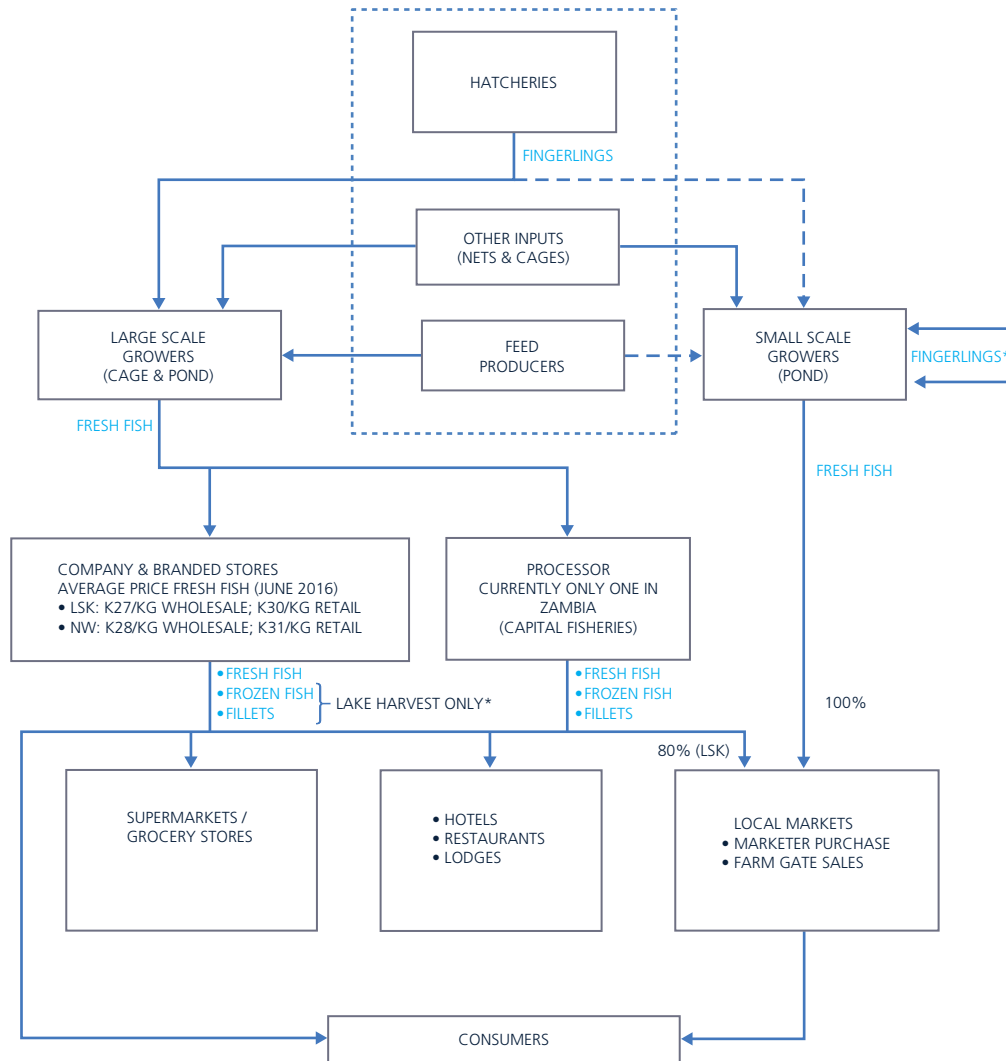


Photo: WorldFish Center

<sup>49</sup> Department of Fisheries [2016] 2015 Fisheries Statistics Annual Report.

<sup>50</sup> The Department of Fisheries reports that over 48,000 MT of fish were informally exported to DRC from June to November 2015 from capture fisheries.

Figure 16  
Zambia - Aquaculture Value Chain



**Note:** (1) Fish retained to reproduce in farmers' own ponds; some sell fingerlings to other SSFs; (2) Lake Harvest's processed fish is from Zimbabwe.  
**Source:** Global Development Solutions, LLC.

Province. No private hatchery exists in Northwestern Province, despite having the largest concentration of SSFs in the sector. Of the nine public hatcheries operated by the Ministry of Fisheries and Livestock, two have never been operational.<sup>51</sup> A new public facility in Solwezi (Northwestern Province) has been established with a capacity of two million fingerlings, but the lack of electricity, due to load shedding, and insufficient funding have reduced its ability to fulfill its capacity, having produced only 30,000 fingerlings midway through 2016. Due to the limited availability of fingerlings from public and private hatcheries, many farmers either produce their own fingerlings in-pond or purchase fingerlings from other SSFs who breed fingerlings in-pond.

- **Inputs – Feed producers: Zambia has six established fish feed producers with a cumulative annual production of about 30,000 MT.** An additional feed production is expected to be established in 2017 by

<sup>51</sup> The operational hatcheries are located in Copperbelt, Lusaka, Eastern, Northern, Luapula, and Northwestern provinces. The two non-operational hatcheries are located in Southern and Central provinces.



Yalelo, a commercial fish producer based in the Southern Province. While other feed mills produce a variety of animal feeds, the Yalelo plant will be dedicated solely to fish feed production.

- Farmers: The farms in Northwestern and Lusaka provinces, where the sector is concentrated, are largely small-scale operations.** The one exception is the LCF in Lusaka – Kafue Fisheries – with 130 ponds covering a total area of 97 ha. The average size of surveyed farms was 0.4 ha in Northwestern Province and approximately 0.3 ha in Lusaka, excluding the LCF. 47 percent of farms surveyed in Lusaka and 58 percent in Northwestern Province were larger than 0.1 ha. Farm profile data suggests that there is a near even split between formally registered and informal farms, with 54 percent of all survey participants being registered. The mean age of all farms surveyed across the provinces is 8.2 years, with 85 percent of the farms having been established within the last decade and reflecting the nascent status of the aquaculture sector. Table 7 provides a profile of surveyed farms across provinces.

**Table 7**  
Profile of aquaculture farms in the Jobs in Value Chains Survey

	<b>Lusaka (n=19)</b>	<b>Northwestern (n=24)</b>
Estimated total farms	320	2,915
Mean farm age (years)	8.6	7.9
Mean pond area (ha)	0.34	0.4
Percent registered	58%	54%
Farms with (some) female ownership	90%	96%
Of these, average percent female ownership	46.5%	46.5%
Percent of income from aquaculture	51%	59%
Capacity utilization	60%	49%
Permanent employees per hectare	5.7	7.4
Full-time equivalent employees per hectare	0.2	0.7
Sales per employee (USD (ZMW))	4,428 (44,275)	572 (5,715)

**Source:** Global Development Solutions, LLC; Department of Fisheries.

Other data from the survey include: (a) on average, 74 percent of SSFs’ sales or trades took place in domestic markets;<sup>52</sup> and (b) 71 percent of farmers reported retaining fish as seed, i.e., using fish to produce their own fingerlings on-farm. For these farmers, the average percentage of fish saved as seed<sup>53</sup> was 23 percent, which reduces SSFs’ income generating opportunity by U.S. Dollar (USD) 3,400 (ZMW 34,000) per hectare.<sup>54</sup> This is a symptom of the lack of available hatchery fingerlings.

- Processors: As of June 2016, Zambia had only one commercial processor: Capital Fisheries.** The company purchases fresh fish from Kafue Fisheries, Zimbabwe-based producer Lake Harvest, and imports frozen fish from China.<sup>55</sup> Local fish purchased by Capital Fisheries is processed and distributed throughout major cities in Zambia through the channels shown in Figure 17 below.

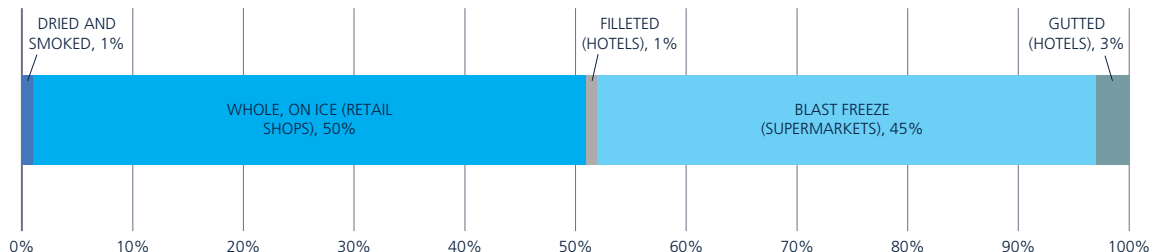
<sup>52</sup> Farm gate sales were not specified by the survey mechanism, but some farmers explained their sales channels to the data survey team. Farm gate sales comprise most of SSF sales for the farms surveyed. Percentages are not available since this was not part of the survey. Similarly, no percentages are available for the SSFs in Lusaka Province.

<sup>53</sup> Refers to fish retained as seed, i.e., used as breeding stock to produce fingerlings in the pond in both provinces, albeit to a lesser extent in Lusaka where there is relatively better access to fingerlings.

<sup>54</sup> Assumes stocking a pond at 60 percent of best practice recommendation, 10 percent mortality, harvest at 0.25 kg and selling price of USD2.2 [ZMW22]/kg.

<sup>55</sup> Capital Fisheries imports an average of 300 MT/month of frozen fish from China, or 400% more than it purchases locally for processing. For 400-gram fish, the landed price from China is approximately 10% lower than for local fish. For fish weighing 100 to 200 grams, the price per kilogram is the same for imported and local.

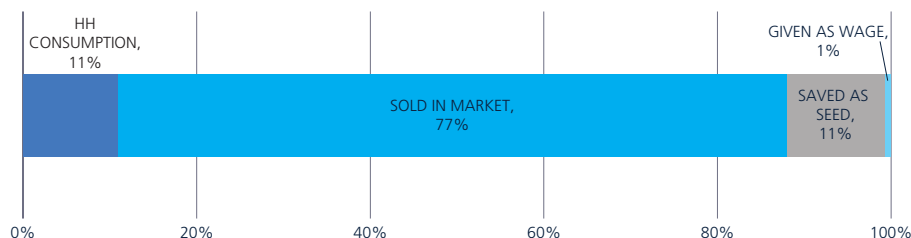
**Figure 17**  
Capital Fisheries' processing and distribution in Zambia



Source: Capital Fisheries, Ltd.

- Distribution: As noted with the poultry sector, SSFs and LCFs operate in parallel markets where SSFs sell in local markets and LCFs supply commercial outlets with value addition.** SSFs sell about 80 percent of their production to individual consumers or collectors on local markets (e.g., farm gate sales). Distribution is essentially limited to local markets, as shown in Figure 18, since they do not have access to continuous cold chains. Fish from large producers is distributed to major cities throughout the country in different forms, including frozen, fresh on ice, and, to a much lesser extent, filleted. There are no statistics quantifying the distribution of fish overall. However, as an example, Kafue Fisheries, which has aquaculture ponds in Lusaka Province, distributes 5–19 percent (5-23 MT) of its monthly output to the Copperbelt.

**Figure 18**  
Distribution of aquaculture harvest



Source: Global Development Solutions, LLC.

- Retailers: Large commercial companies have multiple retail outlets.** Most of the lead firms sell in company-branded stores (i.e., fish retailer stores carrying the name of the fishing company) to individual resellers, who resell on open markets or directly to people's homes, and to distributors, who sell directly to hotels and restaurants. Capital Fisheries, for instance, which procures approximately 50 MT of fish per month from Kafue Fisheries (Lusaka) and Yalelo (Siavonga/Lake Kariba), distributes throughout the country to supermarkets and to its own fish retail shops.<sup>56</sup>

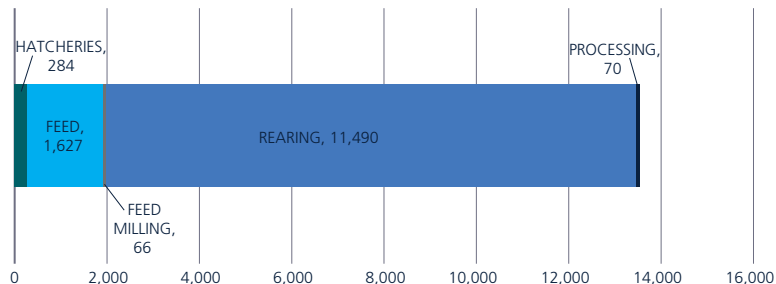
## JOB IN THE AQUACULTURE VALUE CHAIN

**Most jobs in the current VC are provided by small-scale farmers.** Based on survey responses and data from the Ministry of Fisheries and Livestock, Figure 19 estimates the jobs profile across Zambia's aquaculture VC. The estimation is approximately 13,000 jobs, which are primarily on-farm and among SSFs. Due to the relatively large number of small aquaculture farms and relatively lower efficiency (compared to the LCF), SSFs provide the bulk of the jobs. The estimations are based on feed conversion rates of 2.5 for SSFs and 1.6 for LCFs.<sup>57</sup>

<sup>56</sup> With the installation of a blast freezer, Yalelo plans direct distribution to Copperbelt in 2016.

<sup>57</sup> The Feed Conversion Ratio [FCR] is a major indicator of feed efficiency in fish farming. It refers to feed provided/animal weight gain. The estimations noted refer to the amount in kilograms of feed to produce 1 kilogram of fish.

**Figure 19**  
Estimated jobs profile across the aquaculture VC



Source: Adapted from the Ministry of Fisheries and Livestock.

**The vast majority of employment in the aquaculture VC is low-skilled.** The survey data indicate that over three quarters of employees on large- and small-scale farms, and about two thirds of employees in hatcheries and feed mills, are permanent low-skilled workers. Seasonal or temporary workers constitute less than 10 percent on large- and small-scale farms as well as at feed mills, yet over 20 percent in the hatcheries (Table 8). Further, survey respondents stated that 93 percent of the seasonal jobs (largely for harvesting fish) at the SSF level are of one month or less in duration. Given the size of the farms and nature of the work, the duration of seasonal jobs is more likely to be only a few days.

**Table 8**  
Distribution of jobs by type across aquaculture value chain nodes

	Estimated node share of total value chain jobs	Share of total jobs		Share of permanent	
		Permanent	Seasonal	High skill	Low skill
<b>Small scale farms</b> (n=43)	40.7%	91%	9%	7%	93%
<b>Large commercial farms</b> (n=1)	6.1%	95%	5%	19%	81%
<b>Collectors</b>	44.7%				
<b>Hatcheries</b> (n=3)	3.0%	78%	22%	21%	79%
<b>Processor</b> (n=1)	2.8%				
<b>Feed mills</b> (n=3)	2.7%	91%	9%	31%	69%
<b>Total</b>	100%	91%	9%	10%	90%

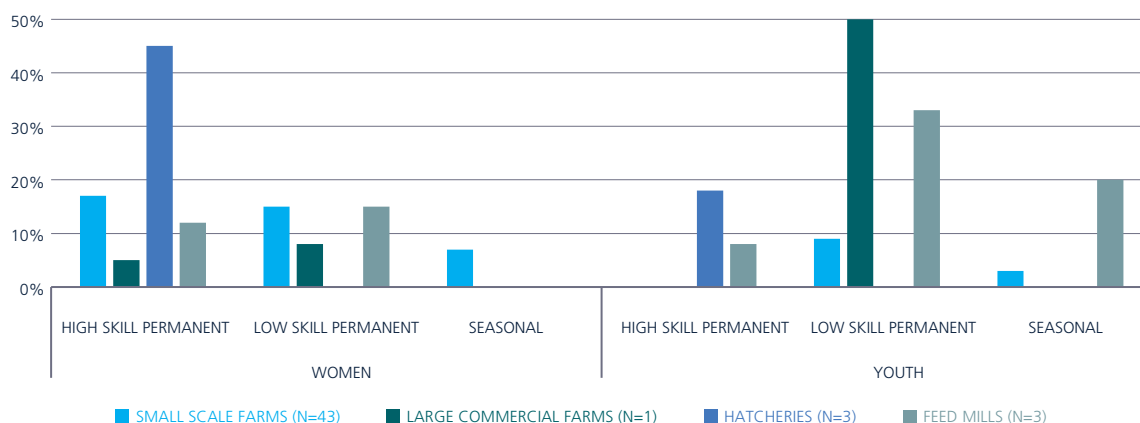
Note: No survey data was available for collectors and processors.  
Source: Global Development Solutions, LLC.

**Few women and youth are currently employed in the aquaculture VC.** Drawing upon survey data, Figure 20 breaks down the share of jobs by women and youth. Women comprise a relatively small part of the workforce in the VC, constituting around 8 percent of all employees. According to surveyed farmers, on-farm jobs require physical strength, and as a possible result, women rarely seek permanent employment on the farm. Youth are primarily employed on the one large-scale farm that participated in the survey and in feed mills. However, in absolute terms, there are few young Zambians engaged in the aquaculture VC since most jobs are located on SSFs.

## JOB GROWTH SCENARIOS IN THE AQUACULTURE VALUE CHAIN

**Expanding the Zambian aquaculture VC holds potential to promote job creation.** Due to the low-skilled nature of most jobs in the VC, there is particular potential to create employment for vulnerable groups, such as poor and young Zambians. Most employment will be created on SSFs. The following two scenarios lay

**Figure 20**  
Share of jobs in aquaculture among women and youth, by node and type



Source: Global Development Solutions, LLC.

out how growing domestic consumption and import substitution would affect job creation potential in the aquaculture VC.<sup>58</sup>

**Scenario 1: Natural population growth and increasing per capita consumption.** The first scenario assumes that the population continues to grow at the current rate of 3.1 percent in addition to a 25 percent increase in per capita consumption. Per capita consumption is likely to increase, since growing incomes will contribute to a shift in dietary patterns towards a greater share of animal proteins. Moreover, if efficiency improvements along the VC are passed on to consumers through lower prices, demand will increase further. Independent, semi-structured interviews with consumers indicated they would purchase more fish if it were more affordable. Data shows that from an average current weekly household purchase of 3.75 kilos, weekly household purchases would increase approximately 2.5 times if the price dropped by 10 percent. If Zambian producers manage to capture the additional demand, the VC could provide a total of over 22,000 jobs by 2022 (Figure 21). The lion's share of jobs will continue to be on farms, particularly on small farms. The feed sector, especially through the backward linkages to maize and soya farmers, provides the second largest source of jobs. It has to be noted that the estimated numbers are conservative since they are based on the assumption that the split between fish consumption from aquaculture and fish consumption from capture fisheries remains constant. However, since Zambian capture fisheries are at their limit, a shift towards greater consumption of fish from aquaculture seems likely.

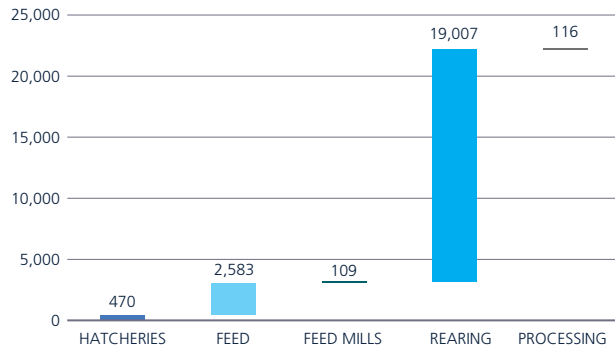
**Scenario 2: Substituting 30 percent of imports.** Currently, Zambia imports approximately 77,000 MT of fish each year.<sup>59</sup> By addressing the inefficiencies in the VC and improving competitiveness, domestic production could replace part of these imports. A 30 percent increase in self-sufficiency and additional domestic production of 23,000 MT could lead to around 13,000 additional jobs (Figure 22). 85 percent of these additional jobs would be on-farm. Since these jobs are primarily low-skilled, they provide ample room to employ young Zambians with little education.

**The feed sector is the second largest source for job creation, as in Scenario 1.** This is due to the backward linkages to farms growing soy and maize. Although maize is a smaller input for fish feed than soy (40 percent versus 55 percent), maize production creates more jobs than soy production. This is due to the larger share of smallholders: as noted in poultry analysis, 60 percent of maize is produced on small farms, whereas only 10 percent of soy is produced by smallholders. The lower productivity on SSFs then translates into a larger number of

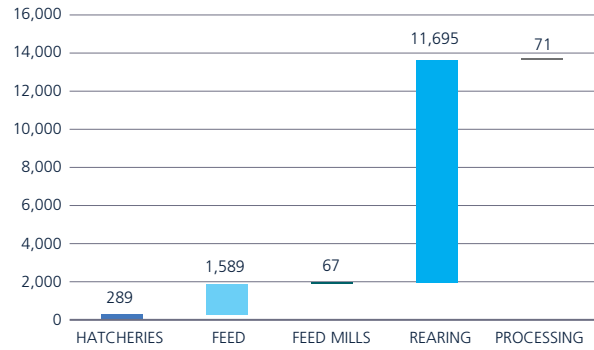
<sup>58</sup> For the purpose of simplicity, both scenarios assume full capacity utilization at baseline.

<sup>59</sup> Department of Fisheries. 2016. 2015 Fisheries Statistics Annual Report. Chilanga, Zambia: Ministry of Fisheries and Livestock.

**Figure 21**  
Scenario 1 – Total number of jobs by 2022



**Figure 22**  
Scenario 2 – Additional number of jobs



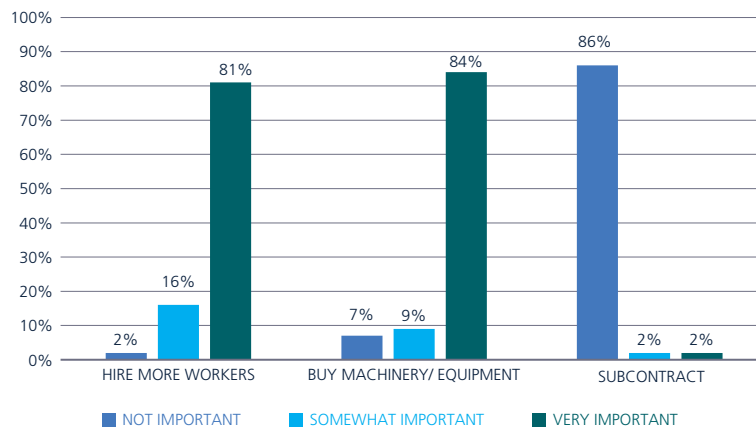
Source: Survey responses and data from the Ministry of Fisheries and Livestock.

jobs.<sup>60</sup> In the first scenario, the additional demand for fish feed creates approximately 1,500 jobs on maize and 1,000 jobs on soy farms. In the second scenario, roughly 900 and 600 additional jobs are created on maize and soy farms, respectively.

**The number of workers and amount of equipment available are strongly related to the ability to sustain growth.**

Figure 23 shows farmer perceptions from the survey data of the relevance of the number of workers, equipment, and subcontracts to the ability to respond to a significant growth in demand. Hiring more workers and investing in more equipment are both considered very important to growth by most farmers (about 81 percent and 84 percent, respectively), whereas subcontracts are not considered relevant in the sector. For each of the factors considered relevant, Figure 24 shows the percent increase that farmers believe would be necessary to double their current output in response to a doubling of demand. While machinery investment is considered very important in responding to increased demand, farmers anticipate a need for only one-third more new equipment. On the other hand, over 50 percent more high-skilled workers are anticipated to be needed to meet a doubling in demand, and the most significant factor deemed necessary for large growth is a 141 percent increase in low-skilled workers (that is, workers with little to no prior aquaculture experience or training) to tend the ponds.

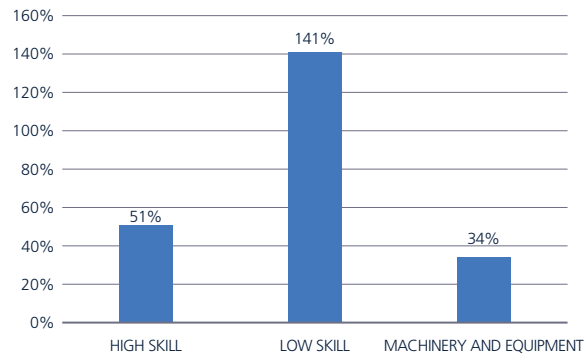
**Figure 23**  
Response to significant increase in demand



Source: Global Development Solutions, LLC.

<sup>60</sup> As in the poultry scenario, the yield for maize production on small farms is assumed to be 2.13 MT per hectare and 50 man-days are required to produce one hectare of maize. On large maize farms, the yield is assumed to be 9 MT per hectare and 30 man-days are required to produce one hectare of maize.

Figure 24  
Increase in input factors in response to doubling in demand



Source: Global Development Solutions, LLC.



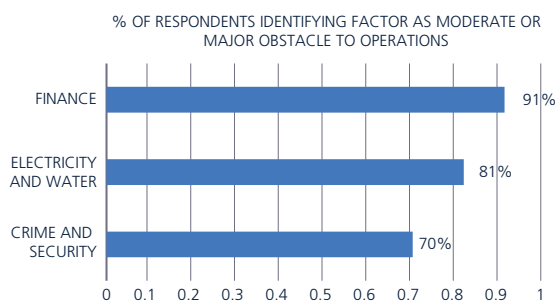
## CONSTRAINTS TO GROWTH AND JOBS

According to survey results, finance, electricity/water, and crime and security are the three main obstacles to current operations for SSFs in Lusaka and Northwestern Province (Figure 25). Insufficient access to affordable finance limits farmers' ability to purchase inputs and to invest in improved on-farm equipment. Electricity represents a challenge since load-shedding leads to long and sometimes unexpected outages that interfere with the operation of machinery. Lastly, crime was cited as a moderate obstacle to operations in terms of farm workers stealing fish.

**Small-scale farmers recognize the challenges in meeting the standards of larger and more institutionalized clients.** When asked for the main constraints to sales growth, SSFs noted the volume, quality, and delivery time requirements of such clients (Figure 26). The underlying issues are further elaborated below:

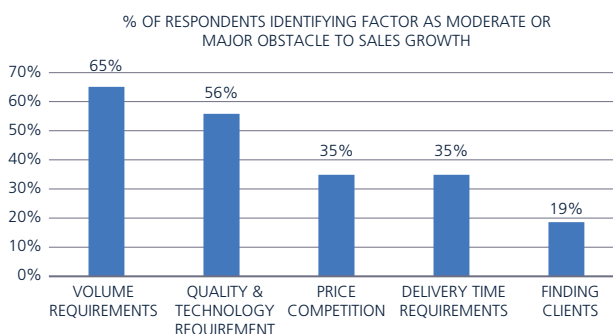
- Inability to meet volume requirements.** Canteen managers in mining operations located in Northwestern Province expressed openness to sourcing fish from local farmers, but cite inconsistent quality, inability to deliver minimum quantities, and smallholders' inability to freeze fish as reasons for preferring imported over local products. Limited access to critical inputs and poor on-farm management techniques are the main reasons for farmers' inability to meet the standards of larger off-takers. SSFs are often only able to purchase mixed sex fingerlings, which leads to in-pond breeding. Such breeding increases the number of fish in the pond, which means that the ratio of feed per fish drops, leading to undersized fish.<sup>61</sup>
- Inadequate use of production best practices for high quality.** Poor quality production can be attributed mainly to two issues: limited access to extension services and limited affordability and availability of inputs, especially fish feed and fingerlings. Nineteen percent of surveyed farmers in Lusaka and Northwestern Province had never received assistance from government agricultural services and 33 percent of farmers received assistance merely once per year. The poor access to training can translate into suboptimal stocking, feeding, and pond maintenance practices, which contributes to both higher mortality rates and lower quality. In addition, farmers have reacted to the increase in the cost of fish feed by reducing the number of fish reared, reducing the amount of feed, or by substituting high quality feed with alternative sources, such as manure, crop residues, and food scraps. This slows down the growth of the fish and lengthens the time to maturity. Since farmers are not always willing or able to wait, they harvest undersized fish, of lower quality. In addition, inadequate funding prevents public hatcheries from acquiring sex reversal hormones, a crucial input to producing single-sex fingerlings and maximizing harvest. SSFs also lack the capacity to operate pumps, temporarily store fish, and expand into processing through freezing without proper packaging and equipment.

Figure 25  
Perceived constraints to operations



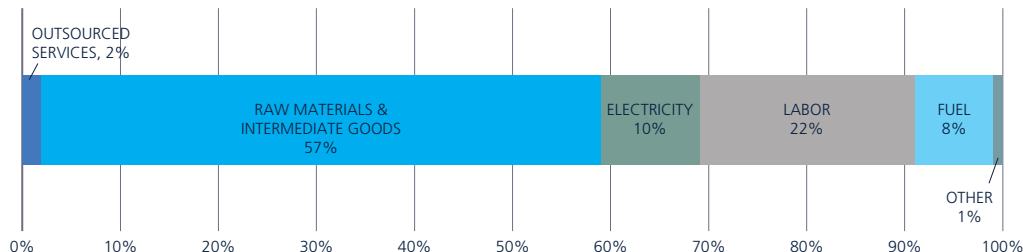
Source: Global Development Solutions, LLC

Figure 26  
Perceived constraints to sales growth



<sup>61</sup> Even if farmers were to adjust the feeding regime to an expanding population, they would not know the actual size of the fish population, which will result in an incorrect feeding regime and inconsistent fish size.

Figure 27  
Production costs for small-scale pond aquaculture



Source: Global Development Solutions, LLC.

- **Excessive delivery times without market infrastructure.** Rural SSFs face challenges, due to distance to markets, in terms of distribution without the required transport and logistics infrastructure. The Zambia Development Agency notes<sup>62</sup> that the long distances between catching and consumption areas means that 65 percent of production is dried, since farmers often lack cold storage and refrigerated trucks. Weak distributor networks are also a constraint for sourcing inputs. In all of Northwestern Province, there are only two stockists selling fish feed. With only one public hatchery in Northwestern Province, farmers can travel hundreds of kilometers for critical inputs, which results in high transaction costs per unit for SSFs who purchase small quantities.
- **Uncompetitive pricing.** An analysis of the VC's cost structure shows that input supply and production constitute the largest part of expenses across the aquaculture VC (Figure 27). With over 50 percent of total costs, input supply costs are prohibitive. A further breakdown of input costs reveals that raw materials, especially fingerlings and fish feed, are the main determinants of input costs.

**The importance of building up production to maximize capacity can significantly impact downstream activities in the VC.** In a large hatchery one employee can produce up to 1 to 1.5 million fry per year. One million fry, allowing a mortality of 50 percent over the whole rearing period and a harvest size of 400 grams, could then result in the production of 200 MT of fish. In other words, each hatchery employee can be at the origin of 200 MT of tilapia per year.<sup>63</sup> The per-worker potential for increased production could be 142 MT annually if fry were at the required commercial size, which would spur labor demand and present opportunities for additional new jobs.

## CONCLUSIONS AND THE WAY FORWARD

The aquaculture VC analysis highlights the potential to expand SSFs' income generation opportunities in the sector. Policies to unlock this job growth potential in the sector will need to focus on enabling more SSFs to participate in commercial markets through improved quantities and quality of production. Among smallholders, farmers that benefit from adequate resources, particularly inputs, can continue expansion in the industry if agricultural investment policies can facilitate the transition to medium-scale production. Measures to facilitate income generating opportunities for SSFs through market linkages will require overcoming the key issues below:

**Improving access to critical inputs.** Strengthening the supply chain for inputs, especially fingerlings and feed, can increase productivity and product quality. Quality issues in the fingerling VC can be addressed through greater funding for public hatcheries so that sex reversal hormones are more readily available, which would allow hatcheries to supply farmers with single-sex fingerling. Strengthening the distribution network can make inputs more available in rural areas, thus ensuring adoption of best practices. Stronger distribution channels can further lower operational costs, which is essential to support livelihood growth for the sector.

<sup>62</sup> Zambia Development Agency 2011.

<sup>63</sup> WorldFish Center 2014. *Analysis of market system underpinning the Fish VC in Zambia*. Aquaculture Development Association of Zambia presentation to National Assembly Committee on Agriculture, 26th January 2015.



**Investing in on-farm management and access to training.** Investing in models to improve training by non-government entities, in collaboration with MAL and the industry association, can support consistent profitability through productivity growth among SSFs. For instance, demonstration ponds in areas where SSFs are concentrated with support from input providers (feed mills, public and private hatcheries) can promote optimization of practices. Further, a public-private partnership between company-branded stores and MAL could leverage financial incentives in support of SSFs' adoption of best practices through a forward contract offering technical assistance.

**Increasing access to capital and market infrastructure.** SSFs could benefit from greater financial access through funding schemes, contingent upon participation in training programs focused on the use of quality fingerlings from formally registered hatcheries to ensure maximum yields at harvest. For collectors/traders, the need is for working capital to expand activities in rural areas that are challenging to reach. From a jobs view, the aim is to incentivize investments in quality inputs and collection activities to support greater production and marketing in line with rising demand where SSFs benefit. Similarly, working with input suppliers and leveraging farmer groups can lead to organized deliveries of the required raw materials that fulfill the needs of SSFs at a required scale that makes economic sense.

**Ultimately, increasing the productivity and competitiveness of smallholder agriculture requires the development of a supporting "ecosystem" of infrastructure, input suppliers and technical assistance.** The jobs agenda in the aquaculture sector will need to focus on enhancing smallholder productivity and improving product quality in order to enhance the quality of jobs for SSFs in the informal sector. It is uncertain in the current context if the aquaculture sector can deliver sustainable new jobs that would help lift Zambians out of poverty, even though there are food security outcomes, particularly in protein deficient areas. Rather, the jobs potential may be enhanced primarily through increasing linkages to commercial off-takers, where SSFs continue to benefit from demand growth for protein such as fish.





Photo: WorldFish Center

# ANNEX A. METHODOLOGY

The VC analysis was carried out through a combination of structured surveys, semi-structured interviews, and secondary research. The surveys piloted the 'Jobs in VCs' survey instrument and approach.<sup>64</sup> Structured surveys were administered to actors across all nodes of the VC, with the objective to be representative at each node as well as (in some nodes) between large and small firms (farms). The jobs estimation data requires a number of underlying assumptions that are elaborated on in Box A1 as illustrative of potential for growth in workers as the sectors develop.

## BOX A1: ESTIMATING EMPLOYMENT FROM SURVEY AND OTHER AVAILABLE DATA: APPROACH AND CHALLENGES

Estimations of employment in the poultry and aquaculture VCs presented in this report are derived through a three-step process:

1. **Calculating employment reported in the sample population:** Data on permanent and seasonal labor, categorized according to skill level, age, and sex, were collected, as were data on wages paid for different types of workers. These data were tabulated for each node in the VC.
2. **Adjusting reported employment data from the sample population:** As employment data were collected based on total activities of the firms / farms, the data were adjusted to reflect the percent of activity associated with poultry and aquaculture.
3. **Scaling-up to the overall population:** The final estimate for the sample population was then scaled up [or down, in the case of firms serving the national market, in order to reflect activity for the targeted provinces] to the general population based on weightings developed from the initial sample frame.

Source: Global Development Solutions, LLC.

The team faced a number of challenges while implementing the survey sampling strategy. In the case of these two subsectors, there are no comprehensive or validated lists of individuals<sup>65</sup> (farmers or laborers in agriculture/agribusiness) across the country. Existing industry associations in agriculture/agribusiness were unable to provide full lists by province. Conducting block sampling in order to ensure a representative sample across sectors proved infeasible due to the scope of this analysis. In the poultry sector, sampling of farmers was based on known "hot pockets" of farmers in collaboration with the Livestock Department and Poultry Association of Zambia. These are areas that tend to be clustered in farming blocks in the target provinces of Copperbelt and Lusaka. In aquaculture, a similar approach was taken with the Department of Fisheries extension services<sup>66</sup> and the ILO,<sup>67</sup> focusing primarily on Northwestern and Lusaka provinces.

The survey instruments were complemented by the following primary research:

- **Structured interviews.** Structured interviews were carried out with firms in peripheral nodes of the VC, particularly to test the implications of specific growth opportunities assessed in the VC.

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<sup>64</sup> Zambia is one of two country pilots for this tool. The first pilot was conducted in Lebanon in 2016.

<sup>65</sup> The most recent Department of Fisheries Statistical Report from 2014 estimates the number of farmers, but does not provide contact information. No registry data are yet available from the Aquaculture Development Association of Zambia (ADAZ) because it is a newly formed association.

<sup>66</sup> There is potential for sampling bias towards farms receiving extension services.

<sup>67</sup> ILO's recent YAPASA project conducted research on aquaculture development in Zambia, including aquaculture VCs [production of feed, fingerlings, and fish] in Northwestern Province.

- **Semi-structured interviews.** Semi-structured interviews were carried out with key informants across VCs both at the initial stage of the research and following completion of the structured surveys.
- **Focus groups.** Focus group discussions were held with stakeholders across the VCs on two occasions: in April, 2016 as part of the VC selection assessment; and in June, 2016 to present and discuss preliminary results from the survey.

Including use of the survey instruments and complementary semi-structured interviews, 220 data points were gathered in the poultry VC, and 119 in the aquaculture VC. Annex B provides the breakdown of the samples by VC node across sectors.



Photo: IM Swedish Development Partner

# ANNEX B. OVERVIEW OF POPULATION AND SURVEY SAMPLE BY VC NODE ACROSS SECTORS

**Table B1**

Summary of survey and respondents across the poultry value chain

Value chain node	Estimated population	Surveys completed	Interviews <sup>68</sup>	Comments
Feed producers	10	3	2	Overlap between poultry and aquaculture sector feed producers; Also interviewed Allied Industries Subcommittee.
Hatcheries	8	1	1	Refers to both broiler and layer hatcheries.
Processors	6	1	2	
Stockists (for feed & chicks)	N/A		5	N/A refers to the fact that the number of stockists is far too many for an estimate.
Point of lay producers	3	3 <sup>69</sup>		70% of the market is controlled by one producer.
Farmers <sup>70</sup>				No official statistics exist and conflicting estimates were provided. The Poultry Association of Zambia provided their best estimate of 12,000 for broiler farms, but no layer farm estimate was available from PAZ or any other stakeholder along the chain.
Layer farmers	140 <sup>70</sup>	66	N/A	Among layer farmers, the size breakdown is approximately 20% small scale and 80% emergent and large scale.
Broiler farmers	4,745 <sup>71</sup>	61	N/A	Among broiler farmers, the size breakdown is approximately 70% small scale and 30% emergent and large scale.
Collectors/Traders				
Broilers	N/A		10	
Eggs	N/A		10	
Formal retail sales outlets	N/A		10	
Sellers in open markets				
Broilers	N/A		10	
Eggs	N/A		10	

(continued on next page)

<sup>68</sup> Refers to the semi-structured interviews carried out as complementary primary research alongside the use of the Jobs in VCs survey tool.

<sup>69</sup> The sampling frame initially called for surveys of five farms that, with the assistance of industry stakeholders, had been identified as POL producers; however, during the survey process it was discovered that only three companies previously identified produced at a commercial level. All three of the existing commercial POL producers were therefore surveyed.

<sup>70</sup> The Poultry Association of Zambia notes that layer farms are classified by size, i.e., small, medium, large, commercial, corporate). Based on survey results, approximately 10% of farms keep more than 10,000 birds. By comparison to the broiler subsector, a 10,000 bird farm is considered medium scale. Large scale broiler farms are from 20,000–50,000 birds while 50,000–100,000 birds are classified as commercial farms and more than 100,000 are considered corporate farms (of which there are less than ten in the country).

<sup>71</sup> GDS estimates of total number of farms in the subsectors in the two target provinces of Copperbelt and Lusaka.

Table B1 (continued)

Summary of survey and respondents across the poultry value chain

Value chain node	Estimated population	Surveys completed	Interviews <sup>68</sup>	Comments
Egg exporters	N/A		5	
Consumers	N/A		20	
<b>SUBTOTAL</b>		135	85	
<b>TOTAL</b>	<b>220</b>			

Source: Global Development Solutions, LLC.

Table B2

Summary of survey and respondents across the aquaculture value chain

Value chain node	Estimated population	Surveys completed	Interviews	Comments
Feed producers	6	3	2	Overlap between poultry and aquaculture sector feed producers; Also interviewed Allied Industries Subcommittee.
Feed distribution points (retailers)	3		3	
Hatcheries	17	3		17 refers to the number of hatcheries across Zambia, including 8 private and 9 public.
Lead aquaculture firms	5	2	1	Defined as companies with own distribution network (branded retail store or consistent major grocery store distribution). All had offices in Lusaka, but only 1 had its aquaculture operation in the target area. This company has a large commercial farm which was surveyed. An additional large commercial farm outside of the target areas, which uses a cage aquaculture system (as opposed to pond aquaculture used by all other respondents) was also surveyed as a means of comparison and additional information gathering.
Aquaculture farms				
Northwestern	2,915	24		All small-scale farms; no large commercial farms exist in Northwestern Province.
Lusaka	320	20		All small scale; the one large commercial farm in Lusaka was surveyed (noted above).
Collectors/Traders	N/A		10	Additional open-ended interviews were conducted with open market retailers, company branded stores, supermarkets, and the Aquaculture Development Association of Zambia.
Fish retail outlets, formal storefronts	N/A		13	
Sellers in open air markets	N/A		5	
Processors/driers	N/A		5	
Restaurants	N/A		5	
Large mining operations	N/A		3	
Consumers	N/A		20	
<b>SUBTOTAL</b>		52	67	
<b>TOTAL</b>	<b>119</b>			

Source: Global Development Solutions, LLC.

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