Economic and marketing performance of chicken value chain actors in Ethiopia: challenges and business opportunities for sustainable livelihoods

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Acronyms and abbreviations

ACGG	African Chicken Genetic Gains
BMGF	Bill & Melinda Gates Foundation
CSA	Central statistical agency of Ethiopia
DOC	Day old chicks
ETB	Ethiopian birr
EU	European Union
FAO	Food and Agricultural Organization of United Nations
GFI	Gross farm income
GM	Gross margin
ILRI	International Livestock Research Institute
MRR	Marginal rate of return
NBE	National Bank of Ethiopia
NFI	Net farm income
PP	Producer price
PSh	Producers share
RP	Retail price
SCP	Structure-conduct-performance
SD	Standard deviation
TAIBs	Tropically adapted improved breeds
TFC	Total fixed cost
TFI	Total farm income

TGM	Traders' gross margin
TMu	Total mark-ups
TVC	Total variable cost

Executive summary

Poultry production has multiple roles in the livelihoods of rural and peri-urban households in Ethiopia. It provides high-quality protein, generates income and employment opportunities, and supplies manure that enhances crop and other livestock production activities. The sector has diverse economic and social contributions at the household, community and national levels. It is the source of livelihood for many different actors including input suppliers, marketing actors (aggregators/collectors, retailers and wholesalers) and processors. The poultry production sector in Ethiopia comprises backyard or smallholder production, small-scale commercial production and large-scale commercial production. Although it is mostly known for its low-input and low-output production system, backyard or smallholder poultry production is one of the main contributors to eggs and meat in the country. As a result, the country has been implementing a poultry development roadmap to enhance the production and productivity of the sector over the last few year (Shapiro et al. 2015). The focuses of the roadmap are transforming existing traditional smallholder poultry production to improved semi-scavenging production system and increasing specialised layer and broiler productions.

As part of these efforts, together with other national partners, ILRI has been implementing the ACGG project since 2014. The project tests and introduced high-producing and farmer-preferred locally adapted genotypes that increase smallholder chicken production and productivity in sub-Saharan Africa, more specifically in Ethiopia, Nigeria and Ethiopia. Project interventions included the on-farm and on-station testing of tropically adapted improved breeds (TAIBs) that help to enhance chicken production and productivity in the region. Results from the on-farm and on-station experiments demonstrate that some of the genotypes have higher egg and meat productivity under smallholder management conditions. Farmers prefer these breeds, and locally adapted genotypes have been distributed to smallholder producers through public-private partnership approaches. This partnership has involved mother units that can raise chicks for a certain number of days in an intensive management system. There is inadequate evidence however on the economic performance of adopting these introduced breeds under smallholder management conditions, mother units and other producers such as small-scale commercial producers and marketing actors along the value chain. In response to this, ILRI conducted a brief assessment to explore the economic feasibility and marketing performance of different value chain actors and examine the main challenges and opportunities in the sector.

This report presents the main findings of the assessment conducted in selected market sheds of the country. The assessment focused on smallholder chicken producers, mother units, small-scale commercial farms, traders and meat processors. We adopted multistage sampling techniques where we selected market sheds, chicken producing villages and sample respondents subsequently. The market sheds were selected purposively based on their chicken production and marketing potentials and the presence of different value chain actors in the area. Accordingly, we selected Addis Ababa, Wolaita and Bahir Dar as the three market sheds. We selected the locations based on their dual-purpose improved breed chicken adoption status as one of the main objectives of the assessment was to estimate the economic contribution of dual-purpose breed-based chicken production. Small-scale commercial producers and other marketing actors were selected based on their availability in each market shed. We interviewed a sample of smallholder producers, mother units, layers farms, broilers farms, aggregators, wholesalers, retailers and chicken meat processors in each market shed. Furthermore, as background information on the overall smallholder-chicken production and use in the country, we used 14-year time series secondary data collected by the Central Statistical Agency of Ethiopia (CSA).

Using structured questionnaires, we conducted face-to-face interviews to collect data from different actors. The data were collected by trained enumerators and researchers in the team. The questionnaires included sections on production, marketing, challenges and opportunities along the value chain. The data were entered into SPSS Statistics software and transferred to Stata software for data cleaning and analysis. We applied partial budget analysis and conventional benefit-cost analysis techniques to measure the economic performance of value chain actors. Moreover, we summarised the reported challenges and opportunities using proper descriptive statistics approaches.

This report first presents an overview of smallholder poultry production in the country. It then describes the findings on inputs use, outputs produced, economic performance, main challenges, and opportunities reported by a sample of smallholder producers, mother units and small-scale commercial layer and broiler farms. Next, it presents the performances and challenges of traders; an overview of the structure, conduct, performance of the market; chicken meat processing activities in the country; and identified business opportunities along the value chain. Finally, conclusions and policy recommendations are presented.

Evidence generated from CSA data shows that out of the total number of livestock holders in the country, the average proportion of poultry holders between 2005 and 2018 was 55% compared to cattle holders (79%) During this period, the average percentage of indigenous chicken breed holders was 95.2%, while the proportion of hybrid and exotic chicken breed holders was 3.2% and 1.7%, respectively. The overall average annual growth rates of indigenous, hybrid and exotic breed populations were 5.0%, 5.2% and 23.2%, respectively. The relative growth of exotic breed populations seems significantly higher than for other breeds. This could be associated with an increasing trend in research and extension effort in the years prior to the period of study. Among the different outflows, mortality accounts for the largest proportion of outflow during this period. In total outflows, the country lost 60.9% on average through mortality caused by disease, predatory attack and other factors. The average proportion of chicken mortality was more than 333.3% and 359.7% compared with the number of chickens consumed and sold, respectively. Only 19.9% of the total outflow was used for consumption, 18.4% for income generation and 0.8% for offerings. At the smallholder level, indigenous breeds continued to be the main source of eggs from 2006–18. On average, these breeds contributed 83.9% of the total eggs produced while hybrid and exotic breeds contributed 9.4% and 6.7%, respectively.

Data generated from the marketing assessment survey highlight additional insights into smallholder chicken production and marketing activities in the country. During this assessment, sample smallholder producers held both improved and local breed chickens. Of the total respondents, 43.0% kept local breeds while 92.0% had improved breeds. A higher proportion of improved breed holding is expected as the sample respondents were found in areas where dual-purpose improved breeds were recently introduced by ACGG and partner institutions. Producers used day-old chicks (DOCs), hens, cocks and pullets as foundation stock. Since the majority of our sample respondents kept dual-purpose breeds, they used 45-day old chicks as foundation flock. Most of the smallholder producers had provided supplementary feed (99%) and vaccination and/or disease treatment (79%) in the previous 12 months. Compared to producers who held local breeds, producers who held improved breeds spent more time managing their flocks, due to the better care required by improved breeds. Most producers had a separate house (85%) for chickens and used feeders (65%) and drinkers (69%).

On average, local hens produced 14 eggs per clutch for five clutches per year. For natural incubation, producers set aside 14 eggs on average for hatching per brooding cycle. The estimated average hatchability and survival rates were 79.3% and 63.3%, respectively. Smallholder producers used TAIBs to produce eggs and raise cockerels. The reported average number of eggs per hen produced by TAIBs was 248 eggs per year.

We applied partial budget analysis techniques to estimate the economic feasibility of adopting dual-purpose improved breeds at the smallholder level. We conducted the analysis based on the premises found from smallholder chicken producers and mother units. We considered two production scenarios based on Food and Agricultural Organization of United Nations (FAO) poultry production classifications: extensive scavenging and semi-intensive production systems. In both scenarios, we assumed live birds and eggs as the main outputs produced. We considered three main assumptions

in the analysis: change in breeds; change in flock size; and modest change in management or use of other inputs. Change in breeds refers to switching local breeds to TAIBs. Similarly, the change in flock size refers to using an average flock size of 50–75 improved breeds instead of the existing 5–50 average flock size kept by most smallholder producers under an extensive scavenging system.

The results of the partial budget analysis indicate that shifting from extensive scavenging to TAIBs based semi-intensive production systems generate substantial income gains for smallholder producers. In the 50 flock size scenarios, for example, smallholder producers generated an additional 23,500 Ethiopian Birr (ETB) in income gain in one production cycle (18 months). Furthermore, the estimated marginal rate of return (MRR) is 168.6%, suggesting that each ETB invested in TAIBs based production generates ETB1.7 in return. The estimated economic performance indicators clearly show that adopting TAIBs based production is economically and financially feasible under smallholder management conditions. The qualitative data generated from smallholder producers have confirmed the significant benefits of adopting these breeds. Smallholder producers generally believe that chicken production has enhanced their household income and food security significantly. However, multidimensional production and marketing constraints have been reported as the main hindrances to exploiting opportunities in the sector..

We have also documented the significant role of mother units in transforming an extensive scavenging system into a high-yielding TAIBs based production. Mother units raise DOCs for a certain number of days during the early growth stages when they are highly vulnerable to disease and predator attacks before selling to smallholder producers for eggs and live bird production. We estimated the economic performance of these farms using production and marketing data generated from the sample mother units. Two types of mother units were observed during this assessment: farms that raise chicks for 45 days, and farms that raise pullets for 90 days. Sampled 45-day chick farms raised an average of 1,349 chicks/batch for about five batches per year. Similarly, the 90-day pullet farms raised about 3,517 pullets per batch for about three batches a year. Both farms raise chicks following standard management protocols: using commercial feed, vaccination and improved housing facilities. In these farms, from total variable cost (TVCs), the cost of DOCs accounted for 70.0 and 51.8% % of the TVC in 45-day old chicks producer and 90-day pullet producer farms, respectively. Feed cost accounted for the second-largest expense in both farms. The 45-day chick mother units generated a 21.6% gross margin (GM) per annum with an average net farm income (NFI) of ETB81,100 per year. The GM and NFI generated by 90-day pullet farms were greater by far than 45-day chick mother units. Despite the existence of various challenges, both farms generate good economic and social benefits to the operators and the national economy. Based on the responses obtained from mother units, limited access to the market, inadequate DOC supply, disease prevalence, and limited access to health services are the main challenges in the sector.

We assessed the production and marketing activities of selected small-scale commercial layer farms in the three market sheds. The sampled commercial layer farms had an average of 1,490 layers during the survey period, with a minimum of 160 and a maximum of 5,000 layers. Layer farms kept hens for about 21.7 months with an average of 16.5 months of egg-laying duration. Feed accounted for 82.03% TVC, and these farms generated income from the sale of eggs, spent hens and manure. In one production cycle, the estimated average GM was 32.8% per layer, and the average NFI per layer was ETB461.1. Limited access to better markets and high feed costs are among the most important challenges reported by layer farms. Layer producers however have explained the availability of a good production environment and quick return for investors as the main opportunities in layer farm production.

We also assessed the economic feasibility of two types of specialist broiler farms: commercial line broilers and dual-purpose breed cockerels. The main differences between these two farms are the type of breeds, type of producers and production duration. Dual-purpose cockerels were raised by smallholder farmers under village management conditions, while commercial broilers were raised by commercial farms around urban centres. On average, while the commercial line broilers were ready for slaughter in 46 days, the dual-purpose breeds took 95 days. Commercial and dual-purpose breeds produced an average of four and three batches per year, respectively. In both farms, the cost of feed and DOCs accounted for the first and second-largest proportion of variable costs. Since dual-purpose cockerel producers use 45-

day chicks, their cost was higher than commercial line broiler producers. Broiler farms generated income from the sale of live birds and manure. Among those sampled, commercial broiler farms generated ETB403,670 per year on average while dual-purpose cockerel farms generated ETB23,880 per year. The average GM commercial broiler and dual-purpose breeds were about 39.4 and 31.6%, respectively, among the samples. Larger differences in estimated NFI could be associated with volume and frequency of production, access to better markets and other factors. Limited access to inputs, high disease incidence and limited access to the market are the main challenges reported by both farms.

Aggregators, wholesalers and retailers are the major marketing actors addressed in the present assessment. Aggregators usually collect live birds from smallholder producers and sell them to wholesalers or retailers in central markets. On average, they generated a 16.3% GM per bird. Bird mortality, limited transportation facilities, lack of proper marketplaces and fluctuating market demand are the main challenges reported by aggregators. Wholesalers and retailers buy live birds from smallholder producers, aggregators and small-scale commercial farmers. 82.4% of retailers and 88.9% of wholesalers reported smallholder producers as their source of live bird supply. Next to smallholder producers, aggregators were the main supplier of live birds for both wholesalers and retailers. Feed, shop rental, disease treatment and water were the main marketing costs reported for both traders. The overall average GM for both traders was 21.3%, with a minimum of 9.4% in the Bahir Dar market shed and a maximum of 30.3% in the Addis Ababa market shed. Live bird traders in Addis Ababa generated a higher profit margin than traders in the other two market sheds. Just as with live bird traders, egg wholesalers and retailers buy eggs from smallholder producers, small and large-scale commercial producers and aggregators. Wholesalers and retailers sell poultry products to individual consumers, restaurants, and institutional buyers. On average, egg traders generated 12.6% per crate (30 eggs) GM with a minimum of 8.2% in the Wolaita market shed and a maximum of 15.2% in Addis Ababa. Disease, mortality and limited marketing places and access to better markets are the main challenges reported by live bird traders. Similarly, egg traders raised egg breakage, price fluctuation, egg spoilage and other infrastructure-related factors as the main challenges.

Poultry processing is one of the most underdeveloped value chain activities in the country. This sector can be characterised by the existence of many small-scale and very few medium- and large-scale processing firms. According to sampled respondents, limited access to land, a shortage of parent stock, limited access to foreign currency or finance to import parent stock and processing equipment and limited government support are the main challenges in the sector. The marketing challenges reported by smallholder and commercial producers and the growing demand for poultry product consumption require efficient processing activities in the value chain. The sector therefore needs pragmatic policy interventions that enhance the performance of existing processing firms while removing entry barriers for new firms and slaughtering services. This may include improving access to land, capital, water and electricity, and introducing innovative processing technologies such as mobile processing units.

Our assessment indicates that the performance of existing poultry product marketing activities is inadequate. This could be explained by reported constraints such as high marketing costs, qualitative and quantitative loss of products, a higher level of price instability and seasonal product consumption. The inadequate performance of the market could be associated with challenges in the structure and conduct of the market. Constraints such as the availability of very few input suppliers, the limited number of wholesalers and retailers, diverse entry barriers in the small-scale commercial production sub-sector, the absence of better market infrastructure and transportation facilities, and limited sectoral coordination could all be considered indicators of the inadequacy of the market structure. The absence of a product grading and standardisation system, the limited bargaining power of smallholder producers, better coordination among traders than producers and consumers, and the overall weakness of vertical and horizontal coordination could explain the inadequacies in the market conduct.

Evidence generated by the value chain assessment suggests the presence of significant commercial opportunities that simultaneously enhance the overall performance of the value chain and create employment opportunities for women and young people. This may include small-scale local hatchery services, mother units, local feed mixing, poultry health service provisions, semi-intensive and small-scale commercial production, product collection and distribution and small-scale

processing and slaughtering services. To exploit these business opportunities, there is a need to develop an innovative and inclusive business model that integrates the above business services along the value chain.

In conclusion, the challenges reported by most smallholder and small-scale commercial producers, traders, and processors confirm the presence of systemwide production and marketing constraints that should be addressed by innovative policy options. Despite multiple challenges, the economic and social gains generated from the sector at different levels of the value chain prove the potential contribution of the sector to household livelihoods and food security in the country. Moreover, an increasing trend in poultry product demand can be an incentive to transform a low productivity sector into a high productivity one while creating significant business opportunities along the value chain. Based on the empirical data generated by different value chain actors, we would like to highlight the following lessons, policy options, and interventions that will enhance the economic and marketing performance of the sector and help to transform it for sustained livelihood outcomes.

- Despite its low productivity, smallholder chicken production remains the main source of eggs and meat in the country. A significant change in input use under the traditional extensive production system shows the willingness of smallholder producers to invest their limited resources in the sector. This is seen as a good opportunity to introduce innovative interventions that transform existing low-input and low-output based production into a more productive and economically viable semi-intensive production system. Innovative interventions may include introducing TAIBs that would simultaneously maximise the income generation and consumption goals of the country's resource-poor smallholder producers.
- Due to limited access to input and output markets in remote rural areas, using self-propagating improved breeds for sustainable smallholder production would have a bigger contribution than hatchery-based production systems. Therefore, besides hatchery-based development interventions, there is a need to develop self-propagating improved breeds in the future.
- The majority of smallholder and commercial producers and marketing actors identified poultry disease as the most important production and marketing constraint in the poultry value chain. Some of the producers have questioned the efficacy of vaccines and drugs in the market to current pathogen strains. Widespread concern posed by disease incidence highlights the overall economic, social and environmental importance of developing integrated disease prevention and control strategies along the value chain.
- Limited access to quality feed and high feed costs are among the main challenges reported by smallholder and commercial producers. This is worse in rural areas due to limited access to infrastructures and higher marketing costs. One potential solution is the introducing of innovative local feed mixers to produce quality feeds from locally available inputs. Increasing the production and productivity of strategic crops such as wheat, maize and soya bean, which constitute the bulk of poultry feed could be considered a vital strategy in transforming the sector.
- Market-related challenges reported widely by smallholder producers rather than commercial producers confirm the absence of a marketing system along the value chain that favours smallholder chicken production. This could suggest the need to integrate enhanced marketing interventions with production and productivity-related interventions. The economic gains from the adoption of improved technologies would be better realised under more conducive market opportunities for the products. Enhancing access to a better market should therefore be an integral part of production and productivity improvement interventions.
- Due to their limited access to terminal markets, inadequate access to market information, a smaller volume of production, and inadequate horizontal and vertical coordination smallholder producers are mostly price takers compared with commercial producers and are at a competitive disadvantage. This is likely to have a significant detrimental effect on the prospects of smallholder production if the commercial sector keeps on growing rapidly. Improving smallholders' access to better marketing opportunities and market information through value chain integration, and strengthening their collective actions need to be considered among the priority interventions.
- Higher marketing costs and entry barriers to poultry product marketing need to be addressed properly to protect urban consumers from higher prices and ensure the food security of urban communities. This could be achieved by improving road infrastructures, product storage and transport facilities, marketing places and facilities, and establishing better pricing and marketing systems.

- The significant economic and social gains generated by adopting TAIBs based production point to the potential contribution these breeds can play in the smallholder and small-scale commercial production system. Surplus eggs and live chicken production help smallholder producers to send children to school, cover medical expenses, purchase agricultural inputs and accumulate assets. This highlights the need to design innovative and sustainable dissemination strategies that integrate vital production and marketing activities.
- The economic gain analysis results show that the economic benefits of smallholder chicken production are highly dependent on flock size. This suggests identifying optimal flock sizes suitable for smallholder production that consider producer capacity, available inputs and market opportunities.
- The presence of multidimensional challenges under the smallholder chicken production system suggests the need for developing innovative business models that integrate both production and marketing interventions and create business opportunities for young and unemployed people. On the production aspect, serious consideration needs to be given to the following interventions: sustainable supply of foundation flocks; building farmers' financial and technical capacity; connecting farmers to financial institutions; organizing farmers for collective actions; introducing local feed mixers; and innovative community-based poultry health services with better access to vaccines and drugs.
- Similarly, the following interventions need to be considered in the marketing aspect: enforcing input (i.e. feed, vaccine, DOCs) quality standards; establishing poultry product collection and grading points and connecting collection points to traders and other institutional buyers; enhancing poultry product processing companies; introducing standardised slaughterhouses and services; improving marketing places and facilities; organizing traders and connecting them with financial and other institutions.
- The overall findings of this study demonstrate that enhancing the production and productivity of the poultry sector will contribute significantly to sustainable livelihood outcomes in rural and urban areas. However, policy interventions that aim to improve production and productivity need to create better economic and financial incentives for all value chain actors. This will be realized by establishing an efficient and effective input-output marketing system. Better marketing and pricing approaches need to be an integral part of agricultural interventions that aim to enhance production productivity in developing countries.

1 Introduction

The role of poultry production in the livelihoods of many rural and peri-urban households is documented in various empirical studies (Scanes 2007; Padhi 2016; Hänke and Barkmann 2017; Wong et al. 2017). It contributes to the food and nutritional security of households, generates income to support household livelihood activities, and produces manure to improve soil fertility. Beyond producers, poultry production has an enormous economic impact on different actors along the value chain such as input suppliers, processors and marketing actors that include aggregators or collectors, retailers and wholesalers.

Like most developing countries, the poultry production sector in Ethiopia could be categorised into backyard or smallholder production, small-scale commercial production and large-scale commercial production. Most poultry products however come from the traditional smallholder poultry production sector, which is mostly characterised as a low-input and low-output production system. When compared to many developed and some developing countries, the overall level of production and productivity in Ethiopia generally looks extremely low. Among other reasons, the low levels of production and productivity could be associated with the genetic potential of existing breeds, high disease prevalence, limited technical skills, limited access to inputs such as feed and vaccines, poor institutional and organisational support, and inadequate inclusive economic policy frameworks that support the sector.

Considering the vital role the sector plays in food security, poverty alleviation, and the overall wellbeing of women and resource-poor households, the government of Ethiopia has developed and implemented a poultry development roadmap over the past few years (Shapiro et al. 2015). The roadmap focuses on improving the productivity of smallholder producers and increasing small-scale commercial layer and broiler production. Research and development institutions need to align their activities to this plan and support the implementation of the roadmap. To this end, the ACGG project has been conducting integrated interventions that improve the production and productivity of smallholder chicken production in the country since 2014. Project interventions focused on the on-farm and on-station testing of TAIBs, introducing mother units, and facilitating the access and dissemination of selected TAIBs. The project has also provided technical support to different value chain actors, built the capacity of national and regional partners, nurtured community, and national poultry innovation platforms to co-create solutions with stakeholders and enhanced women's empowerment along the poultry value chain.

Indicators generated by the on-farm and on-station experiments demonstrate that introduced dual-purpose breeds contribute significantly to enhancing the production and productivity of smallholder chicken producers and expanding small-scale specialised commercial egg and chicken production. However, empirical evidence on the feasibility of adopting these breeds at the smallholder level and economic performance of mother units and small-scale commercial production is inadequate. Moreover, comprehensive and policy-relevant information on the marketing performance of the sector and existing challenges and opportunities along the value chain are insufficient. As a result, we conducted a brief assessment of different value chain actors to explore their economic performances and identify challenges and opportunities in the sector. The main aim of the assessment was to evaluate the cost and benefits of different actors and identify main production and marketing related constraints and opportunities along the chicken value chain. Moreover,

the assessment highlights the structure, conduct and performance of poultry product marketing, and suggests entry points for development interventions and value additions. The assessment focused on smallholder producers; mother units; small-scale commercial layer and broiler farms; traders such as aggregators, wholesalers and retailers; and processors.

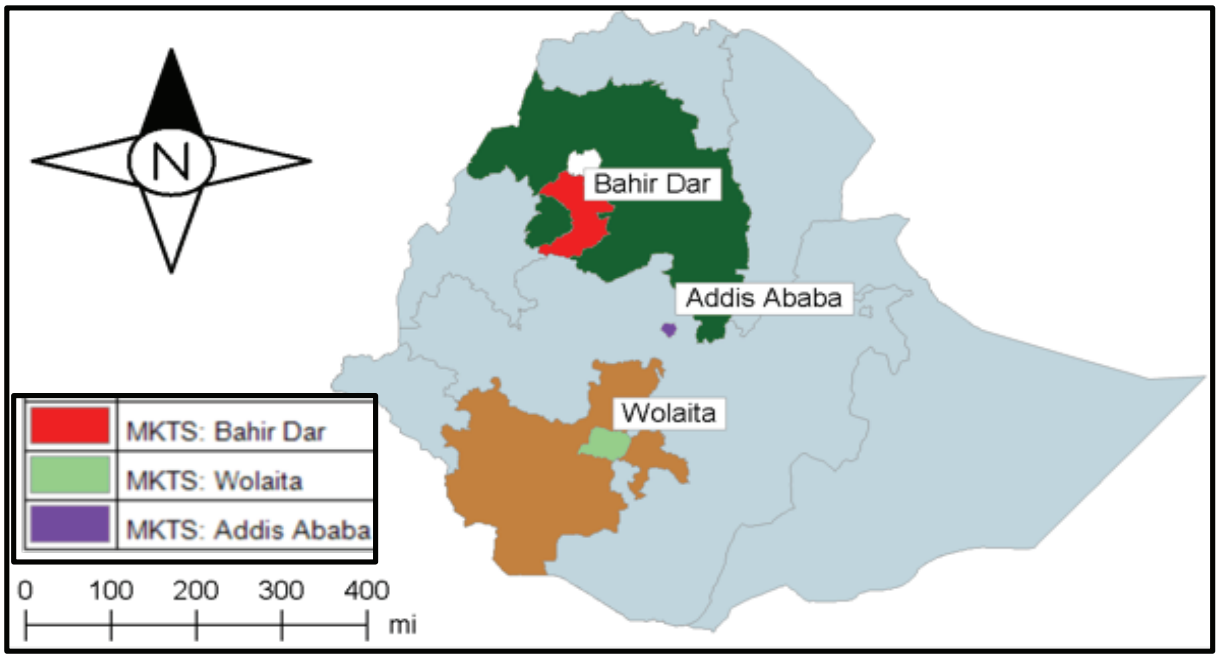
This report summarises the key findings of the assessment and outlines possible interventions that could help to enhance the production and marketing of poultry products in the country. The report is organized into 12 sections. After The introduction in section one, section two presents a summary of the methods and approach adopted. Section three summarises an overview of smallholder poultry production and consumption in the country. Section four summarises production and marketing activities, and the economic feasibility of smallholder chicken production in the sampled market sheds. Sections five, six, and seven present the production and marketing activities and economic performance of mother units, small-scale layer, and small-scale broiler farms, respectively. Section eight presents the economic performance, challenges, and opportunities of traders along the value chain. Section nine presents an overview of poultry meat processing and slaughtering services. Section ten summarises the structure, conduct, and performance of the poultry value chain. Section eleven discusses possible development interventions and business opportunities that could enhance the performance of the value chain and create employment opportunities. Finally, conclusion, main lessons learned, suggested research and development interventions and key policy recommendations are presented in section twelve.

2 Methodology

2.1 Sampling and sample sizes

The marketing assessment survey was conducted in 2019. Sample respondents were selected using multistage sampling techniques along the poultry value chain. In the first stage, three market sheds Addis Ababa, Wolaita and Bahir Dar were purposively selected based on the level of chicken production and availability of various production and marketing actors (Figure 1). From each market shed, different types of producers and marketing actors were then selected based on predefined selection criteria. For smallholder producers, two villages were selected based on the availability of recently introduced dual-purpose TAIBs adopters in the area. From each village, 15 chicken producers with more than ten chickens were selected randomly. The sample for smallholder producers deliberately excluded producers who had too few chickens to generate adequate input and output data for economic contribution analysis. For Addis Ababa market sheds, the two villages were selected from the Eastern Shewa and North Shewa zones. A total of 100 smallholder chicken producers were selected for face-to-face interviews. Similarly, in each market shed about five mother unit farms, small-scale commercial layers and small-scale commercial broiler farms were randomly selected based on their availability. Likewise, about three poultry product marketing places were selected in each market shed, and 5–10 marketing actors such as wholesalers, retailers, and aggregators were selected in each marketing place based on their accessibility. We interviewed 32 live bird traders (aggregators, wholesalers and retailers) and 23 egg traders (wholesalers and retailers) on poultry products marketing. Due to their limited number in the country, we attended four commercial processors to generate evidence on the current status of poultry processing activities in the sampled market shed.

Figure 1: Market sheds sampled for the assessment



2.2 Data management and analysis

The data were collected using a semi-structured paper-based questionnaire during a face-to-face interview. After coding, the data were entered into SPSS and transferred to Stata for cleaning, data generation and analysis. We summarised the data using descriptive statistics and different benefit-cost analysis techniques such as partial budget analysis and conventional benefit-cost analysis approaches.

Partial budget analysis was conducted to estimate the net gain in income from shifting existing indigenous breed-based extensive scavenging production to TAIBs based semi-intensive production system. The partial budget analysis comprises the following four main sections: added income, reduced income, added cost and reduced cost. Added income refers to the income generated from a semi-intensive based production system. The reduced cost is the sum of the costs forgone due to a shift in production or costs associated with extensive scavenging production. Reduced income refers to the income given up due to changes in the production system or income from extensive scavenging. The added cost is the cost associated with the semi-intensive production system. While the sum of added income and reduced cost give the total gain, the sum of reduced income and added cost gives us the total loss. The difference between total gain and total loss gives us the Net Gain (NG) in income.

$$TG = ADIN + RDCO \quad \ldots\ldots 1$$

$$TL = RDIN + ADCO \quad \ldots\ldots 2$$

$$NG = TG - TL \quad \ldots\ldots 3$$

Where TG =total gain; ADIN = added income; RDCO = reduced cost; TL = total loss; RDIN = reduced income; ADCO = added cost; NG = net gain.

For commercial farms (mother unit, broiler and layer farms), we applied a conventional benefit-cost analysis. For these farms we generated gross farm income (GFI), GM and NFI as economic performance indicators. We estimated the indicators using the following formula:

$$GFI = TFI - TVC \quad \ldots\ldots 4$$

$$GM\ (\%) = \frac{TFI - TVC}{TFI}\ X\ 100 \quad \ldots\ldots 5$$

$$NFI = TFI - TC(TVC + TFC) \quad \ldots\ldots 6$$

Where TFI = total farm income, TVC = total variable cost, TFC = total fixed cost. For traders we estimated producers share (PSh), TGM and total mark ups (TMu) to assess the marketing performance and explore existing variability among sample market sheds.

$$PSh\ (\%) = \frac{PP}{RP}\ X100 \quad \ldots\ldots 7$$

$$TGM\ (\%) = \frac{RP - PP}{RP}\ X100 \quad \ldots\ldots 8$$

$$TMu\ (\%) = \frac{RP - PP}{PP}\ X\ 100 \quad \ldots\ldots 9$$

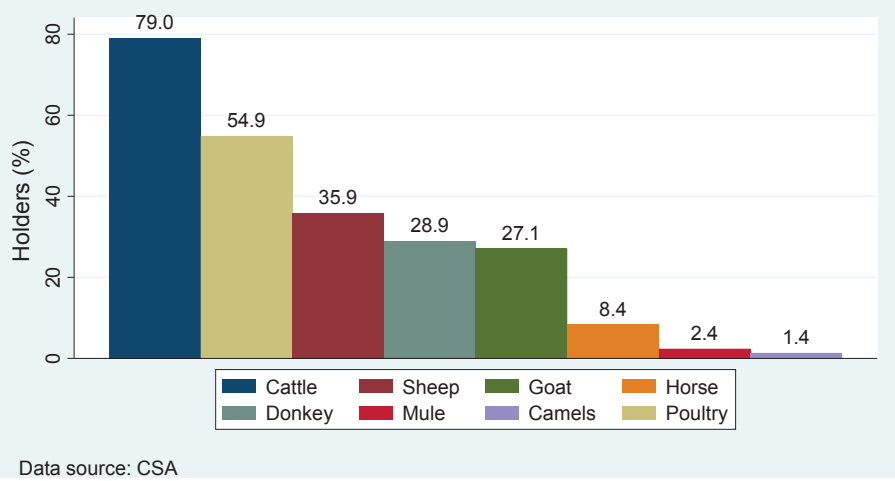
Where PP = produce price, RP = retail price, TGM = traders' gross margin.

3 Overview of smallholder poultry production in Ethiopia

3.1 Smallholder poultry holdings

Agriculture plays a significant role in the economic and social development of Ethiopia. From 2013 to 2018 it contributed 34.9–42.0% of the total gross domestic product of the country (NBE 2018). Next to crop farming, livestock farming was the second most important agricultural sector during the same period, contributing 20.3–27.0% of the agricultural output. In the livestock sector, poultry production plays a significant role in the livelihood of rural and resource-poor households. The poultry sector can be categorised as smallholder or village poultry production, small-scale commercial poultry production and medium and large-scale commercial poultry production. The smallholder/village poultry production system comprises the largest proportion of the sector. For instance, poultry is the second-largest livestock group owned by most of the smallholder livestock keepers in the country (Figure 2). From 2005 to 2018, the average proportion of smallholder poultry keepers from total livestock holders was about 55%, next to cattle keepers at 79%. This shows the significant contribution the sector makes to the livelihood of most smallholder farmers in the country. Furthermore, compared to other livestock types, poultry is owned by resource-poor households, women and children. This shows the potential contributions of the sector in poverty alleviation and the reduction of social and economic inequalities in the rural and agricultural sector.

Figure 2: Proportion of livestock holders from total livestock keepers (2005–18)



Under the smallholder poultry production system, producers keep indigenous, hybrid and exotic breeds. From 2005–18, indigenous breeds represented on average 95.2% of the total population, while hybrid and exotic chickens accounted for 3.2% and 1.7%, respectively (Figure 3). This shows that indigenous breeds were the main source of eggs and meat. The proportion of exotic and hybrid breeds seemed increasing after 2014.

From 2005–2018, the overall average annual growth of the chicken population was 5.00%. On average indigenous, hybrid, and exotic breeds grew by 5.00, 5.23 and 24.40%, respectively. Compared to indigenous and hybrid breeds, the average annual growth rate for exotic breeds from 2015–18 was significantly larger (Figure 4). Furthermore, the trend of exotic breed growth appears dynamic, with a high level of fluctuation. This could be associated with challenges in the multiplication and distribution of these breeds and the lower survival rate of the breeds under smallholder management conditions.

Figure 3: Proportion of chicken breeds held by smallholder producers (2005–18)

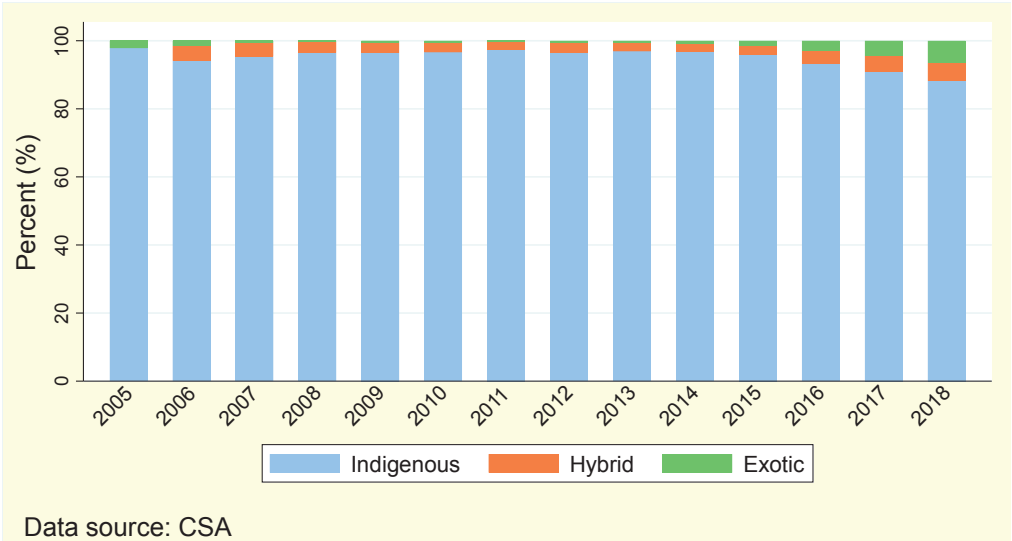
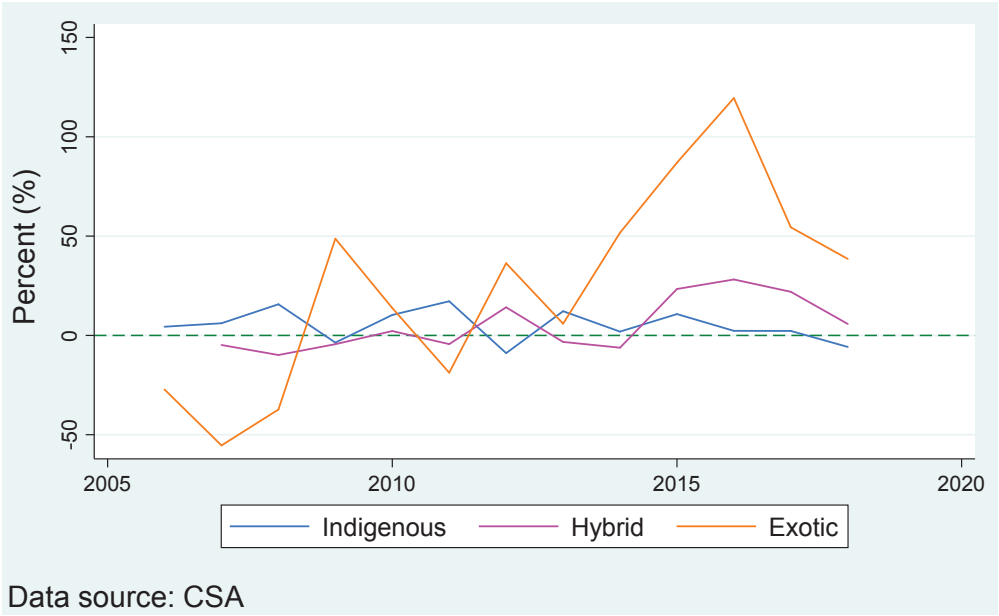


Figure 4: Average annual growth rate of chicken populations by breed (2005–18)

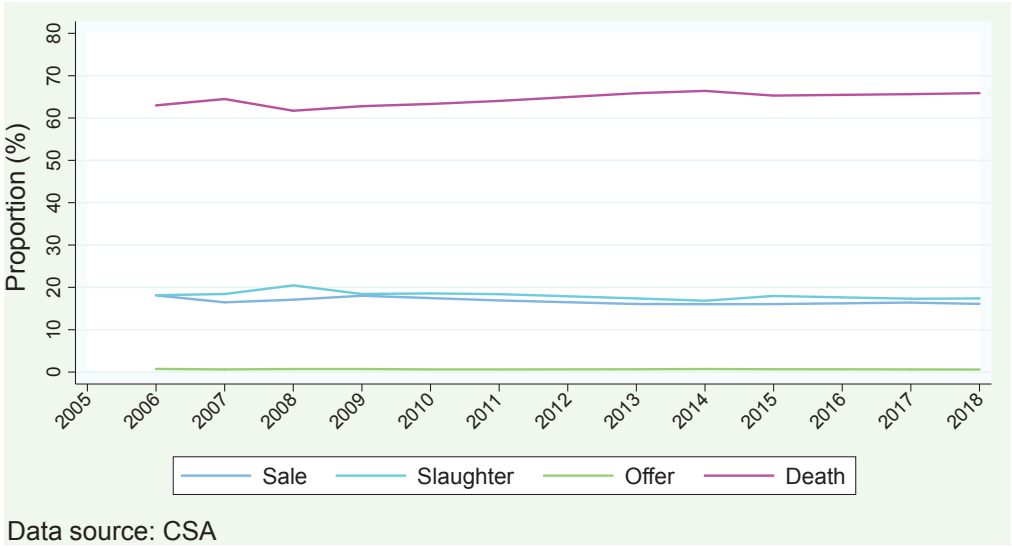


3.2 Flock dynamics: average annual outflow

A summary of chicken outflow indicators shows that sale, slaughter, mortality and offerings are the four types of chicken outflows in Ethiopia (Figure 5). Among these, mortality accounts for the largest proportion over the past 14 years (2005–18). From the total outflows, 60.85% on average was lost through mortality due to disease and other factors such as predator attacks and accidents. During this period, 43.5 million chickens were lost on average each year due to mortality.

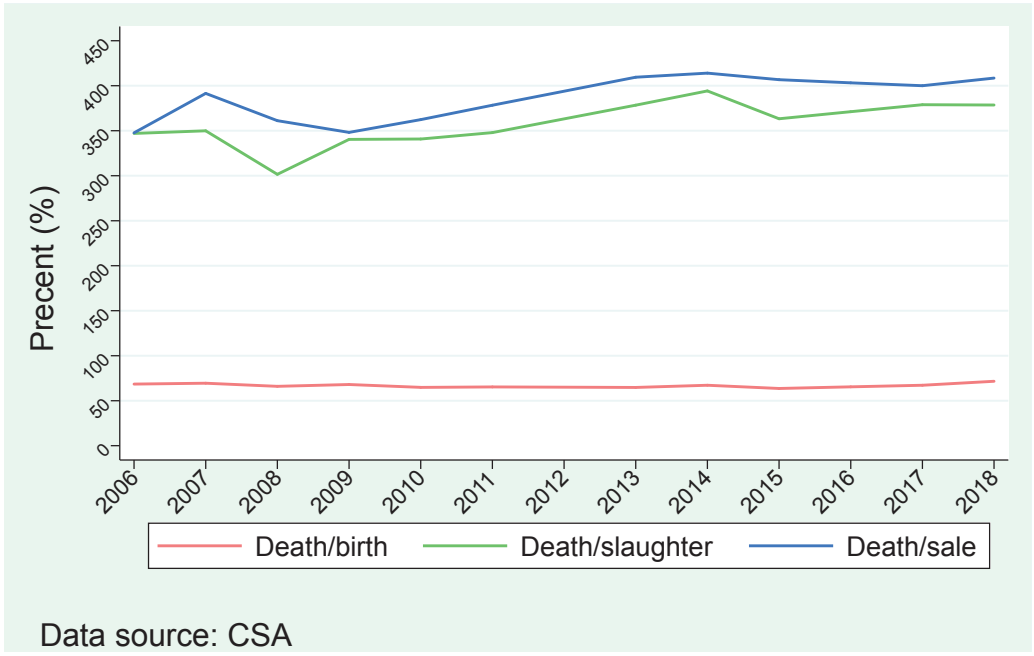
This is a significant loss of resources that would have had economic, social and environmental consequences. The loss would have affected the overall supply of chickens for consumption and income generation. The proportion of outflow through slaughter, sale and offering accounts 19.9, 18.4, 0.8%, respectively. The limited variability in the proportion of outflows over 14 years is one of the interesting observations drawn from this data and will have significant policy implications in the sector.

Figure 5: Major chicken outflow types and estimated proportion of outflows



During this period, the average proportion of chicken mortality was over 333.3% of slaughtered birds and 359.7% of sold birds (Figure 6). Similarly, the average proportion of mortality to birth was about 62.3%. Both the proportion of mortality to slaughter and mortality to sale seems to have an increasing trend. The persistent and higher percentage of outflow through mortality suggests the need for integrated interventions that could address different causes of mortality such as disease and predator attacks to increase smallholder income and food security without significant added investment. This shows the key role of the prevention of disease and other causes of mortality in enhancing the production and productivity of the sector. Empirical studies have documented the significant positive economic impacts of vaccination and poultry housing by reducing mortality and improving productivity (Bessell et al. 2020).

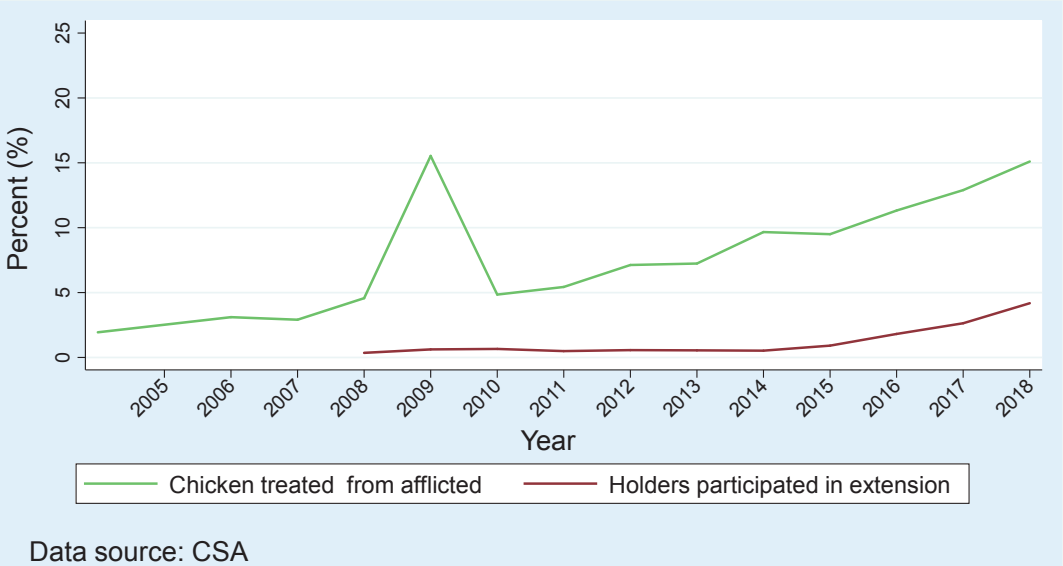
Figure 6: Relative proportion of mortality to birth and other outflow types



3.3 Poultry development packages

The low productivity of smallholder chicken production could be attributed to various management-related factors such as the limited use of inputs and limited access to extension services and development packages. The higher reported chicken outflow due to disease from 2005–2018 could be attributed to farmers' limited access to vaccination and treatment. During this period, the average annual proportion of sick chickens treated was about 8%, with a minimum of 1.94% and a maximum of 15% (Figure 7). This shows that veterinary services provided at a smallholder producers level were very limited. There was, however, an increasing trend during this period which is a good indicator of the presence of efforts to enhance the sector's health services. Similarly, the average proportion of poultry holders who participated in development packages was about 1.2%, with a minimum of 0.3% and a maximum of 4.2%, showing an increasing trend after 2015. It is possible to deduce from both indicators that national level interventions that aim to enhance poultry health services have been extremely limited.

Figure 7: Proportions of holders participated in poultry extension (2005–18)



3.4 Egg production and productivity

Understanding the productivity of chickens kept by smallholder farmers helps to design important policy options that allow the future transformation of the sector. From 2006 to 2018, the average number of eggs produced each year by local, hybrid and exotic breeds was 48, 162 and 107 per hen, respectively (Table 1). Local breed hens laid on average 12 eggs per cutch over an average of four clutches per year. This shows that the productivity of local hens has remained extremely low over the past few decades. The productivity of hybrid and exotic hens was significantly higher than local hens, and the productivity of hybrid hens even higher than exotic. The higher productivity of hybrids over exotic breeds could be associated with better adaptability and management conditions at the smallholder level.

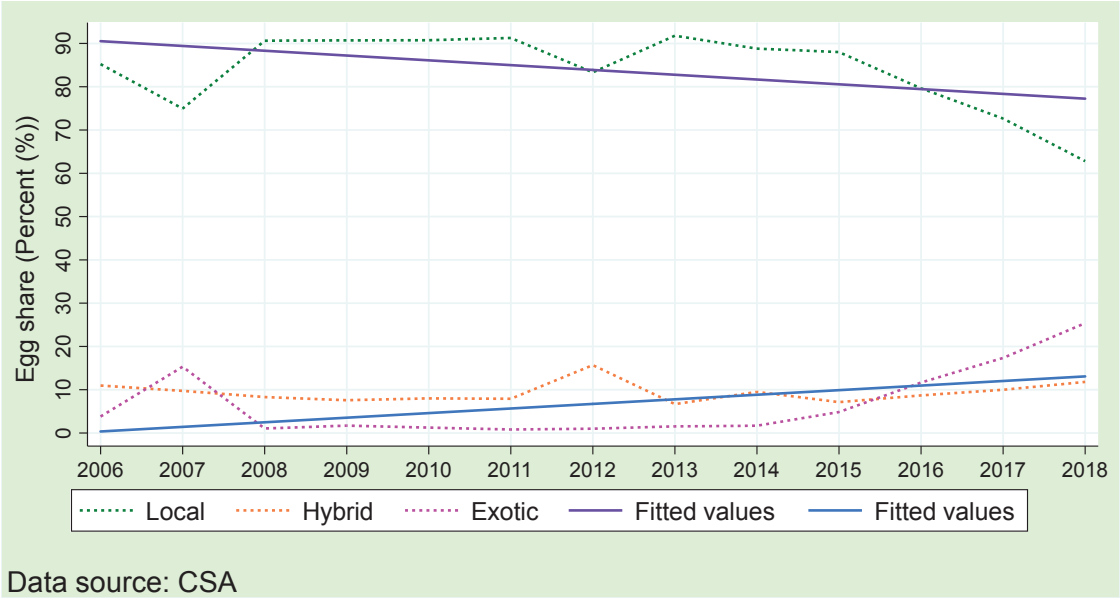
Despite their low productivity, local chickens have been the main contributor to egg production in the country. Figure 8 presents a summary of the proportion of annual eggs contributed by the three types of breed kept by smallholder producers. During the period of study, indigenous breeds remained the largest contributor to total egg production from smallholder producers in the country. Hybrid and exotic breeds contributed the smallest proportion of total eggs produced. On average, indigenous breeds contributed 83.9%, while hybrid and exotic breeds contributed 9.4% and 6.7% of the total eggs produced, respectively. Unlike the proportion of eggs from exotic breeds, there was a decreasing trend in the proportion of eggs from indigenous breeds. This could be associated with an increasing trend in the overall population of exotic breeds adopted at the smallholder level (Figure 4).

Table 1: Number of eggs produced by different breeds (2006–18)

Type of breed Clutches/year		Indicators		
		Egg/clutch	Egg/year	
Local	Mean	4.0	12.0	48.0
	SD	0.0	0.0	0.0
	Min	4.0	12.0	48.0
	Max	4.0	12.0	48.0
Hybrid	Mean	5.2	31.3	161.5
	SD	0.7	5.2	34.7
	Min	4.0	25.0	125.0
	Max	6.0	41.0	246.0
Exotic	Mean			106.8
	SD			26.1
	Min			65.0
	Max			146.0

SD= standard deviation

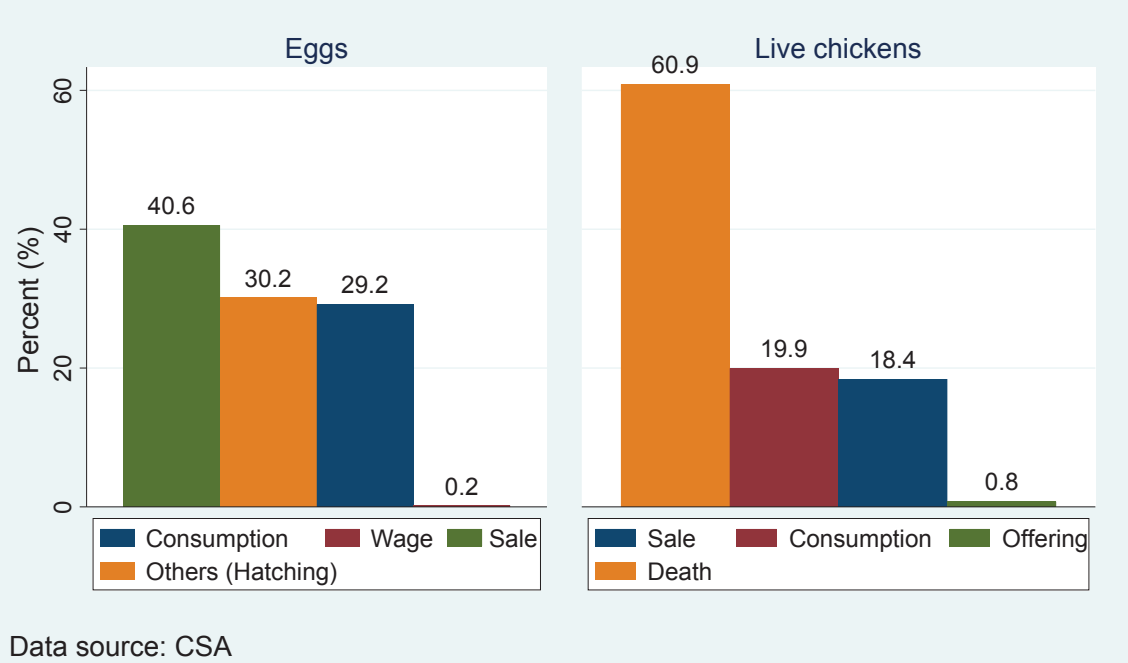
Figure 8: Proportion of eggs produced from different breeds (2006–18)



3.5 Poultry product use at smallholder level

Smallholder farmers use poultry products for home consumption and income generation to support other livelihood activities. A summary of poultry product use indicates that smallholder producers used live birds for home consumption, income generation and offerings (Figure 9). From the total outflows, about 19.9, 18.4, and 0.8% were used for home consumption, income generation and offerings, respectively. As indicated above, about 60.9% of the total outflow was accounted for mortality. Similarly, smallholder farmers used eggs for income generation, hatching, consumption and wage payment. The largest proportion of eggs was used for income generation (40.6%), followed by hatching (30.2%). The proportion of eggs used for consumption was 29.2%. A lower proportion of eggs used for consumption and higher proportion for income generation may indicate a greater interest by households in income generation from production that may be associated with limited nutritional knowledge and other socio-economic and cultural factors.

Figure 9: Average proportion of egg and live chicken users (2009–18)



The average number of eggs and live birds consumed by smallholders looks very low. On average, smallholder producers used twelve eggs and three live birds (Table 2) in a year. The average number of eggs and live birds used for home consumption was about four and two, respectively. Generally, the number of eggs and live birds used by households looks very low. As shown above, this could be associated with a lower level of productivity in existing breeds and a higher number of mortalities experienced by households.

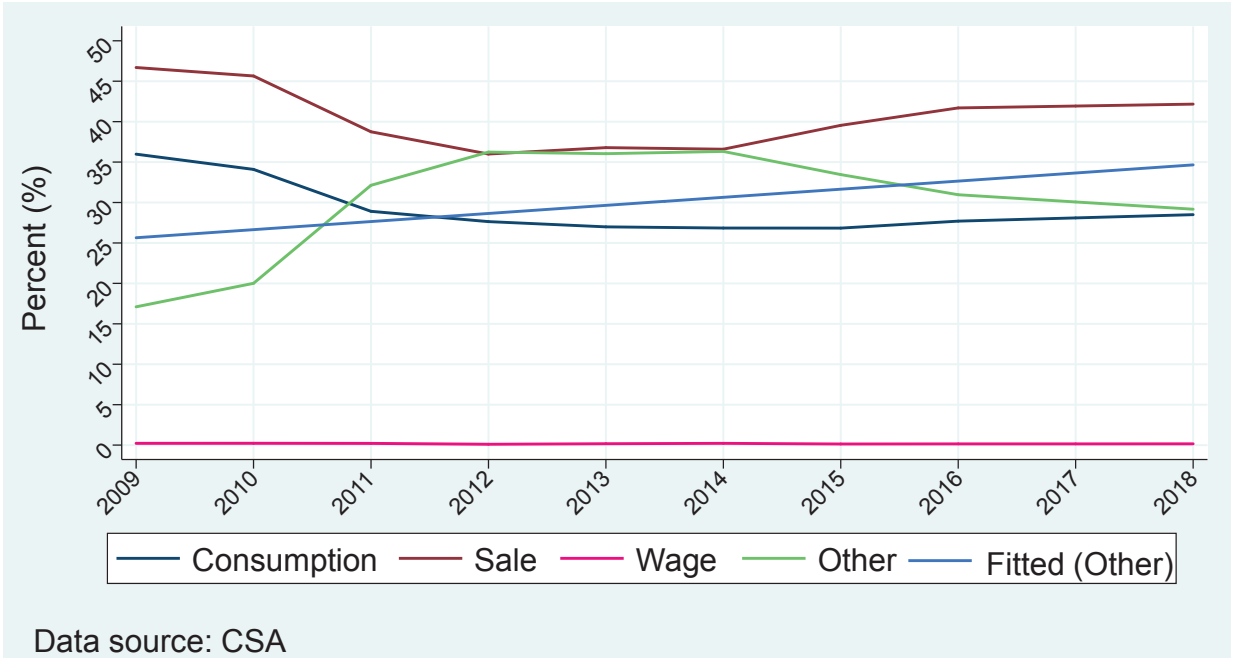
Table 2: Number of eggs and live birds consumed by smallholders

Type of product	Type of use/year	Average number/holder**			
		Mean	SD	Min	Max
Eggs	Egg used/holder	11.52	0.98	10.45	13.88
	Consumption/holder	3.36	0.42	2.81	3.96
	Sale/holder	4.68	0.64	3.82	5.85
	Wage/holder	0.02	0.00	0.01	0.03
	Other/holder	3.47	0.77	1.87	4.19
Live birds	Live birds used/holder	3.02	0.19	2.78	3.37
	Sale/holder	1.42	0.09	1.31	1.59
	Slaughter/holder	1.54	0.10	1.41	1.72
	Offering/holder	0.06	0.01	0.05	0.07

**Average annual number of holders 7,916,701

Figure 10 shows the trend in egg use by smallholders from 2009–18. While the proportion of eggs used for consumption looks stable, the proportion used for sale and hatching are inversely related. This may reflect the decision taken by farmers to prioritise income generation. Production could have an inverse relation at the smallholder level, which could be associated with a low level of production and productivity.

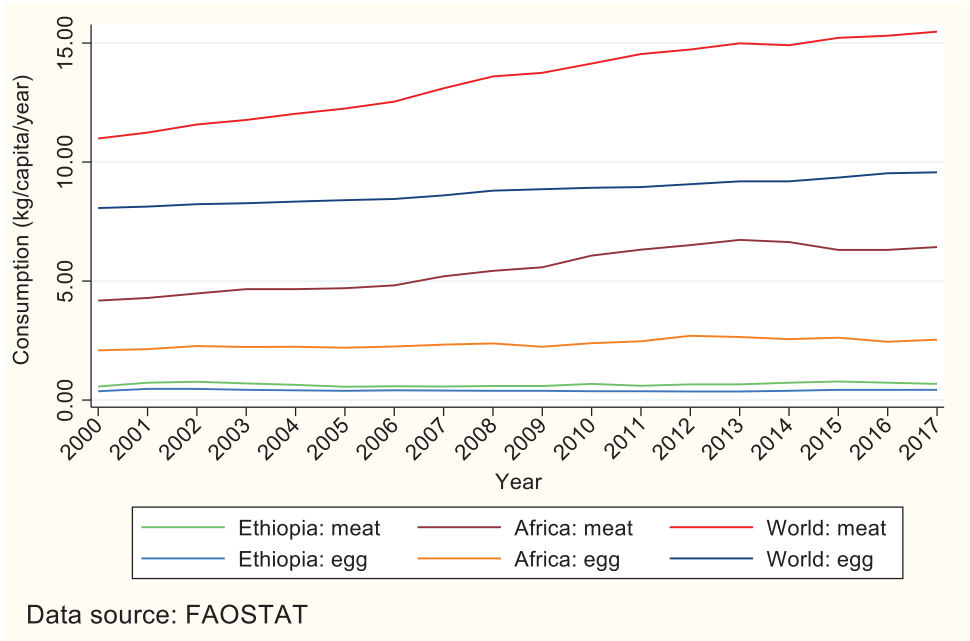
Figure 10: Trends in proportion of egg use by smallholders (2009–18)



3.6 Poultry product consumption trends in Ethiopia

Poultry product consumption at a national level appears exceptionally low. From 2000 to 2017, average poultry meat consumption was 0.66 kg/capita per year, while regional and global consumption was about 5.52 and 13.45 kg/capita per year, respectively (Figure 11). This shows that the consumption level in the country is significantly lower than the regional and global average consumption. Similarly, the level of egg consumption was significantly lower than global and regional consumption levels. In Ethiopia, average egg consumption was 0.4 kg/capita per year. Average regional and global consumption was 2.38 and 8.77 kg/capita per year. Contrary to increasing regional and global trends, meat consumption was stable in Ethiopia during this period.

Figure 11: Average national poultry product consumption in Ethiopia (2000–17)



Lower levels of egg and poultry meat consumption could be associated with various factors including lower levels of production and productivity, household economic status, household food consumption patterns and other religious and cultural factors. Lower level production and productivity could however be considered the main factors. As shown above, the poultry production sector is dominated by a traditional smallholder production system based on subsistence production and has an inadequate surplus for the urban population. Improving persistently lower levels of consumption requires sectoral transformation through strategies that address constraints along the poultry value chains.

4 Economic performance of smallholder chicken production

4.1 Type and number of chicken holdings

From the three selected market sheds, we conducted face to face interviews with 100 smallholder chicken producers about production and marketing activities. From these respondents, 84.7 and 14.3% were male and female-headed households, respectively. The average number of chickens held by sample respondents was 36, with a minimum of 3 and a maximum of 589 chickens (Table 3). On average, producers had 14 local and 33 improved breed chickens. During the assessment, the proportion of sample respondents with local breeds was 43%, while the proportion with improved breeds was 92%. This shows that most sample respondents had improved breed chickens, although some had both local and improved breeds. The higher number of improved chicken holdings could be associated with the nature of our sampling, as we selected the villages based on their previous exposure to TAIBs. According to some respondents, most producers are replacing local breeds with dual-purpose TAIBs. The main reported reasons for this are a better performance of dual-purpose breeds in egg and cockerel production.

Table 3: Numbers of local and improved chicken breed owned by respondents

Type of breed	Average number of chicken holdings				Proportion of holders (%)
	Mean	SD	Min	Max	
Local	14.1	17.5	1.0	89.0	43.0
Improved	32.6	66.0	2.0	500.0	92.0
Overall	36.0	70.2	3.0	589.0	100.0

SD=Standard deviation; Min=Minimum; Max=Maximum

4.2 Type of inputs used and cost of production

Foundation stock

The productivity of smallholder chicken flocks has a strong association with the type and composition of foundation stocks used by producers. Under the traditional production system, smallholder chicken producers use hens, cocks and pullets or cockerel as foundation flock. Due to the emergence of commercial hatcheries and better research and extension interventions, smallholder producers have recently started using DOCs or 45-day old chicks as foundation flock. Our assessment has confirmed this. 4% of sample respondents had used DOCs as foundation flock, while 64% of them used 45-day old chicks and 7% used 90-day pullets (Table 4). Similarly, 21% used hens and 10% used cocks as foundation flock. Most of the respondents who started with DOCs or pullets are holders of improved breeds.

Most smallholder producers used 45-day- old pullets or cockerels as foundation flock. This is mainly due to a greater number of samples coming from villages where different stakeholders had been distributing dual-purpose TAIBs in their area. The average price for each type of chicken used as a foundation flock shows the expected difference in buying prices (Table 4.). The average buying price for DOCs was ETB26.3, while 45-day old chicks and 90-day old pullets cost ETB59 and 132, respectively. Compared to pullets, the standard deviation (SD) of the average price for hens and cocks appears very high, suggesting significant variations in retail prices. This could be associated with the year of purchase and size and bodyweight of chickens. Producers who started production using local breeds some years ago had a lower buying price for cocks and hens.

Table 4: Type and number of chickens used as foundation stock

Type of chicken	Average number of stocks					Average price (ETB)		% of holders
	Mean	SD	Median	Min	Max	Mean	SD	
DOCs	317.5	461.8	125.0	20.0	1000.0	26.3	16.1	4.0
Hens	3.5	4.1	2.0	1.0	20.0	93.3	77.0	21.0
45-day old chicks	25.7	37.4	20.0	1.0	300.0	58.9	7.9	64.0
90-day old pullets	151.0	207.1	50.0	2.0	500.0	132.0	18.6	7.0
Cocks	1.3	0.7	1.0	1.0	3.0	82.2	67.6	10.0
Local pullets	3.1	2.5	2.0	1.0	10.0	78.7	29.8	15.0

SD=Standard deviation; Min=Minimum; Max=Maximum

Type and value of feed used

Poultry feed is the most important input affecting the production and productivity of chickens. In most developing countries, smallholder chicken production is mainly known by scavenging based production systems with periodic feed supplementations. This is mainly because of the scavenging qualities of local chickens and their better performance with poor-quality feeds. During this brief assessment, we asked smallholder producers to identify the source, type and amount of feed they provided in the previous 12 months. With the exception of one producer, all smallholder producers provided supplementary feed to their chickens. This could be associated with the availability of a higher number of improved breeds in the sample households. Smallholder producers used feeds sourced from their production and/or bought from markets (Table 5). The main types of feeds were balanced commercial feed, maize bran or maize and mixed feeds made from maize, soybean, wheat, barley, sorghum, teff and other crops. Feeds made from maize and mixed feed were the most common types used by smallholder producers. More than half of the producers had used commercial feed that included starter, grower and finisher feeds for improved breeds. If producers held local and improved breeds, they typically provided different types of feed for each breed. For the most part they provided grains or mixed feeds for the local breeds and commercial or better-quality feeds for improved breeds.

The presence of a higher number of smallholder producers that use supplementary feeds indicates the change in the most common traditional scavenging-based production system to an extensive production system. This shows a change in perception among smallholder producers on the need to provide additional feeds to improve the production and productivity of chicken at the smallholder level. The change in feeding practice may indicate the willingness and ability of smallholder producers to shift their traditional low input-based production systems to better input-oriented production systems.

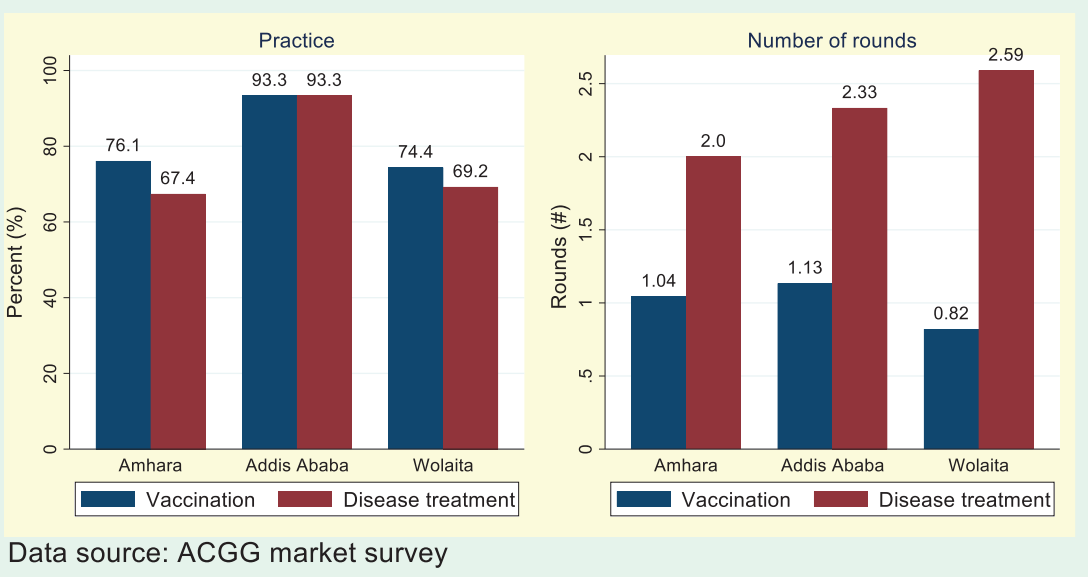
Table 5: Major types and sources of feed used by smallholder producers

Type of feed	Yes		No	
	№	%	№	%
Maize bran/maize (own + purchased)	71	71.0	29	29.0
Commercial (purchased)	57	57.0	43	43.0
Mixed (own + purchased)	74	74.0	26	26.0
Total	99	99.0	1	1.0

Vaccination and disease treatment

As indicated in the national level production data above, one of the main challenges in the Ethiopian poultry sector is the higher level of mortality associated with disease incidence and predatory attacks. Smallholder chicken production in the country is widely known by its lower bio-security level and higher prevalence of disease outbreak. This could be associated with limited access to health services, poor levels of management skills that may include a lower level of disease prevention and treatment practices. During this assessment, we asked producers if they carried out any vaccination and disease treatments in the previous 12 months. Accordingly, 79% of the producers said that they had carried out either vaccination or disease treatment in the previous 12 months. The proportion of producers who used vaccinations was higher than those who carried out treatments. Furthermore, there are significant differences among households that carried out disease treatments and vaccinations in the three market sheds (Figure 12). Producers in the Addis Ababa market sheds appeared to have better access to vaccination and disease treatment than producers in the other two market sheds. Summaries on the frequency of vaccination and disease treatment indicate that producers in Wolaita conducted on average three rounds of disease treatments per year, while producers in the Bahir Dar market shed conducted two. The average number of reported vaccination rounds was one across the three market sheds. The difference in the intensity of vaccination and treatment could be associated with disease prevalence, access to services or differences in management.

Figure 12: Proportion of producers practiced vaccination and disease treatment



Data source: ACGG market survey

Compared to national average indicators, a higher proportion of vaccination and disease treatment participation in our sample households may be the result of a higher proportion of producers participating in dual-purpose improved breeds production and their proximity to urban areas. Producers who adopted dual-purpose improved breeds have better access to vaccination and disease treatment services due to their networks with commercial hatcheries and the special support given by government agricultural offices.

Housing and other fixed items

The role of poultry housing under smallholder management conditions is documented in different empirical studies (Ahlers et al. 2009; Melesse 2014; Wong et al. 2017). Poultry houses protect birds from extreme weather conditions such as warm and cool temperatures, predator attacks and theft. Similarly, other fixed items such as feeders and drinkers do not simply provide feed and water, but help to administer medicine and vitamins properly and enhance the health of the birds, as they minimise feeds and water contamination by disease-causing agents. Producers were asked if they had different fixed assets used for smallholder chicken production and a summary of the responses are presented in Table 6. From the total number of respondents, 85.0% of producers said that they had separate chicken houses/cages, with the remainder keeping their chickens in their home together with people, on perches or in the kitchen. Some of the respondents who do not use separate housing for chickens indicated that fear of theft or predator attack was among the main reasons to not use separate houses. In general, the data show that the largest proportion of producers use separate chicken houses, which is a good indicator of the presence of a change in perception about the role of better management in the smallholder chicken production system. Similarly, 65% of producers indicated that they use feeders, and 69% use drinkers. The higher proportion of feeder and drinker use could be associated with the enhanced management required by improved breeds.

Table 6: Proportion of producers who own fixed assets

Availability of asset	Proportion of producers		
	Chicken house (%)	Feeder (%)	Drinker (%)
Yes	85.0	65.0	69.0
No	15.0	35.0	31.0

Estimated cost of major inputs

Table 7 presents a summary of the reported cost of the main inputs used by smallholder producers. The reported input costs indicate that feed and vaccination are the two main inputs used by smallholder chicken producers. On average, producers who mainly kept improved breeds incurred higher annual feed and vaccination costs than those who kept only local breeds. While producers who kept only local breeds spent ETB103.6 bird/year for feed and vaccination, producers who kept mainly improved breeds spent ETB160.5 bird/year for the two inputs. Similarly, the average annual fixed asset depreciation cost for local and improved breed keepers was ETB2.6 and 10.1 bird/year, respectively. The reported difference in variable and fixed asset costs is expected, due to better management required by improved breeds. Contrary to variable and fixed costs, the average cost for foundation stock for local breeds was double that of improved breeds. This variation is also expected because of the difference in the type of chickens used as foundation flock. Keepers of improved breeds mostly used DOCs or 45-day pullets as foundation flock which have lower prices than adult chickens.

Table 7: Annual estimated cost of different inputs used by smallholder producers

	Average cost of inputs (ETB/bird per year)					
	Only local		Improved and local		Overall	
Variable costs	Mean	SD	Mean	SD	Mean	SD
Feed	91.6	71.0	152.6	180.7	147.7	175.1
Vaccination/treatment	12.0	12.6	7.9	10.2	8.2	10.4
Total cost	103.6	66.0	160.5	180.9	155.9	175.0
Other costs						
Foundation stock	124.0	52.5	67.2	38.1	71.7	42.1
Fixed assets depreciation	2.6	2.6	10.1	15.4	9.5	15.0

SD=Standard deviation

Family labour utilisation

The demand for labour in smallholder chicken production depends on the type of production system adopted by the producer. Compared to semi-intensive and intensive production systems, extensive scavenging or scavenging systems require a lower amount of labour. Producers who practice semi-intensive or intensive production systems spend more time carrying out different management activities such as the provision of feed and water, cleaning the house, and protecting chicks from predator attack and theft. Estimating the amount and value of time households spend on chicken management helps us to understand the economic and social values the producers give to the production system. This helps design interventions and strategies that can enhance the production and productivity of the sector in the future (Sharma 2013). During the face-to-face interviews, we asked producers how much time on average the family members spend to conduct different activities related to chicken management. The breed level disaggregated summary of their responses is presented in Table 8. On average, smallholder producers spent 3.19 hours/day on different management activities. However, when this result is disaggregated by the type of breed kept by smallholder producers, producers who kept local breeds only spent about 30 minutes per day, while producers who held both improved and local breeds spent 3.43 hours/day. The higher labour allocation for two breed keepers could be associated with a better management demand by the improved breeds for feed and water provision and protecting them from predator attack and theft as indicated above.

Table 8: Average amount of labour used by sampled respondents

Type of breeds in the farm	Average time in hours/day			
	Mean	SD	Min	Max
Only local	0.49	0.23	0.25	1.00
Improved & local	3.43	3.10	0.10	12.00
Total	3.19	3.08	0.10	12.00

SD=Standard deviation; Min=Minimum; Max=Maximum

4.3 Total production and productivity of chickens

Improving the production and productivity of smallholder chicken systems has a significant impact on the livelihoods of small-scale producers (Mapiye et al. 2008; Wong et al. 2017; Fuglie 2018). However, the productivity of smallholder chickens depends on the type of inputs used, levels of management and environmental conditions. A better understanding of the level of production and productivity helps to design interventions and strategies that can transform the sector and enhance the living conditions of the producers. Under the smallholder chicken production system, the most important outputs are eggs and live birds. However, if the producers hold a large number of chickens, manure can be considered another important output. In the following sections, we have summarised the reported level and amount of overall production and productivity indicators. This helps us to assess the return associated with the production system and suggest interventions to transform the sector in the future.

Egg production and productivity

Producers were asked to report their number of layers, level of egg production and other productivity indicators for the previous 12 months. Each respondent responded separately for local and improved breed hens. The results showed that during the previous 12 months, 39.0% of the total respondents had local breed hens that produced eggs and 69.1% had improved breed hens (Table 9). For local breeds, the average number of reported clutches per year was five, with a minimum of three and a maximum of eight. The highest number of clutches per year could be associated with hybrid

hens and a manipulation of the brooding periods as reported by producers. Some smallholder producers indicated that they shorten the brooding period by using different methods as this helps to increase egg production per year. Other researchers have also reported similar findings in Ethiopia (Hailemichael et al. 2017). The average number of eggs per clutch was 14, with an average clutch length of 26 days. The average number of reported eggs produced from local birds was 70, with a minimum of 30 and a maximum of 98. The average number of eggs reported for local breeds appears higher than the national average (48) as indicated above, due to the use of hybrid breeds and brooding period manipulation.

The average number of improved breed hens among holders of improved breeds was 17, with a minimum of 2 and a maximum of 100. Improved hens provided an average of 248 eggs per year, with a minimum of 123 and a maximum of 300. The egg productivity of improved breed hens and dual-purpose breeds seems higher than the national average for exotic breeds reported above. This could be associated with the level of management conditions adopted by the sample farmers and adaptability of dual-purpose breeds used by farmers. According to farmers and local level extension workers, the dual-purpose improved breeds used by farmers are highly adaptive to the local environment and can provide more eggs under farmers' management conditions than existing breeds. This could have a serious impact on policies and interventions that aim to improve smallholder chicken production and productivity in developing countries.

Table 9: Egg productivity of local and improved chickens

Production/productivity indicators	Mean	SD	Min	Max	Percent (%)
Local hens	6.3	6.3	1.0	34.0	39.0
Improved hens	16.9	20.9	2.0	100.0	69.0
Number of clutches/years	5.0	1.3	3.0	8.0	41.0
Eggs/clutch	14.3	2.5	10.0	22.0	41.0
Clutch length (days)	25.6	6.4	6.0	35.0	41.0
Local hen average eggs/year	70.4	16.8	30.0	98.0	41.0
Improved hen average eggs/year	247.5	50.7	123.0	300.0	71.0

SD=Standard deviation; Min=Minimum; Max=Maximum

Chick production

Live chicken production for home consumption and income generation is the other main purpose of smallholder chicken production in developing countries. Under a traditional production system, the total number of chicks produced is highly dependent on egg hatchability and chick survival rate. Table 10 presents the estimated chick productivity for local birds in the three market sheds. In the previous 12 months, households reported an average of three broody hens with an average hatching frequency of three rounds per year. The average number of eggs set for hatching was 14, with a hatchability rate of 79 .3%. The estimated average chick survival rate to grower stage was 63.3%, with a minimum of 0.0 and a maximum of 90.0%. This indicates a 36.7% chick loss rate, which is particularly high even before considering losses after the grower stage. Under the traditional production system, a higher rate of chick loss through death has been indicated above (Figure 5).

Table 10: Chick production and productivity of local chickens

Indicators	Mean	SD	Min	Max
Number of broody hens	2.7	2.8	1.0	10.0
Number of hatches/years	2.4	1.0	1.0	6.0
Number of eggs set	13.5	4.0	5.0	30.0
Egg hatchability (%)	79.3	13.4	40.0	100.0
Chicken survival (%)	63.3	19.1	0.0	90.0

SD=Standard deviation; Min=minimum; Max=maximum

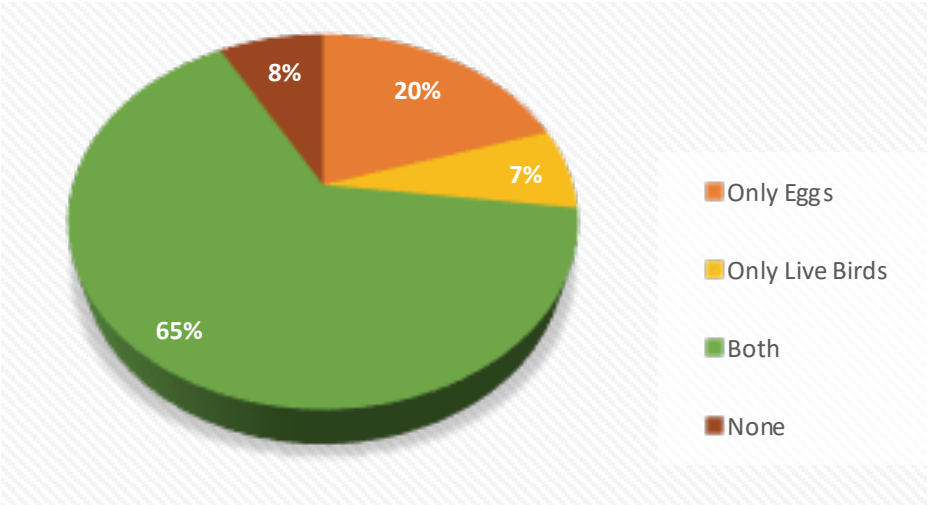
The lower proportion of survival rates reported could be associated with management and environmental factors. Management factors include disease treatment and prevention, feeding and housing-related factors. Some respondents raised disease and predator attack as the major causes of chick loss during the early stages. This demands an integrated approach that may include different management options. Empirical evidence on improving the survival rate of chicks suggests the need for adopting innovative approaches in health, feed, housing and other management to improve chick survival rates at the smallholder level (Sodjinou et al. 2013).

Marketing of poultry products

Market participation of smallholder producers

Producers' market participation depends on various factors, including the level of production, access to market, household income and wealth status and other socio-economic factors. Producers were asked whether they participated in live bird and egg selling during the previous 12 months. 72.0 and 85.0% of producers reported their participation in live bird and egg marketing in the previous 12 months, respectively (Figure 13). From the total respondents, only 8.0% did not participate in live bird or egg marketing in the previous 12 months. From the producers who participated in live bird marketing, 7.0% sold only live birds and 65.0% sold both live birds and eggs. Similarly, from the total producers who participated in egg marketing, 20.0% participated only in egg selling.

Figure 13: Proportion of producers participated in egg and live bird marketing

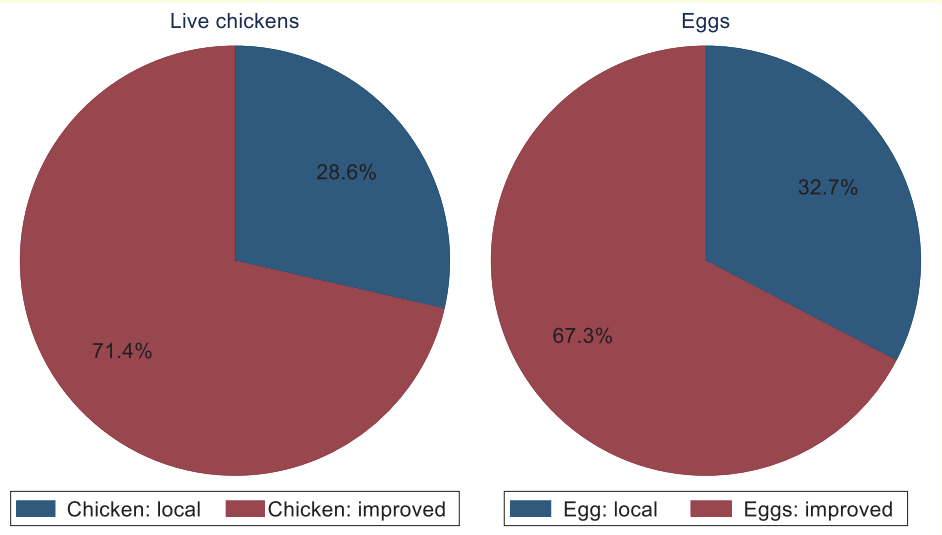


More smallholder producers participated in egg selling than live bird selling. This could be associated with producer production objectives and a higher number of improved breed holdings. This is in line with the national level indicators reported in Figure 9, which show that most smallholder producers in the country used eggs to generate income rather than home consumption or reproduction.

Market participation could be associated with the strong links between chicken productivity and the type of breeds used. To assess if different types of breed holdings have any correlation with market participation, we summarised the proportion of eggs and live birds sold by type of breed. Figure 14 presents the relative proportions of sample respondents who participated in improved and local breed product marketing. From the total respondents participating in the marketing of products, a higher proportion of sample respondents (71.4 and 67.3%) participated in improved live bird and egg selling than local breed products, respectively. This could be associated with the better egg and live bird productivity of improved breeds. Smallholder producers who kept TAIBs produced a higher number of surplus eggs and cockerels that could be supplied to local consumers. According to most smallholder producers, dual-purpose breed cockerels can be ready for slaughter at three months, which indicates that producers can have about four batches of cockerel production per year. However, under indigenous breed-based production, a cock reaches slaughter age at

over six months. Market participation data from producers shows that keeping dual-purpose improved breeds enhances household market participation due to higher surplus production. This highlights the significant contribution of improved breed-based production to household income generation that could be used to support other livelihood activities. Most respondents indicated that they use sale proceeds to cover planned and unplanned expenses such as school fees, medical expenses, agricultural input purchases and other food and non-food household expenses.

Figure 14: Proportion of live chicken and egg sellers by type of breeds



Data source: ACGG market survey

The amount of sale proceeds generated by poultry products depends not only on household market participation but on the volume of sale and intensity of participation. The intensity of market participation has a direct association with the level of productivity and total production amount (Abeykoon et al. 2013; Akidi et al. 2018). The average number of live birds sold by smallholder producers in the previous 12 months was 16, with a minimum of 0 and a maximum of 315 (Table 11). Zero values may refer to households that focused only on egg production. The maximum number of live birds sold was reported by dual-purpose cockerel producers. The average number of eggs sold in a month was 184, with a minimum of 0 and a maximum of 1,444. For both products, the highest quantity was sold to individual consumers/fellow farmers followed by traders.

Table 11: Total quantity of live birds sold/year and eggs sold/month

Type of product	Type of buyers	Average quantity sold			
		Mean	SD	Min	Max
Live Birds	Consumers	9.7	21.7	0.0	115.0
	Traders/aggregators	5.8	25.0	0.0	200.0
	Total	15.5	38.2	0.0	315.0
Eggs	Consumers	96.8	248.5	0.0	1,440.0
	Traders/aggregators	77.7	179.2	0.0	1,230.0
	Restaurants/hotel	10.1	58.8	0.0	400.0
	Total	183.9	282.1	0.0	1,440.0

SD=standard deviation; Min=minimum; Max=maximum

To explore the effects of improved breed-based production on sale volume, we disaggregated the total volume of sale by the type of breeds kept by producers (Table 12). The average number of live birds sold by improved breed keepers is about four times higher than local breed keepers. This could be explained by the short growth duration and better survival rates of improved cockerels due to management-related factors. Unlike local breed-based production, smallholder producers can raise any number of cockerels based on available resources through the dual-purpose

improved breed-based production. As with the sale of live birds, keepers of improved breeds reported a higher volume of egg sales per month than local breed keepers. The average volume of eggs sold by improved breed keepers is about five times greater than local breed keepers. However, the average sale volume of local breed owners for both products is significantly higher than the volume of sales reported at the national level, as the sample smallholder producers own a higher number of hens and use different inputs. For example, the producer who reported the sale of 120 eggs per month has more than 12 hens.

Table 12: Total number of eggs and live birds sold by type of breeds

Breeds		Mean	SD	Min	Max
Only local	Live birds	4.0	3.3	0.0	10.0
	Eggs	42.6	35.2	10.0	120.0
Mainly improved	Live birds	16.5	39.6	0.0	315.0
	Eggs	196.7	291.1	0.0	1,440.0
Total	Live birds	15.5	38.2	0.0	315.0
	Eggs	184.2	282.3	0.0	1,440.0

SD=standard deviation; Min=minimum; Max=maximum

When we disaggregate the type of live birds sold by age and sex, the proportion of producers who sold improved cocks is much greater than any other chicken type (Table 13). Next to improved cocks/cockerels, a higher number of producers participated in the selling of local cocks. Higher market participation of improved breed holders in the sample market sheds again confirms the contribution of TAIBs to smallholder producers' market participation. The average selling price of different chicken types was estimated from the reported selling prices (Table 13). While improved cocks earned the highest average selling price, local pullets had the lowest average selling price. On average, improved cockerels were sold at ETB262.7, with a minimum of 170 and a maximum of ETB500. The higher price of improved cocks could be associated with higher live body weights and sizes. According to some of the smallholder producers in the Wolaita market shed, the price of TAIBs cocks was much greater than the price of local breed cocks. Similarly, improved hens fetched higher prices in the local market when compared to local hens. This is because of the higher egg productivity of improved hens as indicated by the sample respondents. The price of poultry products affects producer market participation in different ways (Akidi et al. 2018). Unreasonable prices provide a negative incentive for producers to participate in production and marketing activities.

Table 13: Average price of different chicken types

Type of chicken	Average price (ETB/bird)					Proportion of participants (%)
	Mean	SD	Median	Min	Max	
Cock-local	217.9	63.4	200.0	120.0	350.0	19.0
Cock/cockerel-improved	262.7	76.8	250.0	170.0	500.0	47.0
Hen-local	157.5	56.8	135.0	120.0	240.0	4.0
Hen-improved	190.4	52.1	190.0	100.0	300.0	14.0
Pullet-local	150.0	50.0	150.0	100.0	200.0	3.0

SD=standard deviation; Min=minimum; Max=maximum

Although not significant, the average price of local breed eggs is marginally higher than improved breed eggs (Table 14). The price of local breed eggs is ETB0.12 higher than the price of improved eggs. Unlike commercial line breeds, a lower margin between the two breeds could be associated with the higher similarity of dual-purpose breed eggs with local breeds due to their scavenging ability. According to sample respondents, eggs from local breed chickens had a higher demand than eggs from improved breed chickens due to better tase of local breed eggs (Moges et al. 2010).

Table 14: Average price of local and improved breed chicken eggs (ETB/egg)

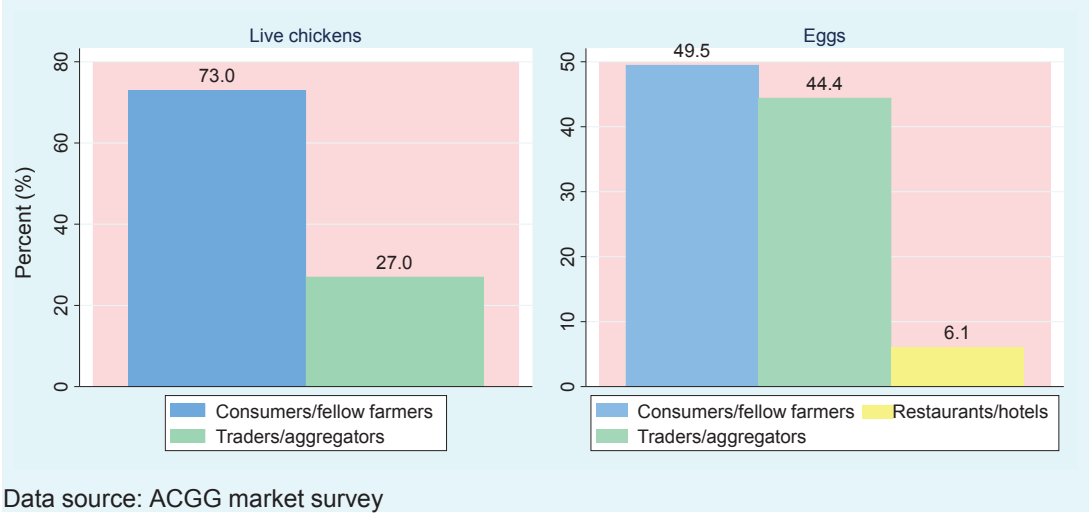
Type of breed	Mean	SD	Median	Min	Max	Proportion of participants (%)
Local	3.51	0.57	3.50	2.00	4.50	32.7
improved	3.39	0.47	3.50	2.00	4.00	67.3

SD=standard deviation; Min=minimum; Max=maximum

Types of live bird and egg buyers

Smallholder chicken producers sell their products to different types of buyer. We asked producers to indicate the main buyers of their products over the previous 12 months. The results showed that live birds were sold to individual consumers/fellow farmers and traders that include aggregators/collectors, wholesalers and retailers (Figure 15). Individual consumers and fellow farmers were the main buyers of live birds. About 73.0% of producers sold to individual consumers/fellow farmers and the remaining 27.0% sold to traders/aggregators. This shows that the majority of chickens produced at the smallholder level was sold in the local market to local consumers or other fellow producers. Unlike live birds, the proportion of eggs sold to buyers has a different pattern. About 49.5 % of producers sold their eggs to individual consumers/fellow farmers followed by aggregators/traders (44.4%) and very few to restaurants/hotels.

Figure 15: Proportion of reported live chicken and egg buyers

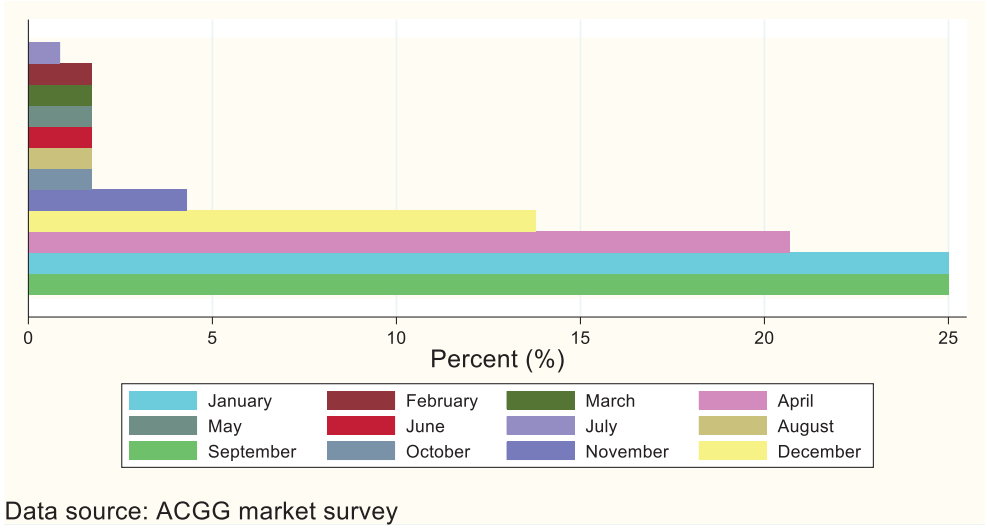


Data source: ACGG market survey

Seasonality of live birds selling

In developing countries, livestock product consumption depends not only on household income but on other cultural and religious factors. Empirical studies have documented that poultry product consumption, specifically meat, is highly seasonal (Ramdurg et al. 2010). To generate evidence on the nature of poultry product demand and supply, we asked sample respondents when they sold poultry products. A summary of our sample respondents' responses indicates the presence of significant variability among the different months of the year. The largest proportion of live bird selling was conducted in December/ January, September and April (Figure 16). This is associated with the presence of major religious holidays in these months, when most of the population in the country celebrates with meat consumption. In contrast, the proportion of producers who sold live birds in other months such as May to August was very small. The observed seasonal variation in live bird marketing influences the price of inputs, outputs and farmers' decisions on production. Unlike live bird selling, egg selling does not have any significant seasonal variability. Despite a prevailing price fluctuation among different seasons, most producers said that they sold eggs throughout the year.

Figure 16: Proportion of producers who sold live chickens in different months



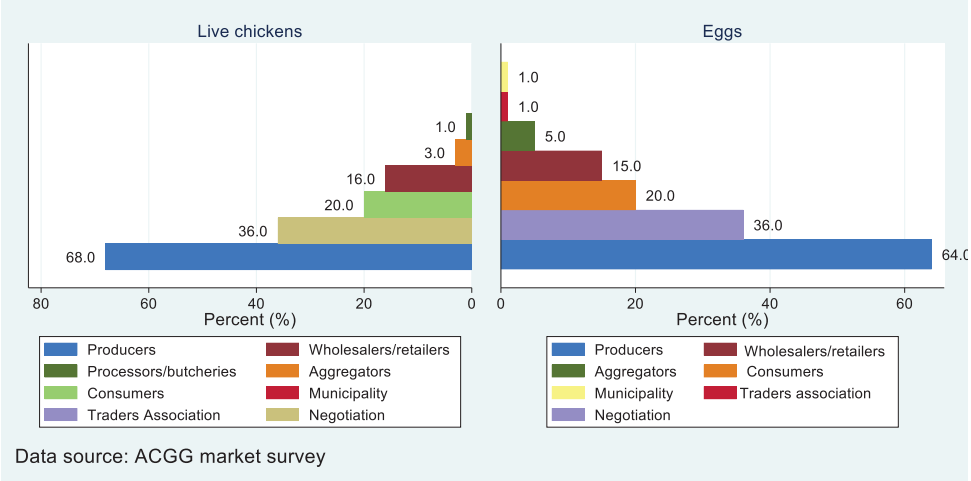
Data source: ACGG market survey

Pricing of poultry products

The pricing of agricultural products usually attracts the interest of the government and nongovernment organisations due to its significant role in the social, economic and overall wellbeing of producers and consumers. As a result, it has been one of the main policy arenas in most developing and developed countries. Traditionally, it is widely believed that smallholder agricultural producers in developing countries receive inappropriate gain during the marketing of agricultural products. Due to market failures and other institutional and structural problems, they are largely known by their limited bargaining power and are considered price takers. Due to the dynamic nature of the global commodity market, a better understanding of prevailing price formation mechanisms has a significant role in policy formulation.

We asked smallholder producers about the process of determining the price of live birds and eggs in their local markets. Different actors such as producers, traders, consumers and processors participate in price determination. Most producers emphasised the significant role of producers and buyers in price formation (Figure 17). From the total respondents, 68.0 and 64% indicated that they participate in the determination of live bird and egg prices, respectively. Smallholder producers explained that although they quote initial prices, the final sale price is reached by negotiation, which was indicated by other respondents as well. However, limited access to market and market information usually places smallholder producers at a disadvantage during the bargaining process. Empirical findings suggest that the bargaining power of small-scale producers in developing countries can be improved by building the capacity of producers and collective actions (Kamdem et al. 2009; Courtois and Subervie 2015). In the sample market sheds, the involvement of governments, producer associations, trader associations or other actors in price determination is almost non-existent.

Figure 17: Proportion of marketing actors who determine live chicken and egg prices



Data source: ACGG market survey

Criteria for buying live birds and eggs

In the rural and agricultural setting, quality attributes of poultry products form the primary basis for price determination. This could be associated with differences in the testing and consumer preferences of eggs and meat. We asked sample respondents to list the three most important buying criteria their buyers usually consider in the price formation process. From the total respondents who participated in egg marketing, 72.0% said that egg size was the most important criterion their buyers use in the price determination process (Table 15). Large eggs are more preferable than small ones. Breed type was indicated as the second most important buying criteria. Most respondents stated that large size and local breed eggs were preferred by individual consumers. Other quality attributes like eggshell and yolk colour were mentioned among the criteria of buyers by a few producers. The majority of producers (74.0%) reported that body size or weight of birds was the most important criterion for the price formation of live birds. Next to body size, the colour and health status of birds were also considered by buyers as the next two most important criteria. Some producers indicated that breed type and sex were important buying criteria. Given the above buying criteria, we asked producers if there existed any standardising and grading approaches during the selling of live birds and eggs. Most producers reported the absence of any standardising and grading system, and only 56.6% of smallholder producers explained the presence of an informal grading system based on traditional practices. However, grading minimises information asymmetry and can be an incentive for producers to supply quality products, as they receive better prices for quality products and improve buyer satisfaction as they can buy products based on their demands. The absence of better grading and standardisation systems may suggest the need to develop innovative approaches in this aspect to enhance value chain marketing performance in the future.

Table 15: Buying criteria of live birds and eggs

Eggs		Live birds	
Criteria	Percentage of cases (%)	Criteria	Percentage of cases (%)
Type of breed	51.0	Type of breed	29.0
Egg size	72.0	Sex of birds	21.0
Shell colour	30.0	Weight/body size	74.0
Egg shell	18.0	Colour	44.0
Yolk colour	9.0	Health status	35.0

Vertical and horizontal linkages and collective actions

The vertical and horizontal linkages of farmers with other value chain actors, their collective actions with other fellow farmers and membership of farmers' associations contribute substantially to enhancing the production and productivity of smallholder producers in developing countries. Sample respondents were asked if they had any production or marketing agreement with either input suppliers or buyers along the value chain. Only 3.0% said that they had had a production agreement in the previous 12 months (Table 16). Similarly, only 5.0% had participated in collective action activities. In this case, collective action refers to group actions to purchase inputs such as feed and vaccines, group marketing and knowledge sharing on production and marketing. At the smallholder producer level, collective actions enhance inclusion and reduce marketing costs (FAO 2016). Unlike collective action and production agreement activities, none of the producers were members of poultry production groups. Various empirical studies in Africa and other developing countries indicate that farmers' organisations and collective actions enhanced their members' access to factor and output markets (Barrett 2008; Hellin et al. 2009; Kaganzi et al. 2009; Gyau et al. 2014). The vertical and horizontal coordination of smallholder producers appears to be minimal, suggesting the need for pertinent intervention on this aspect.

Table 16: Producers collective action and production agreement

Type of engagement	Proportion of producers	
	Yes (%)	No (%)
Collective action	5.0	95.0
Membership	0.0	100.0
Production agreement	3.0	97.0

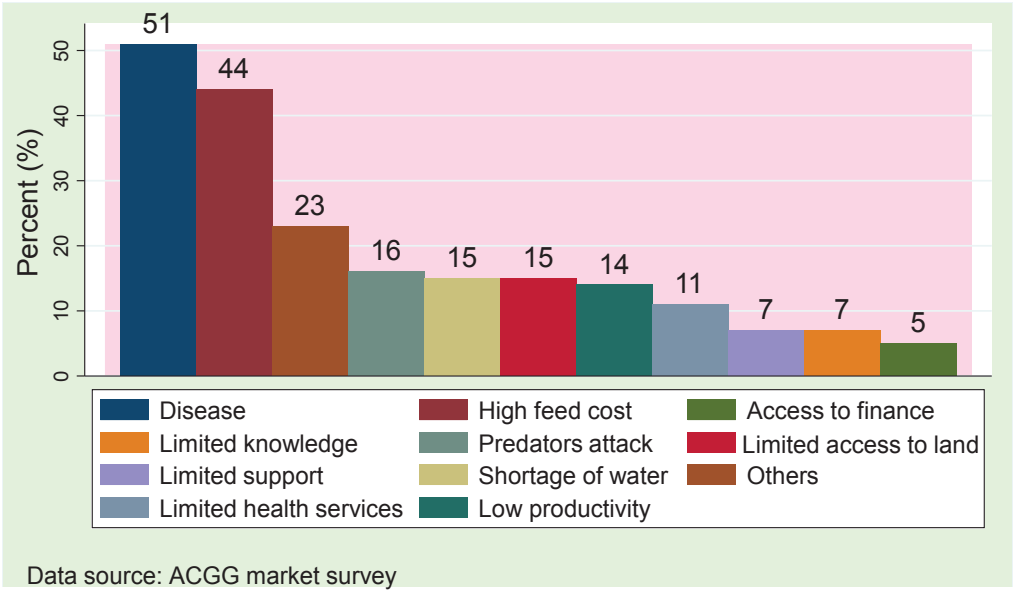
Major challenges and opportunities

Empirical research has documented that smallholder chicken production in most developing countries is constrained by various production, marketing and policy-related challenges (Mapiye et al. 2008; Aboki et al. 2013; FAO 2014; Padhi 2016). Although some challenges could be associated with the context of production environments, most are related to technical, financial, institutional and other socio-economic factors. However, due to the dynamic nature of the global production and consumption environment, understanding the current perceptions of smallholder producers on challenges and opportunities available in their production systems could be a good starting point for designing any interventions that aim for sustainable outcomes. As a result, we asked sample respondents to describe the three most important constraints and opportunities in smallholder chicken production. Despite the diverse nature of the responses, we have categorised them broadly into the following production and marketing challenges.

Production constraints

Producers listed 11 constraints related to chicken production in their local areas, with the overall proportion of these constraints summarised in Figure 18. Among these constraints, disease and high feed costs take first and second place, respectively. Most producers (51%) raised high disease prevalence and mortality as their main challenge for sustainable production. Some producers (11%) indicated that limited access to health services would make this challenge worse. Most producers, especially those who keep improved breeds, highlighted high feed costs and access to quality feed as the main problems in their local areas. In addition to disease and feed, predator attack, shortage of water, access to land, the low production potential of local breeds and limited access to different services were all reported as important production constraints. Limited skills and support from different actors were mentioned as other constraints. The presence of multiple production constraints may suggest the need to adopt integrated approaches to enhance the production and productivity of the sector.

Figure 18: Major production-related constraints raised by sampled producers

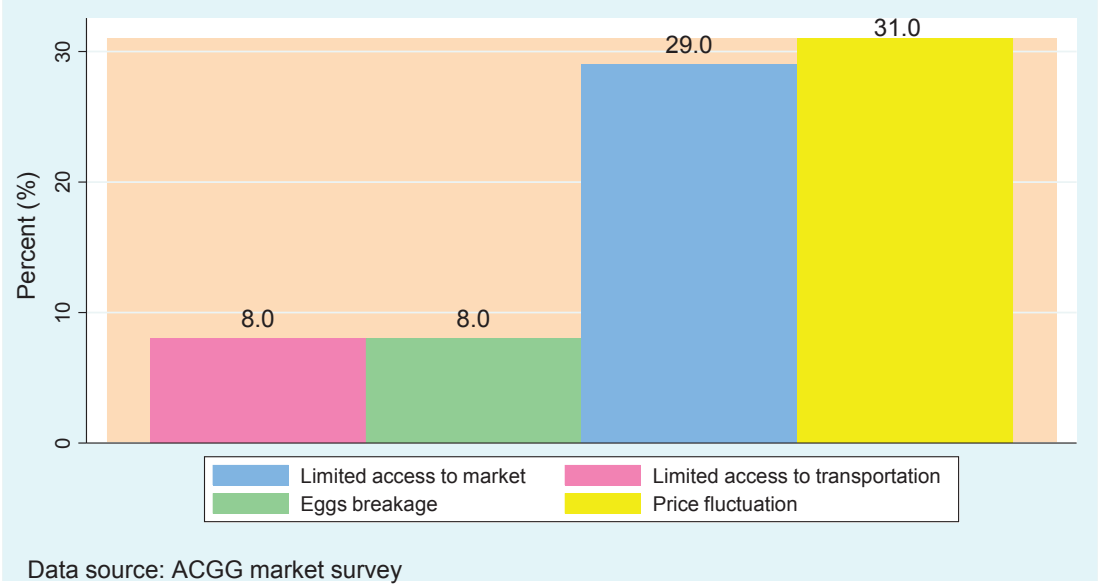


Data source: ACGG market survey

Marketing constraints

Due to poor infrastructure and limited institutional and organisational support, the marketing of poultry products seems to be the most important challenge at present and in the future. We categorised market-related constraints raised by producers into four categories. These are price fluctuation, limited access to market, egg breakage and limited transportation facilities (Figure 19). Due to seasonal consumption patterns of livestock products and other socio-economic factors, price fluctuation appears to be the most important marketing constraint. Producers reported that the price of poultry products increased more during festival and holiday seasons than other seasons that could be associated with an imbalance in the supply and demand of poultry products in the local markets. According to some respondents in the Wolaita market shed, for instance, cockerels were sold for about ETB500 immediately after introducing an improved cockerel breed in the area. When the supply increased due to a higher adoption of dual-purpose TAIBs, the price of similar cockerel dropped significantly to ETB250. Similarly, some producers showed that prices fell significantly during a higher supply of improved breed eggs, especially during fasting seasons. This indicates that producers limited access to better market opportunities, which they identified as the second most important constraint. Challenges posed by price fluctuation and access to better market opportunities suggest the need for integrating market-related and research and development interventions to improve the production and productivity of the sector in the country. Egg breakage was indicated as another important challenge especially by the producers who keep improved breeds. According to empirical studies, egg breakage could be associated with different factors that may include shell defects, irregularities in shell shape, texture and surface (Mazzuco and Bertechini 2014).

Figure 19: Major marketing-related constraints raised by sampled producers



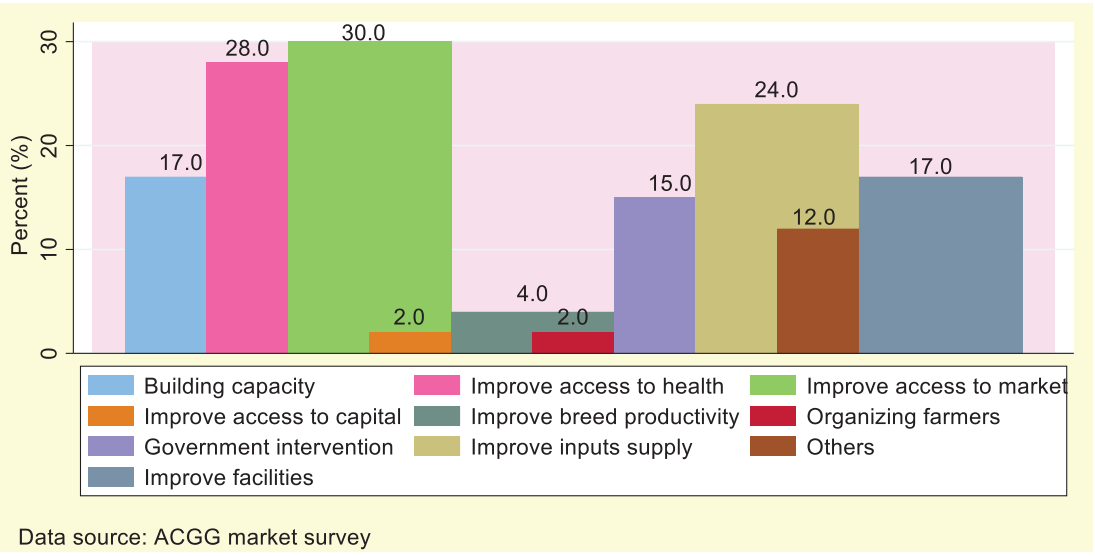
Addressing marketing constraints can significantly enhance the performance of product marketing and overall production and productivity of the sector. Farmers' gain from the adoption of improved breeds can be realised only if there is a good market for products, as their investment in improved breeds is usually associated with different additional costs (Barrett and Mutambatsere 2008). Lower prices and price fluctuation in the poultry market would be effectively resolved not by making price rights but institutions right, as suggest by Barrett and Mutambatsere (2008) The Ethiopian government must therefore work to set up proper institutions that establish appropriate poultry products prices. Introducing of improved storage, packaging and transportation facilities can be a viable solution to minimise product loss along the value chain.

Potential solutions suggested by producers

Integrating the opinions of farmers and their recommended solutions to address the above constraints can have a positive relation to maintaining the impact of agricultural interventions. Following our discussions on the main production and marketing constraints, we asked producers to put forward possible solutions for the main constraints

they raised, which are summarised in Figure 20. The three most widely suggested solutions were improving access to the market (30%), improving health services (28%) and improving the supply of different inputs (24%). Since most of the sample respondents held improved breeds and obtained higher yields, market-related interventions emerged as the most important solution that needs to be considered. Given the reported high disease incidence in most parts of the country, producer demand for better health services also looks critical. Some producers suggested that to maximise the opportunities obtained from access to improved breeds, a sustainable supply of quality feeds with a reasonable price would constitute a strategic intervention. Other viable solutions may include capacity building among farmers and improving poultry production and marketing facilities. Government technical support and improved access to inputs such as land and water were also mentioned by some producers. Despite their deep experience in smallholder chicken production, producers felt that capacity building training of management and marketing aspects would be important interventions. Some of the producers in Wolaita for instance indicated that they usually provide feed without adequate technical knowledge which may expose them to economic losses.

Figure 20: Major suggested solutions to production and marketing constraints



Data source: ACGG market survey

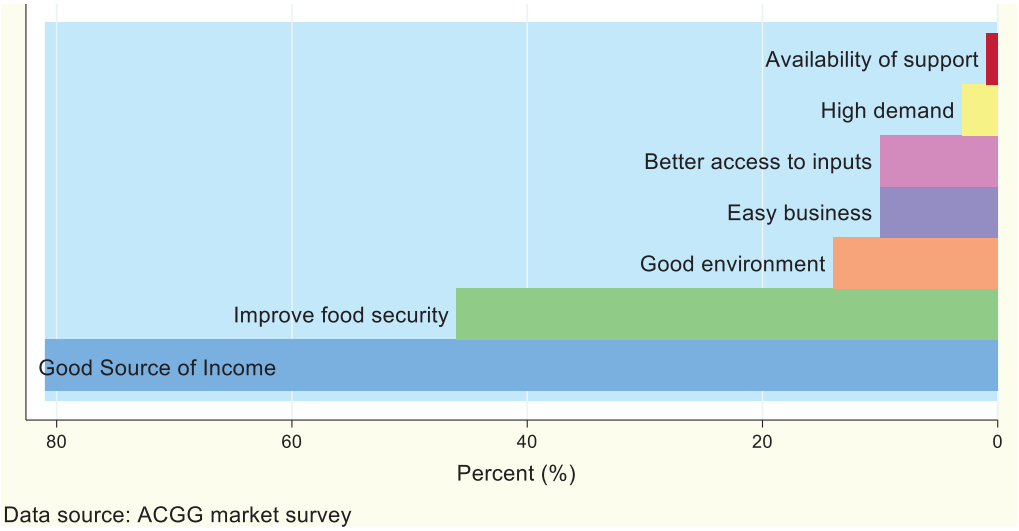
Potential opportunities in the smallholder chicken production sector

In most developing countries, smallholder chicken production is considered to be the role of women and children. This could be associated with existing limited knowledge and understanding of its potential benefits and the lower level of production and productivity of local breed-based production. Furthermore, its limited demand for production resources means poultry production is considered to be the livestock of the poor. However, introducing improved breeds that have better productivity has had a significant impact on changing smallholders' perceptions about the role of the production system in their livelihoods. Nutrition education and other socio-economic gains have also contributed to the observed change in perceptions in the sampled villages. Most smallholder farmers, including male and female, have a strong positive understanding of the role smallholder chicken production plays in their livelihoods.

During our assessment, we asked producers to indicate the three most important benefits they obtained from smallholder chicken production over the previous few years. 81% of respondents indicated that smallholder chicken production had improved their family income (Figure 21). Producers who keep improved breeds explained that adopting TAIBs had helped them to generate enough income to support other livelihood activities. Other respondents showed that the income generated from smallholder chicken production helped send their children to school. Producers explained that they used the income generated from the sale of live birds and eggs to cover immediate household expenses such as school fees and medical costs. 46% of the smallholder producers surveyed said that smallholder chicken production had enhanced the food and nutritional security of their households. According to some smallholder producers, adopting

improved breeds with higher egg yields had helped them to feed their children properly. The availability of a good production environment, ease of doing business and better access to inputs were reported as important opportunities in existing smallholder chicken production. Some producers believed that the availability of TAIBs was a great business opportunity with the potential to transform the smallholder production system. They considered the business lucrative and with immense potential to improve their livelihoods.

Figure 21: Key opportunities reported by sampled smallholder producers



Data source: ACGG market survey

4.4 Economic performance of dual-purpose TAIBs

As indicated above, dual-purpose improved breeds significantly enhance live bird and egg production and productivity under smallholder management conditions. However, higher productivity or production does not always mean better economic gain or profitability. It is therefore imperative to assess the benefits and costs associated with various input uses and production systems for further policy options and scale-ups. Assuming minor or limited changes in the production system, we used partial budget analysis approaches to estimate the added gain in income from adopting dual-purpose breeds. For this purpose, our sampling strategy created comparable groups that use similar types of inputs for local and improved breeds. As shown above, most smallholder producers used feed, vaccination, housing and other inputs.

We applied a partial budget analysis to estimate the economic benefits of using dual-purpose TAIBs based production over the existing indigenous breed-based extensive scavenging production. The basis for the partial budget analysis assumption was the ACGG project intervention implemented in the country since 2014. During this intervention, dual-purpose TAIBs chicks were distributed in different parts of the country, including in the sampled market sheds. The distribution was conducted through public-private partnerships where private hatcheries supplied DOCs to mother units to raise for a certain number of days and distribute to smallholder producers. The mother units provided the necessary vaccinations and treatments during the brooding stage, which is much harder to undertake at the individual smallholder producer level.

We considered the following three main assumptions in our partial budget analysis: change of breed type, change in flock size and minimal change in management. The change in breed type refers to shifting the existing local breed-based production system to dual-purpose TAIBs based production that many smallholder producers are now adopting in the

sampled market sheds. The change in flock size refers to increasing the average number of chickens from extensive scavenging (5–50) to the average number of flocks in semi-intensive production (50–200). In our analysis, we assumed changing the flock size to 50 or 75, which is categorised under semi-intensive production system based on FAO classification (FAO 2014). Moreover, the assumption for minimal change in management refers to moderate change in feeding, vaccination and housing. We refer to the change in management as 'minimal', as most sample smallholder producers in our assessment use purchased feed and vaccinations in extensive scavenging-based production.

The assessment used the input and output indicators reported by sampled smallholder producers. The values of inputs used in both production scenarios were generated from the above-reported values in Table 7. The input costs considered in the dual-purpose scenario were DOCs, feed, vaccination/treatment and housing. The input costs considered in the extensive scavenging scenario were hens and cocks, feed, vaccination/treatment and housing. We assumed the overall production cycle for this analysis to be 18 months. For the shift to a TAIBs scenario, producers were expected to have 50 improved dual-purpose chickens at a time in which 50% of them are assumed to be pullets and the remaining 50% cockerels. Assuming a three-month growth period for cockerels and two to three weeks spent on cleaning, the producers could therefore have at least five batches of cockerels in 18 months. This means 125 cockerels during the entire production cycle. For the 75-flock size scenario, we considered increasing the number of layers to 50, keeping 25 cockerels. The output data for dual-purpose improved breed egg production was taken from the average number of eggs reported by sample respondents. We assumed that on average, layers would start egg laying after five months of their arrival at the farm, resulting in about 13 months of egg laying.

For the extensive scavenging production base scenario, we used the values reported by sample respondents for local breed egg and live bird production. We assumed that producers started with 12 hens and two cocks. Based on our survey indicators, a hen was assumed to lay an average of 14 eggs per clutch with five clutches per year. This gives about 70 eggs in one year. It was assumed that from the 12 hens, four were used for brooding and the remaining eight were used for egg production. Over 18 months, the hens used for egg production would produce eight clutches totalling 105 eggs. The hens used for brooding would have an average of three hatches with full chicken growth to maturity. On average, 14 eggs were set in a single brooding cycle with an average hatchability of 79.3% and survival rate of 63.3%. Based on the estimated hatchability and survival rate, a broody hen could produce seven chicks per cycle, resulting in 21 chicks over the entire production period. This gives 84 live birds produced over 18 months. We used the average price data generated from the sample respondents to estimate the values of the eggs and live birds produced in both scenarios.

Figure 22 presents a summary of the gain, loss and net change in income obtained from the 50-bird flock size scenario. The net change in income shows that shifting the extensive scavenging system to a TAIBs based production system would generate a substantial income gain. On average, smallholder producers could generate up to ETB23,000 as additional income. This figure represents the additional income generated by adopting a dual-purpose breeds-based production in addition to the income generated from the extensive scavenging scenario. The net change in income shows the profitability of adopting the changing scenario compared to the base scenario and does not indicate the overall profit. Similarly, if the producers increase their flock size to 75 (50 layers and 25 cockerels), their average net gain in income would increase to ETB43,500 (Figure 23). The net change in income is highly dependent on flock size and the type of products produced (eggs vs cockerels). The above figures propose that adopting TAIBs based semi-intensive production under smallholder management conditions has a positive impact on household income. This demonstrates the relative importance of TAIBs to enhance the overall production and productivity of smallholder chicken in the country.

Figure 22: Summary of partial budget analysis for flock size 50

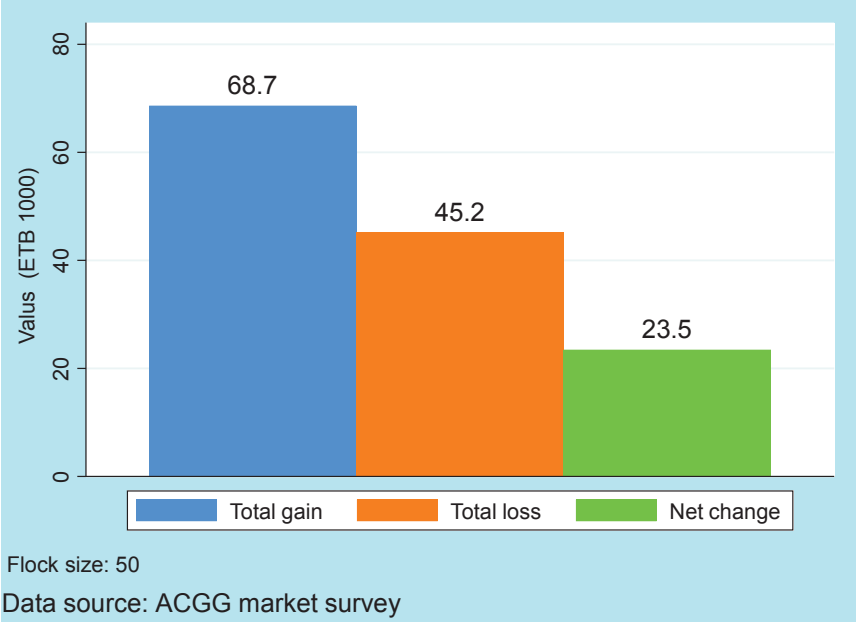
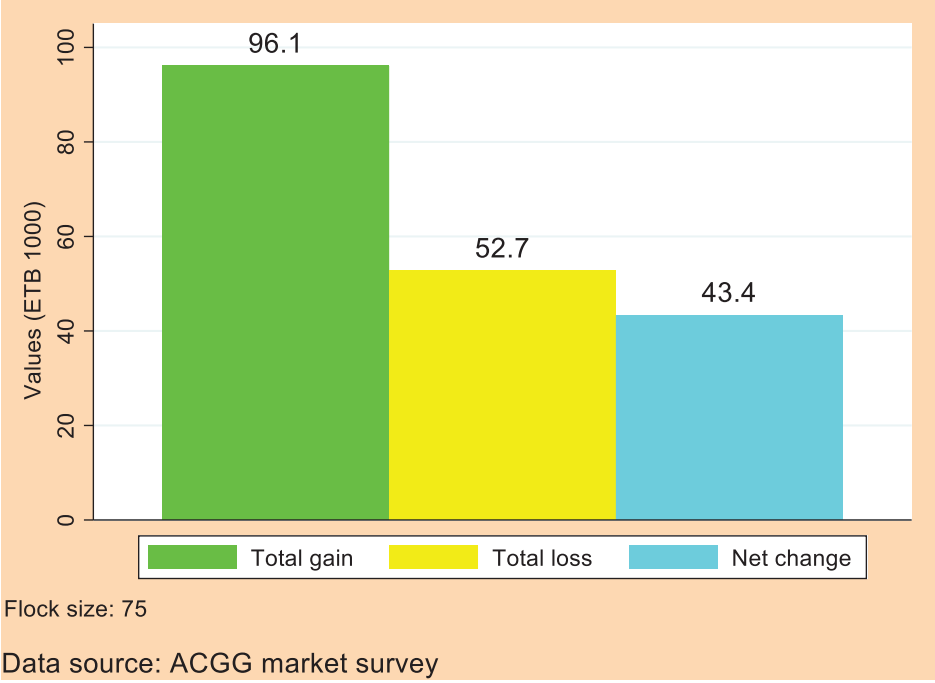


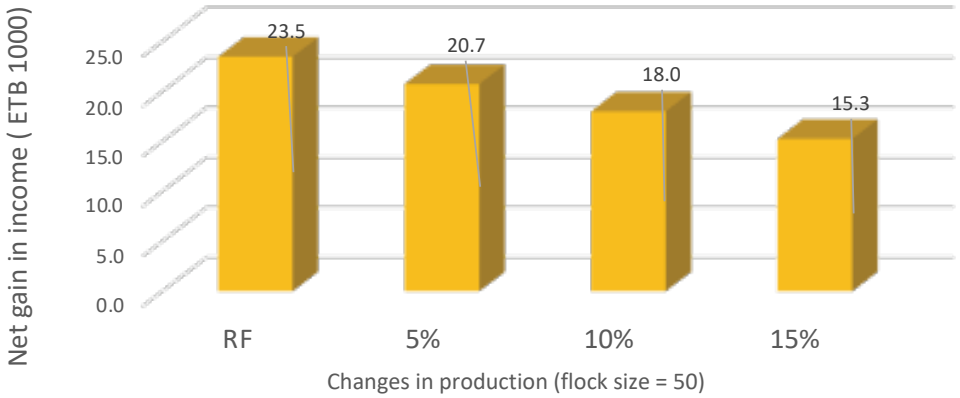
Figure 23: Summary of partial budget analysis for flock size 75



Agricultural production in developing countries such as Ethiopia is associated with production and marketing risks and uncertainties (Ogada et al. 2010; Komarek et al. 2020). In the poultry production sector, production risks may include loss of chickens and reduced production and productivity due to management and genetic factors. This results in a decrease in the overall return and profitability of the producers. Considering different risk factors, we conducted a sensitivity analysis to evaluate the impact of a decrease in outputs on the net change in income of the alternative scenario (Finger and Schmid 2008). Two major assumptions were considered: a reduction in egg productivity or production and loss of chickens due to mortality or other factors. Three scenarios accounting for a 5, 10 and 15% loss in production were estimated and compared with the normal or reference category, which is the estimated value under normal production conditions. A 5% change in production, for example, refers to a simultaneous reduction of 5% in egg productivity and

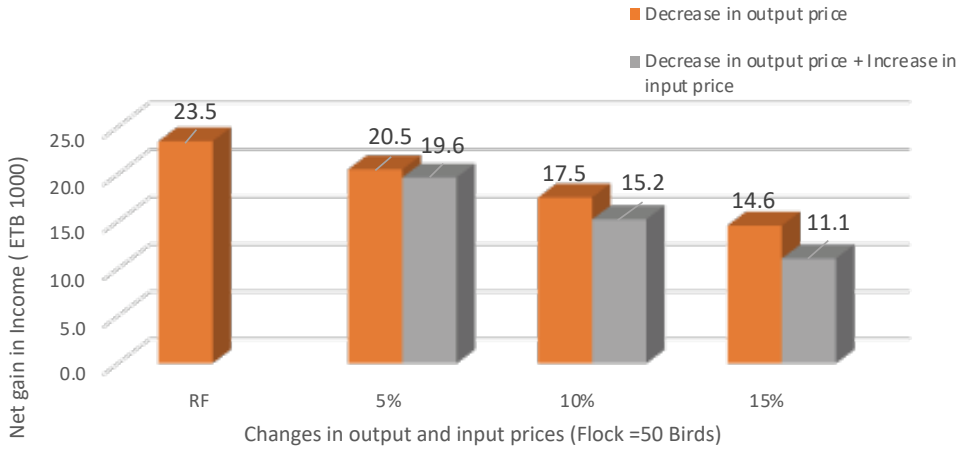
a 5% loss through cockerel mortality. In the 50-flock scenario, the additional gain in income reduced from ETB23,500–20,700 (Figure 24), which shows the net change in income remains positive with this risk scenario. The change in net income gain stays positive even in the 15% loss scenario. The estimated results from the three scenarios highlighted that TAIBs based production continues to generate positive net gains in income. This shows that shifting the production system to TAIBs based production is robust when taking the expected production risks into consideration.

Figure 24: Sensitivity of change in net income due to a decrease in production



The other possible risk source for change in income gain is a rise in input prices and a fall in output prices. This could be considered a marketing risk. As with production risk, we evaluated the effect of these risks on the additional gain in income using the 50-birds flock scenario. The two risks are: a decrease in output price only, and a simultaneous decrease in output price and an increase in input price. Figure 25 presents the estimated change in net income gain due to the change in prices at 5, 10 and 15%. In the first situation, for instance, a 5% decrease in output prices reduces the net gain in income from ETB23,500–20,500, while a simultaneous 5% decrease in output price and 5% rise in input price reduces the net gain in income from ETB23,500–19,600. Despite the expected decrease in income, the net gain in income is positive and significant in all scenarios. Although the prospect of observing both an increase in input price and a decrease in output price is limited, the estimated gains in income in the worst scenario remain positive. This demonstrates that adopting TAIBs based production generates modest income during unexpected price shocks, which could be a good incentive to adopt the production system on a sustainable basis.

Figure 25: Sensitivity of change in net income gain due to price changes



We estimated the MRR from the production shifts proposed above. MRR measures the net return from the additional investment in TAIBs based production. It is the ratio of change in net income/gain (marginal benefits) obtained from shifting from extensive scavenging to semi-intensive production to the change in cost (marginal cost) of production associated with the shift. It measures the net return from the additional capital invested to shift the production system to a TAIBs based production system. For the 50 flock size scenarios, the estimated MRR is 168.6%. This shows that every ETB1.00 invested in shifting the production system generates an ETB1.69 return.

The feasibility of the estimated MRR could be explained using existing lending rates of microfinance institutions in rural areas. In Ethiopia, microfinance and cooperatives lend money to farmers with an annual interest rate of 15%. Assuming 18 months of production duration, the cost of a borrowed capital would be 22.5% (15% + 7.5%). If a farmer assumes that a socially acceptable rate of return for management and other overheads in the community is 100%, the overall expected financial return would be 122.5%. The estimated MRR of 168.6% is 46.1% higher than the expected rate of return. This shows that investing in TAIBs based production generates better financial returns than those expected from similar activities. Where there is access, smallholder producers can borrow money from financial institutions to adopt and use these technologies. As indicated above, the additional income generated from shifting the production system is enough to send children to schools and cover medical expenses. Moreover, the gain in income helps to purchase other inputs such as fertiliser and improved seeds to enhance other agricultural activities such as crop and livestock production and the accumulation of assets.

4.5 Lessons learned and possible interventions

The emerging trends of strong competition between smallholder chicken production and the commercial sector call for strategies that help smallholder producers become more productive and competitive. Despite widespread interventions, the findings of recent empirical studies show that over the past few decades, the observed gains from interventions that aimed to improve the production and productivity of smallholder chicken was negligible. This could be associated with a lack of integrated and comprehensive interventions that address the dynamic and complex nature of the smallholder chicken production system. Strategic efforts that aim to transform the productivity of smallholder chicken production need to adopt holistic approaches, including breed improvement, enhanced management, health interventions, producer capacity building and improving access to finance and markets. Given the limited access to inputs and institutions and significantly lower productivity of local breeds, improving production and employing different production techniques has multiple benefits. One of the best strategies might be to introduce dual-purpose TAIBs that will help producers to maximise their consumption and income generation goals. Due to their suitability for semi-intensive production systems, dual-purpose TAIBs play an important role in enhancing the productivity of smallholder chicken production in the country. Furthermore, organizing smallholder chicken producers for collective actions in production and marketing decisions would have an instrumental role in sustainable production, allowing access to better marketing opportunities, and enhancing producers' entrepreneurial ability.

5 Economic performance of mother units

One of the main challenges of transforming smallholder chicken production through improved breed-based production is the access to a sustainable supply of replacement stock. Especially in developing countries, smallholder producers do not have adequate opportunities to access commercial hatcheries to get replacement stocks due to limited access to infrastructure. Raising birds from DOCs is challenging, due to the intensive level of care needed throughout the early growth stages. Introducing mother units could be among the best solutions. During the ACGG project implementation, this strategy was introduced in the three project countries. Mother units can be considered as small-scale commercial farms that receive DOCs from commercial hatcheries and rear them for a set number of days (typically up to 45). In addition to helping improve chicken production and productivity they play a significant role in employment creation in developing countries.

Mother units are especially important in decreasing chick mortality and improving chicken production and productivity. In smallholder chicken production, the highest proportion of chicken mortality happens during the early growth stage due to multiple factors. At this stage, chicks are more vulnerable to predator attacks such as wild birds and wild animals. Mother units can raise chicks at this stage using a better brooding environment and through the provision of balanced feed, strategic vaccination and medication services. This helps to minimise mortality rates and make the chicks vigorous in the later stages of growth.

Given their important role in smallholder poultry development strategies, it is imperative to assess the profitability of mother units and identify challenges and opportunities to design interventions or strategies that could enhance their sustainability. During our brief market chain assessment, we interviewed selected mother unit owners about their production and marketing activities, collective actions and important challenges and constraints in the production and marketing of products. In the following section, we present the main findings of this assessment.

5.1 Average levels of production

The profitability of agricultural farms depends on the level of production and productivity. Data on production levels were collected to highlight the current levels of production and productivity of the sample mother units. Due to differences in the production cycle, we categorised sampled mother units into two broad categories: 90-day pullet farms with mother units that produce pullets for egg production; and 45-day chick farms, which raise chicks for 45 days and supply for cockerel and layer production. As a result, the production indicators are disaggregated by these two categories. The 90-day pullet farms produce three batches or cycles of pullets per year on average, with a minimum of five and a maximum of eight batches (Table 17). The average number of days the chicks stayed in the farms was about 90. According to the sampled respondents, pullet farms raised 3,517 pullets/batch on average, with a minimum of 2,000 and a maximum of 6,500 birds. 45-day chick producing mother units could produce five batches in a year on average, with a minimum of

three and a maximum of eight batches. On average, they raised 1,349 chicks, with a minimum of 700 and a maximum of 2,100. Compared to pullet farms, 45-day chick farms raised a lower number of chicks per batch. This could be associated with limited access to market and different inputs, and lower technical and financial capacity. Unlike 45-day chick mother unit farms, pullet farms are found around main towns with better housing and other enhanced infrastructures. These farms are usually managed by more experienced entrepreneurs.

Table 17: Number of production cycles and total production by type of farms

Type of farm	Indicators	Mean	SD	Min	Max
45-day chicks	Number of batches/year	4.6	1.4	3.0	8.0
	Number of days/batch	45.0	0.0	45.0	45.0
	Number of chicks batch	1,349.1	503.2	700.0	2,100.0
90-day pullets	Number of batches/year	3.0	1.0	2.0	4.0
	Number of days/batch	90.0	0.0	90.0	90.0
	Number of chicks/batch	3,516.7	2,583.8	2,000.0	6,500.0
Total	Number of batches/year	4.3	1.5	2.0	8.0
	Number of days/batch	54.6	19.2	45.0	90.0
	Number of chicks batch	1,813.6	1440.1	700.0	6,500.0

SD=Standard deviation; Min=Minimum; Max=Maximum

5.2 Cost of production

We summarised the cost of production for the two types of mother units separately. However, both farms used similar variable and fixed costs. The variable costs account for the main cost of production on both farms. Table 18 presents the types and reported values of different variables costs incurred by producers for one production cycle. DOC and feed costs accounted for 93.5% of the TVC of 45-day chick farms and 88.9% of 90-day pullet farms. The remainder went to other costs including hired labour, vaccination, antibiotics and transport costs. While the average variable cost for 45-day chick production was ETB51.0 per chick, the average variable cost for 90-day pullet production was ETB62.6 per chick.

Table 18: Type and value of variable costs used in mother units

Type of cost	Average cost of production (ETB/bird per batch)								
	45-day chicks		Share%	90-day pullets		Share%	Overall		% Share
	Mean	SD		Mean	SD		Mean	SD	
DOCs	35.7	6.3	70.0	32.4	2.3	51.8	35.0	5.7	65.4
Starter/grower feed	12.0	10.8	23.5	23.2	18.4	37.1	14.4	12.8	27.0
Litter	0.4	0.4	0.8	0.4	0.5	0.6	0.4	0.4	0.7
Brooding	0.3	0.3	0.6	0.1	0.1	0.2	0.3	0.3	0.5
Electricity	0.3	0.2	0.6	0.7	0.3	1.1	0.4	0.3	0.8
Vaccination	0.2	0.4	0.4	1.8	1.0	2.9	0.5	0.8	1.0
Antibiotics	0.5	0.3	1.0	0.4	0.2	0.6	0.5	0.2	1.0
Transport	0.4	0.6	0.8	1.1	0.8	1.8	0.5	0.7	1.0
Water	0.2	0.2	0.4	0.3	0.3	0.5	0.2	0.2	0.5
Hired wage	0.3	0.8	0.6	2.2	0.0	3.5	0.7	1.1	1.4
Other/miscellaneous	0.5	0.9	1.0	0.0	0.0	0.0	0.4	0.8	0.8
Total	51.0	8.4	100.0	62.6	16.6	100.0	53.5	11.0	100

SD=Standard deviation

Table 19 presents the estimated total annual variable cost of production for the reported average number of batches. The average annual variable cost of production for 45-day chicks was ETB359,845, with a minimum of ETB143,370 and a maximum of ETB1,010,700. Similarly, the average annual variable cost for 90-day pullets was ETB869,928, with a minimum of ETB212,664 and a maximum of ETB1,963,200. As expected, the cost depends on the size of the mother unit farm and the number of cycles the farm produces in a year.

Table 19: Estimated total annual variable cost of mother units by type of farms

Type of cost	45-day chicks		90-day pullets		Overall	
	Mean	SD	Mean	SD	Mean	SD
DOCs	249,344.5	159,460.2	380,360.0	322,510.6	277,419.3	196,657.1
Starter feed	77,582.7	114,731.7	46,180.0	34,983.9	70,853.6	102,434.1
Litter	2,311.8	3,269.8	2,933.3	1,514.4	2,445.0	2,940.6
Brooding	2,323.6	3,168.6	266.7	461.9	1,882.9	2,919.4
Electricity	2,030.9	1,261.4	7,266.7	3,951.4	3,152.9	2,932.0
Vaccination	2,428.0	5,991.2	27,422.7	32,031.8	7,784.0	17,284.1
Antibiotics	4,181.8	3,547.9	4,400.0	2,707.4	4,228.6	3,289.2
Transport	3,527.3	6,385.5	8,666.7	3,055.1	4,628.6	6,131.1
Water	1,422.3	932.0	2,333.3	1,301.3	1,617.5	1,038.8
Hired wage	2,227.3	4,611.7	27,000.0	23,811.8	7,535.7	14,658.2
Other/ miscellaneous	3,968.0	7,617.1	0.0	0.0	3,117.7	6,891.0
Total	359,844.7	250,042.8	869,928.0	953,242.5	469,148.2	484,835.4

SD=Standard deviation

In addition to the above variable costs, mother units have fixed costs such as housing, feeders and drinkers. Fixed costs include other annual costs such as house rent, interest on operating capital and government fees. We estimated the average fixed cost of production from the depreciation cost using the reported values of construction or purchase of fixed items and the estimated life span of the fixed assets. The total average annual depreciation costs for 45-day chick producers and 90-day pullet farms were ETB12,261.6 and 106,895.0, respectively (Table 20). Some of the sample mother units used rented houses which accounted for the largest share of their fixed costs. Unlike 90-day pullet producers, some of the 45-day chick producers worked with loaned capital.

Table 20: Annual depreciation cost of fixed assets and other costs by type of farms

Type of fixed costs	45-day chicks		90-day pullets		Overall	
	Mean	SD	Mean	SD	Mean	SD
Housing	1,435.1	2,678.8	9,000.0	15,588.5	3,056.1	7,299.4
Feeder	231.9	114.8	1,239.0	1,094.9	447.7	615.2
Drinker	238.4	129.6	781.3	399.7	354.7	301.6
House rent	5,206.9	14,291.9	88,808.0	88,885.6	23,121.4	51,379.7
Interest on operating capital	2,545.5	3,697.7	0.0	0.0	2,000.0	3,419.4
Government fees	2,603.9	3,838.3	7,066.7	4,562.2	3,560.2	4,259.8
Total fixed costs	12,261.6	16,523.9	106,895.0	79,336.0	32,540.2	52,935.5

SD=standard deviation

5.3 Total value of production

Unlike the smallholder production system, estimating the values of products for mother units is straightforward. The main outputs for mother units are the sale of chicks and sale of manure. We estimated the average values of chicks produced using reported values of production and selling prices. However, the total number of chicks sold was adjusted for the loss of chicks due to mortality and damages. As a result, the total estimated income represents the income generated from the volume of sales reported by the producers. According to the producers, the average chick survival rate was 94.7%, representing a 5.3% loss due to disease and other hazards (Table 21). The reported average selling price of chicks was ETB67.3 for 45-day chicks and ETB109.2 for 90-day pullets. The difference in selling price could be associated with a difference in breeds, age and marketing locations. When chicks remain on a farm for longer due to several reasons, producers set higher prices to cover the additional costs.

Table 21: Mother units' total value of annual production by type of farms.

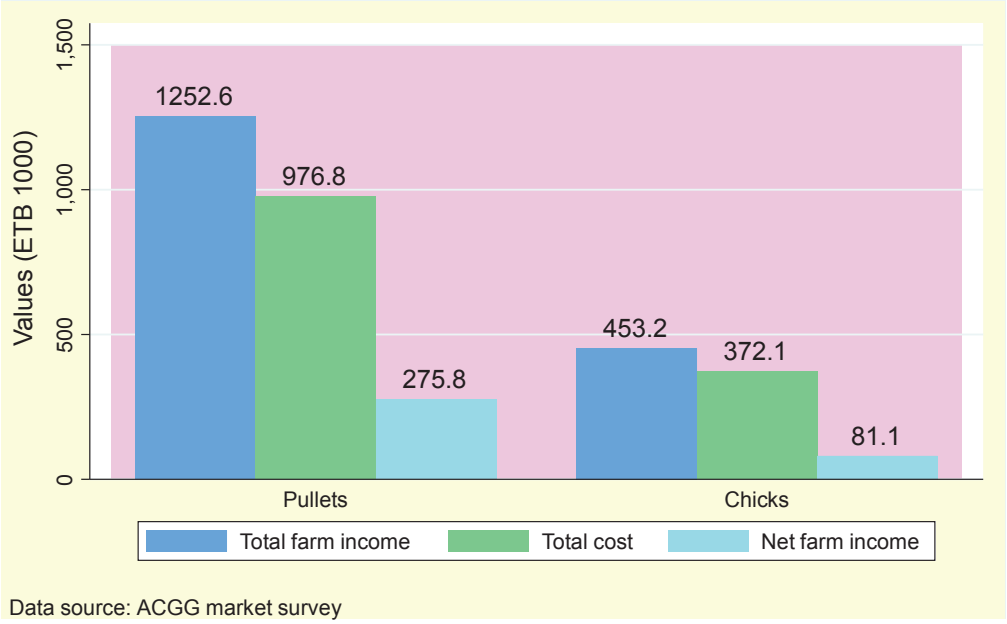
Production indicator	45-day chicks		90-day pullets		Overall	
	Mean	SD	Mean	SD	Mean	SD
Number at starter stage	1,530.9	936.6	4,016.7	3,449.8	2,063.6	1,904.2
Total number sold	1,452.3	872.4	3,846.7	3,544.9	1,965.4	1,886.3
Survival rate (%)	95.4	2.1	92.4	6.1	94.7	3.3
Average price (ETB/chick)	67.3	13.6	109.2	11.3	76.3	21.9
Total income (ETB1000/year)	453.2	305.6	1,252.6	1,017.9	624.5	589.2

SD=Standard deviation

5.4 Estimated annual NFI and farm profitability

Based on the above cost and revenue data, we applied a benefit-cost analysis to assess the profitability and economic viability of these farms (Figure 26 and Table 22). On average, 45-day chick producing mother units generated ETB81,100 per year NFI and the 90-day pullet farms generated ETB275,800 per year of NFI. The average GM for the 45-day chick producers was 21.6%, while for the 90-day pullet producers this was 41.3%. The difference in GM indicates the difference in the level of profitability between the two farms, which could be associated with the volume of production, cost of production, selling price and other factors such as access to support and services.

Figure 26: Estimated values of mother units average annual NFI by farm types



Data source: ACGG market survey

During the assessment, we learnt that mother units in the selected market sheds operate in two different ways. Some farms work independently as any other small-scale business and others work in partnership with commercial chick companies through a production agreement. While the independent farms undertake both the production and marketing decisions independently, the farms that work with commercial companies undertake the production and marketing activities based on the agreements made with the company, mother units and district level offices from the Ethiopian Ministry of Agriculture. For the latter farms, the price of inputs and outputs is determined by joint parties from the three groups and the marketing of chicks is conducted jointly by the three parties with predetermined prices. These farms use a government extension system to distribute chicks to producers. Despite the production and marketing support provided by different parties, however, farm operators believe that the selling price set by the trilateral agreement is low, and that they do not see an optimal profit based on their production costs. This can have serious implications for the sustainability of the farms and should be appropriately addressed.

Table 22: Summary of mother units benefit and cost analysis results

Type of chick	Indicators	Average values			
		Mean	SD	Min	Max
45-day chicks	GFI	93.3	65.6	23.5	263.3
	GM	21.6	9.2	11.3	36.7
	NFI	81.1	63.7	13.1	241.6
90-day pullets	GFI	382.7	108.3	257.7	450.0
	GM	41.3	20.0	18.3	54.8
	NFI	275.8	123.1	170.2	411.0
Overall	GFI	155.3	142.5	23.5	450.0
	GM	25.8	14.1	11.3	54.8
	NFI	122.8	111.0	13.1	411.0

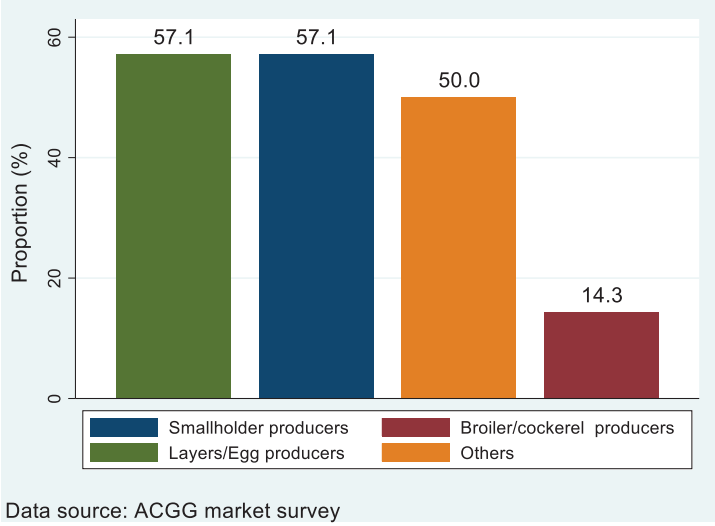
GFI and NFI are in ETB1000; GM is in %; SD=Standard deviation; Min=Minimum; Max=Maximum

5.5 Major buyers of chicks and price determination

The marketing of chicks is one of the most prominent issues in mother units. To better understand the marketing channels of produced chicks and pullets, we asked producers about their most important buyers. Accordingly, smallholder producers, broiler farms, layer farms and other buyers that include government agricultural agents, nongovernmental organisations and marketing agents were mentioned as the most important buyers. Among these, smallholder producers and layer farms or egg producers took the largest share (Figure 27). As indicated in the previous section, some mother units had an agreement with the government agricultural office that would distribute to smallholder farmers. Based on the demand assessment conducted, the government agricultural office participates in chick distribution. This enhances farmer access to chicks and producer access to rural markets. For independent farms, however, access to market can present challenges. Some mother units outlined significant challenges related to accessing smallholder producers and other better marketing opportunities in their area.

We also asked mother units about their low and peak selling months. Most identified November to January as peak selling seasons, associated with the suitability of the following months for chicken production due to favourable temperatures, lower level risk of predator attack and better feed sources. A higher demand for live birds and eggs in February to April may also be the cause of higher chick and pullet demand during these months. July and August were reported as the lowest selling months. The lower sales levels during these months might be associated with the presence of heavy rain, low temperatures and limited feed supplies which are less suitable for chicken production.

Figure 27: Proportion of chick/pullet buyers reported by sampled respondents



Data source: ACGG market survey

We asked mother units how they determine the price of chicks or pullets. Prices are determined either by the producers or collectively by producers, government agricultural offices and chick supplier companies. According to mother unit farms in the sample, producers and government take the first and second largest influence on price determination. Producers and buyers or negotiations based on a prevailing market conditions follow. However, the role of government agricultural offices in price determination is reported only in Wolaita market sheds. We asked producers if they used any grading or quality standards to determine the price of chicks. 50% reported using some grading criteria such as body weight or size, health status and physical conditions such as the absence of any deformity. The remaining 50% confirmed the absence of any grading or quality standards for price determination. The absence of grading and quality standards indicates the poor performance of marketing activities, affecting both mother units and producers.

5.6 Networks and collective action

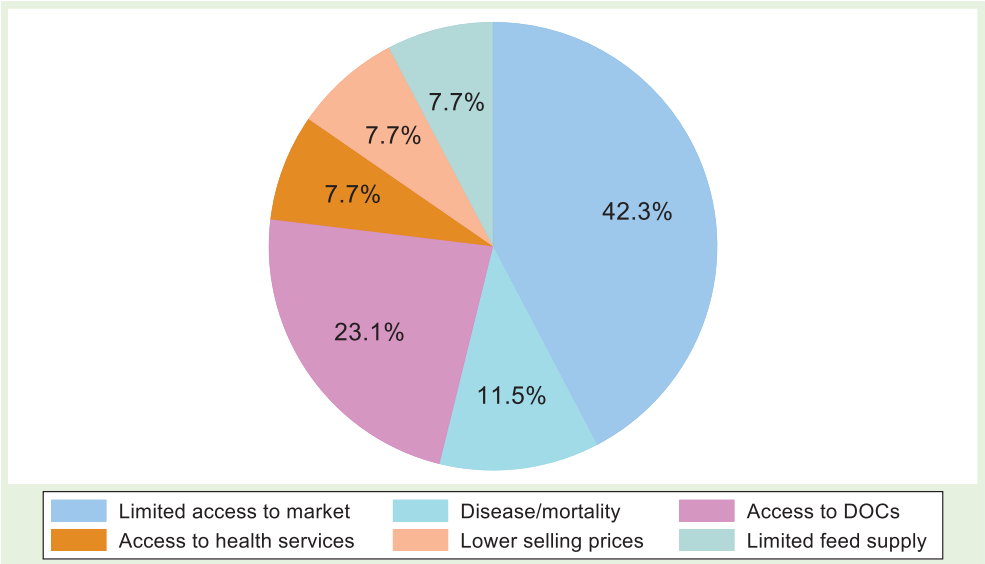
We asked producers if they had production or sale agreements with any actors along the poultry value chain. Only 50% said that they had at least one production agreement with any of their buyers. The remaining 50% had not had any production agreement in the previous 12 months. When we disaggregated the production agreement indicator by market shed, most of the producers were found in Wolaita market sheds. As indicated in section 5.5, since all sample respondents in this market shed were chick producers, most operated together with government agricultural offices and commercial chick producing companies. 35.71% of respondents reported that they had been a member of poultry production and marketing related associations in the previous 12 months. According to these producers, better access to market and access to credit were among the membership benefits.

5.7 Major challenges and opportunities in mother units

As an emerging business, mother units face various challenges. During this assessment, producers raised both production and marketing-related challenges. Limited access to the input and output market is the main challenge experienced by the sample mother unit farms. From the total challenges reported, limited market access to sell chicks (42.3%) and limited access to DOCs supply (23.1%) were the first and second most important (Figure 28). During our assessment, some of the mother units had no chicks due to the unavailability of DOCs in their area. Some farms explained that it usually took a longer time to get replacement DOCs because of the inadequate number of hatcheries. Furthermore,

disease, chick mortality, limited access to health services, limited feed supply and lower selling prices were reported as additional challenges facing the sector. The presence of these varied and multiple challenges suggests the need for integrated interventions in input and output markets to ensure commercial sustainability and enhance the production and productivity of smallholder chicken production and other small-scale poultry production in the country.

Figure 28: Major production and marketing constraints reported by mother units



Daya source: ACGG market survey

To better understand the perspectives of mother unit operators, we asked if they had perceived any opportunities in this business. A good and quick source of income and employment were identified as the main opportunities, followed by the presence of a good production environment and lower labour demand. As a solution to overcome challenges and exploit available opportunities, producers suggested the following interventions: strategic support from governmental or nongovernmental organisations, strengthening hatcheries, enhancing access to better output markets, improving awareness of rural households in improved breeds use, improving access to land, improving access to DOCs and feeds and improving the technical capacity of farm operators. Although economically viable as an emerging business, 45-day chick producers in particular would benefit from strategic support from input supply through to chick marketing.

6 Economic performance of small-scale layer producers

6.1 Production and productivity indicators

An increasing demand for eggs in urban and peri-urban areas has created opportunities for the emergence of small and medium-scale commercial layer farms in Ethiopia Nowadays, it has become common to see newly established commercial layer farms around major cities. These farms supply eggs to most of the urban population as well as hotels and restaurants in major cities. To understand the wider production and productivity status of these farms and their integration into the egg and live bird supply chain, we conducted a brief production and marketing assessment survey on selected small-scale commercial layer farms in the three market sheds. We collected data on production practices, production costs, main products produced, marketing activities, collective action and group membership and major challenges and opportunities in the sector.

Sampled layer farms kept Bovans Brown, Lohmann Brown and Sasso breeds during the assessment. Compared to others, the proportion of layer farms that kept Bovans Brown was higher in the three market sheds. Table 23 presents a summary of the reported number of months layer chickens took to start laying eggs, the number of months layers were kept in the farm and the duration of egg production. The average number of layers kept by sample farms was 1,490, with a minimum of 160 and a maximum of 5,000. On average, layers started laying at five months of age, with a minimum of four and a maximum of seven and a half months. Layers were kept for an average of 22 months on their farm. This means an average of 17 months per laying period, with a minimum of 10 and a maximum of 20 months. Compared with conventional commercial layer production, some of the sample farms appeared to keep layers for a shorter duration.

Table 23: Egg production and productivity of layer farms

Production indicators	Mean	SD	Min	Max
Days to start egg laying (months)	5.2	1.0	4.0	7.5
Length of keeping (months)	21.7	3.3	14.5	26.0
Egg laying duration (months)	16.5	3.0	10.0	20.0
Average number of layers	1,490.0	1,323.0	160.0	5,000.0

SD=Standard deviation; Min=Minimum; Max=Maximum

6.2 Cost of production

Type and value of variable inputs

Commercial layer production typically involves three cycles that include the chick/brooder stage, grower stage and layer stages. The cost of production can be associated with these three stages. The cost of production for farms that start with the chick stage may include the cost of DOCs, feed for the three stages, vaccination and antibiotics, brooding,

electricity, transport, labour and water, among others. However, some farms may start with pullets or point of lay pullets to avoid the risks associated with chick and grower stages. Table 24 presents a summary of the variable costs associated with the whole production cycle. Feed cost accounted for the largest proportion of TVC at 82.03%. As shown above, the overall feed cost is affected by the growth stage the layer farm starts production at. After feed costs, DOCs and hired wage costs took the second and third largest share. The minimum value (ETB28) for chicks represents the cost of DOCs, and the maximum value (ETB125) the cost of point of lay pullets. The average feed expense per bird for one production cycle was ETB714.09 with a minimum of ETB403.3 and a maximum of ETB985.5. The average TVC was ETB870.5 per layer, with a minimum of ETB549.5 and a maximum of ETB1,135.03. The higher variability in the cost of production could be associated with the difference in production duration, type of inputs used and management-related factors. The zero minimum values for some inputs indicate farms that did not use those inputs.

Table 24: Type and value of variable costs reported by sampled layer farms

Type of inputs	Values (ETB/layer)				Share (%)
	Mean	SD	Min	Max	
DOCs/pullets	67.15	40.00	28.00	125.00	7.71
Feed	714.09	189.31	403.27	985.50	82.03
Litter/wood shavings	0.82	0.79	0.17	2.50	0.09
Brooding	0.51	1.03	0.00	3.60	0.06
Electricity	9.76	8.16	0.00	23.00	1.12
Vaccination	3.73	5.57	0.00	18.00	0.43
Antibiotics	2.13	1.94	0.04	6.00	0.25
Transport	11.15	13.37	0.00	38.40	1.28
Water	3.80	4.27	0.00	13.00	0.44
Hired wage	56.61	45.96	0.00	172.13	6.50
Miscellaneous	0.74	1.38	0.00	4.35	0.08
Total variable cost (TVC)	870.50	199.19	549.55	1,135.03	100.00

SD=standard deviation; Min=minimum; Max=maximum

Average annual depreciation costs of fixed assets

The annual depreciation costs of major fixed items such as housing, cages, feeders and drinkers were estimated using reported values of purchase or construction costs. A summary of the estimated values is presented in Table 25. The overall estimated depreciation costs for poultry houses/sheds, feeders and drinkers were ETB7.1, 0.5 and 0.4 per layer, respectively. On average, the total depreciation cost for the above assets during one production cycle was ETB7.9 per layer. However, as indicated by the SD of the mean, there is strong variability among different farms that may be associated with the type and quality of the fixed assets used. The other reported fixed costs include house rent, government payments (tax) and interest on borrowed capital. These costs were zero for some farms and extremely high for those that used rented houses, borrowed money and paid taxes. On average, the total annual fixed cost was ETB36.4 per layer, with significant variability among farms mainly associated with other fixed costs.

Table 25: Depreciation costs of major fixed assets reported by sampled layer farms

Poultry shed/cages	Depreciation cost (ETB/layer)			
	Mean	SD	Min	Max
	7.07	10.71	0.00	38.65
Feeders	0.50	0.35	0.04	1.20
Drinkers	0.39	0.26	0.07	1.08
Other fixed costs	28.47	40.01	0.00	120.55
Total fixed asset	36.36	40.92	3.61	122.00

SD=Standard deviation; Min=Minimum; Max=Maximum

6.3 Total value of production

The average income generated from layer farms depends on the type of products and other by-products sold during the production season. Layer farms generate income from the sale of three products: eggs, spent hens and manure. Although the first two products are the most common, the income generated from the sale of manure may increase proportionally with flock size and farm location. The average value of income generated from eggs was estimated using the reported number of eggs produced and their sale prices. Similarly, the average value of spent hens was estimated using the number of spent hens and their sale prices. Income generated from the sale of manure shows the average amount of reported income generated in a month. Table 26 presents a summary of the sources and the estimated average amount in one production cycle. The average amount of income generated from the sale of eggs, spent hens and manure was ETB1,226.5, 112.3 and 8.5 per layer, respectively. On average, layer farms generated ETB1,347.9 per layer, with a minimum of ETB972.7 and a maximum of ETB1,828.5 per layer. All the sample farms generated income from the sale of manure, with a minimum of ETB4.5 and a maximum of ETB18.0 per layer.

Table 26: Source and amount of income generated by sampled layer farms

Source of income	Income (ETB/layer)			
	Mean	SD	Min	Max
Sale of eggs	1,226.5	261.2	900.0	1,740.0
Sale of spent hens	112.3	53.0	55.0	200.0
Sale of manure	8.5	3.1	4.5	18.0
Total income	1,347.4	245.2	972.7	1,828.5

SD=Standard deviation; Min=Minimum; Max=Maximum

6.4 Estimated annual farm income and profitability

As with commercial farms, the sustainability of layer farms depends on their economic performance. Using the income and production cost data listed above, we estimated the overall economic performance of sample layer farms using conventional benefit-cost analysis techniques. On average, layer farms generated ETB476.9 and 461.1 per layer in GFI and NFI, respectively (Table 27). The overall GM was 32.8%, with a minimum of 11.0% and a maximum of 57.1%. From the estimated benefit and cost indicators, it is possible to say that most of the layer farms are economically viable. Furthermore, the significant variation observed in the incomes of different layer farms suggests the presence of opportunities to enhance the efficiency of some farms.

Table 27: Summary of benefit and cost analysis results for sampled layer farms

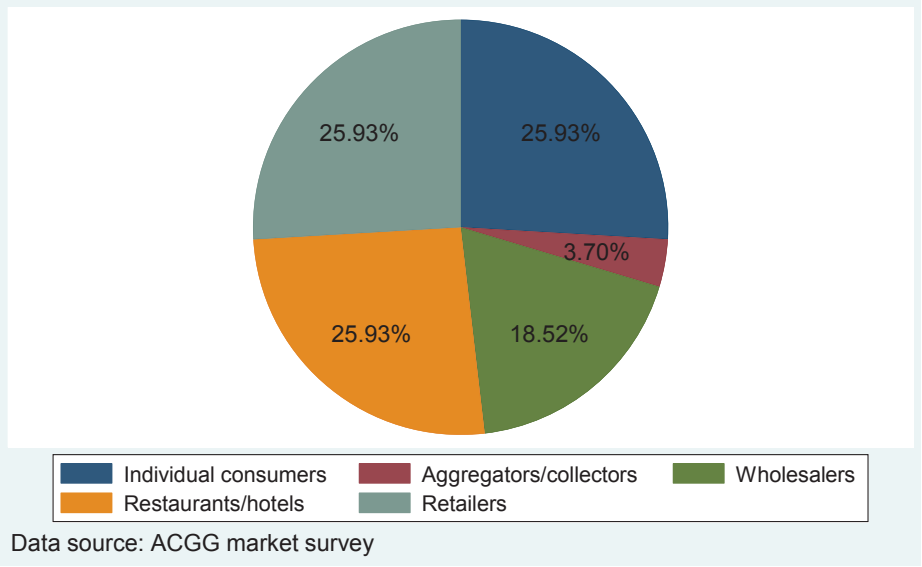
Income/cost	Amount (ETB/layer)			
	Mean	SD	Min	Max
Total income	1,347.4	245.2	972.7	1,828.5
Total cost	886.3	202.3	551.6	1,152.8
GFI	476.9	209.8	146.1	943.5
NFI	461.1	210.7	138.5	938.9
GM (%)	32.8	13.7	11.0	57.1

SD=Standard deviation; Min=Minimum; Max=Maximum

6.5 Major buyers of eggs and price determination

The amount of income generated by layer production depends on access to better markets and price determination mechanisms. Exploring the possible types of buyers and price formation mechanisms helps to understand the presence of incentives for producers to actively engage in the marketing of poultry products. Layer farms reported diverse types of buyers that include individual consumers, aggregators, wholesalers, retailers and restaurants/hotels (Figure 29). From the total proportion of reported buyers, individual consumers, retailers and hotels/restaurants were the three most common buyers of eggs, representing 77.8% of all reported buyers. Aggregators were reported by the smallest number of layer farms.

Figure 29: Main types of egg buyers reported by layer farms



Data source: ACGG market survey

Producers (53%), hotels/restaurants (33.3%) and market conditions (13.3%) are the three major reported actors who determine the price of eggs. Although producers and buyers are involved in the price determination process, the final selling price is usually reached through bargaining. From total sampled respondents, 46.7% of them reported that the price is determined through negotiation. However, compared to smallholder producers, layer farms are more involved in price determination. Moreover, the role of traders in price determination seems extremely limited. According to layer farms, egg size (93.3%), shell colour (46.7%), breed type (33.3%), yolk colour (33.3%) and eggshell strength (13.3%) are the most important criteria used to determine egg prices. Furthermore, some producers highlighted the significant role of egg freshness in the price determination process. However, most have shown the important role of the market situation and supply and demand in determining the volume of sale and selling prices.

6.6 Networks and collective actions

Unlike smallholder producers, commercial farms usually have better networks and collective actions. Layer farms were asked if they had had any production or sale agreements with any of the value chain actors in the previous 12 months. Only 13.3% of the layer farms said that they had held at least one production agreement. Similarly, 20.0% of the farms indicated that they had been a member of an association related to poultry production and marketing. Better access to credit and training were mentioned as the benefits obtained from these memberships. The above figures suggest only a small proportion of the commercial layer farms have a network with other value chain actors, which suggests the need for interventions to strengthen the integration actors along the value chain.

6.7 Major challenges and opportunities in layer production

Commercial layer farms highlighted different production and marketing constraints present in their areas. Limited access to the market (80%) and high feed cost (53.3%) were the first and second most important challenges reported by sample layer farms. Producers indicated that if the recurring increase in feed cost continued into the future, it would hamper the production of eggs in the country. Some producers referred to feed adulteration by certain retailers as another challenge associated with feed supply. According to these producers, some feed retailers mix low-quality feed with commercial feed produced by major feed mill companies which they then sell to poultry farms. This affects the quality and quantity of eggs produced. The observed high feed cost could be associated with an underdeveloped feed production system that in turn increases production costs (Nzeka 2019). High production costs associated with increasing inflation rates has led to an increase in egg prices, resulting in lower demand. Limited access to other inputs such as health services, high disease incidence and shortage of capital was also reported as a challenge by some of the layer farms surveyed.

Producers identified a good production environment, better income and quick return on investment as the major opportunities in layer farm production. Producers have shown that the presence of favourable weather conditions, government support and availability of important infrastructure components such as water and electricity as good opportunities in the sector. Some highlighted the role of layer farms in generating better income and employment opportunities for their families. The short production cycle of layer farms is considered an advantage by some layer farms. To exploit available opportunities in the sector, producers suggested the need to improve access to land, access to inputs such as feed and health, financial services and market opportunities as important interventions for the future. As shown above, some layer farms operate in rented housing and improved access to land could be among the most important interventions to be considered in the sector.

7 Economic performance of small-scale broiler farms

An increasing demand for poultry meat due to population growth, urbanisation and a consumer preference for poultry products should enhance meat production and productivity in the smallholder and commercial production sector. This causes the emergence of small and medium scale broiler chicken farms in various parts of the country. The emergence of this part of the sector has been enhancing the supply of poultry meat to growing populations in urban and peri-urban areas. During this assessment, we interviewed randomly selected small-scale broilers farms to assess their production and marketing activities. Sample producers were asked about their production, marketing strategies and challenges and opportunities in the sector. In the following sub-sections, we present a summary of the major findings of this assessment. Due to some differences in input use and overall production practices between commercial line broilers and dual-purpose breeds, we disaggregated the indicators by these two categories.

7.1 Average level of production

Sample respondents were asked about the average number of production days and cycles in the previous 12 months. The average number of days commercial broilers lines took to reach slaughter was 46, with a minimum of 45 and a maximum of 50 (Table 28). However, dual-purpose breeds took 95 days on average, with a minimum of 75 and a maximum of 120 days. A higher day to slaughter rate for dual-purpose cockerels was expected, due to the slower growth rate of these breeds compared to commercial lines. On average, sample commercial broiler producers produced four batches per year with a minimum of three and a maximum of five batches. Similarly, dual-purpose cockerel producers produced three batches per year, with a minimum of two and a maximum of four batches. According to sample respondents, some broiler farms target only major annual holidays for marketing.

Table 28: Days to slaughter and number of batches for sampled broiler farms

Type of breed	Number of batches				Days to slaughter			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Broilers	3.8	1.1	3.0	5.0	46.0	2.2	45.0	50.0
Dual purpose	3.0	0.6	2.0	4.0	95.0	15.5	75.0	120.0
Total	3.4	0.9	2.0	5.0	72.7	27.9	45.0	120.0

SD=Standard deviation; Min=Minimum; Max=Maximum

Table 29 presents a summary of the number of broilers produced in earlier batches. The average number of chicks used in the starter stage in dual-purpose farms is far lower than the number used in commercial line broiler farms. On average, dual-purpose farms had about 84.0 chicks/batch at the starter stage, with a minimum of 30 and a maximum of 150. At the finisher stage, they had 76 chicks/batch, with a minimum of 27 and a maximum of 144. The average survival rate for these farms was 91.5%, which represents an average loss of 8.5% from disease and other issues. Commercial line broiler farms

had 1,500 chicks/batch at the starter stage, with a minimum of 1,000 and a maximum of 2,500. At the finisher stage, the average number of broilers was 1,416, with a minimum of 890 and a maximum of 2,367. The average survival rate for these farms was 93.9%, with a minimum of 89% and a maximum of 100%. Compared to dual-purpose breeds, the survival rate of chickens in commercial lines appears better. This could be associated with a shorter production duration, better management and access to vaccines and drugs in commercial line broiler farms.

Table 29: Average amount of broilers produced in one batch by type of broilers

No. of chicks	Broilers		Dual-purpose		Overall	
	Mean	SD	Mean	SD	Mean	SD
No. of starters	1,500.0	612.4	83.7	57.6	727.5	835.9
No. of finishers	1,416.4	597.8	76.0	52.4	685.3	796.4
Proportion sold (%)	93.9	4.0	91.5	5.3	92.6	4.7

SD=Standard deviation

7.2 Cost of production

Type and value of variable inputs

One of the most important goals of this assessment was to identify the major types of costs involved in broiler production. Table 30 presents a summary of the variable costs of the two groups of sample broiler farms. From the TVC, the cost of feed accounted for 56.2% for commercial line chickens and 56.6% for dual-purpose chickens. At 28.8%, the cost of DOCs takes the second-largest share for both farm types. The remaining costs may include vaccinations, antibiotics, litter, hired wages, transportation, electricity and other miscellaneous costs. Some of the costs that are necessary for commercial line broilers may not be relevant for dual-purpose producers. For example, since dual-purpose cockerel producers usually start with 45-day old chicks bought from mother unit farms, they do not have higher brooding and vaccination costs. This could be examined from the reported prices of DOCs and cost of brooding. The average production TVC was ETB100.42 per broiler for commercial line producers and ETB174.3 per cockerel for dual-purpose producers.

Table 30: Type and value of variable costs reported by broiler farms

Type of cost	Values (ETB/broiler)								Share (%)
	Broilers		Share (%)	Dual purpose		Share (%)	Overall		
	Mean	SD		Mean	SD		Mean	SD	
DOCs	28.96	3.83	28.84	50.17	8.33	28.78	40.53	12.77	28.80
Feed	56.46	12.68	56.22	98.65	31.88	56.60	79.47	32.53	56.48
Litter	5.13	10.18	5.11	3.06	3.86	1.76	4.00	7.08	2.84
Brooding cost	0.35	0.13	0.35	0.00	0.00	0.00	0.16	0.20	0.11
Electricity	1.17	0.48	1.16	1.33	3.27	0.76	1.26	2.33	0.89
Vaccination	2.21	1.08	2.20	0.85	1.36	0.49	1.47	1.38	1.04
Antibiotics	1.38	1.13	1.37	5.58	3.33	3.20	3.67	3.30	2.61
Transportation	2.82	3.33	2.81	2.24	4.18	1.29	2.50	3.65	1.78
Water	0.70	0.82	0.70	0.27	0.65	0.15	0.46	0.73	0.33
Hired wage	1.12	1.04	1.12	11.67	14.77	6.69	6.87	11.83	4.88
Miscellaneous	0.13	0.28	0.12	0.48	1.17	0.27	0.32	0.86	0.23
Total	100.42	14.33	100.00	174.30	41.36	100.00	140.72	49.25	100.0

SD=Standard deviation

Average annual depreciation cost of fixed assets

The overall production cost at broiler farms includes fixed costs such as housing, feeders, drinkers and other annual fixed costs including house rent and government fees. We estimated the annual depreciation cost using the reported values of the cost of construction/purchase and longevity of assets. The summary of the estimated annual depreciation cost of houses/sheds and other fixed costs is presented in Table 29. The average annual housing/shed costs was ETB8,590.9 per year for commercial line producers and ETB688.7 per year for dual-purpose breeds (Table 31). A larger difference in the two farms is linked to the scale of production and size of farms. The average annual depreciation costs for feeders was ETB1,143.9 and 68.4 per year for commercial line and dual-purpose breeds, respectively. Similarly, the average annual depreciation costs for drinkers was ETB788.2 and 64.1 per year for commercial line and dual-purpose breeds, respectively. The reported values for other estimated costs look high for commercial line broiler producers due to the cost of house rents and government taxes. The overall average total annual cost of fixed assets was ETB37,466.7 per year for commercial lines and ETB1,873.1 for dual-purpose breeds. However, the summary indicates a high variability in the value of different costs. These may be associated with the size and quality of houses, place of construction and other input related factors.

Table 31: Depreciation cost of major fixed assets in broiler farms

Type of cost	Annual depreciation costs					
	Broilers		Dual-purpose		Overall	
	Mean	SD	Mean	SD	Mean	SD
House/shed	8,590.9	5,154.5	688.7	370.3	3,652.0	4,939.2
Feeder	1,143.9	510.8	68.4	56.0	557.2	649.2
Drinker	788.2	603.9	64.1	92.1	393.3	541.4
Other fixed costs	30,380.0	38,637.1	1,166.7	2,401.4	14,445.5	28,857.6
Total cost	37,466.7	41,309.0	1,873.1	2,314.0	18,052.0	32,105.6

SD=Standard deviation

7.3 Estimated annual farm income and profitability

Like any other farm, the economic performance of broiler farms can be measured using the reported values of inputs and outputs. The major outputs from broiler farms are live birds, estimated from the reported number of chicks at the starter and finisher stages. The other output is manure, which can be estimated from the reported amount and value of sales. The average total annual income generated from commercial line broilers was ETB996,480 while the income for dual-purpose farms was ETB71,410 (Table 32). On average, commercial line broiler farms each generated ETB441,130 GFI and ETB403,670NFI per year. Likewise, dual-purpose farms generated ETB25,750 GFI and 23,880 NFI per year. The lower NFI of dual-purpose breed holders is associated with their smaller production volume and scale of operations, as shown above.

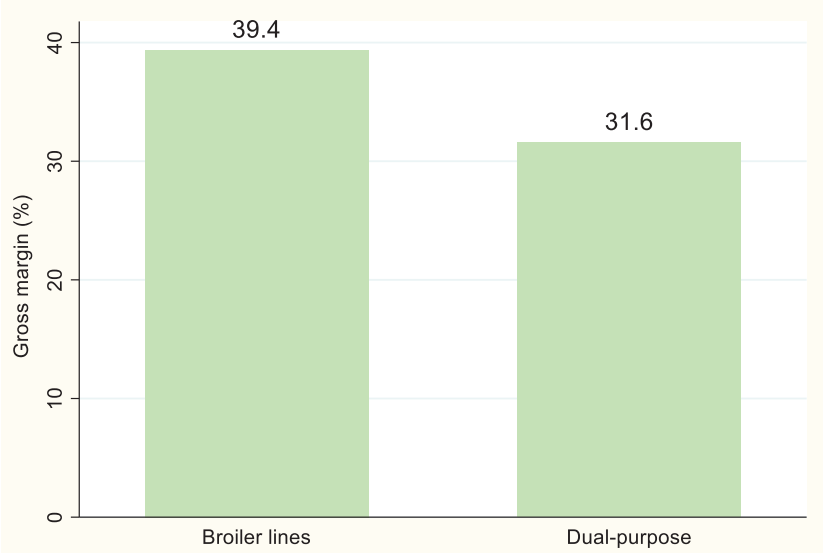
Table 32: Total annual farm income and cost of broiler production (ETB1000)

Income/cost	Com. broilers		Dual-purpose		Overall	
	Mean	SD	Mean	SD	Mean	SD
Total income	996.48	730.13	71.41	81.55	491.9	670.78
Total variable cost	555.34	282.32	45.66	45.95	277.33	322.16
Total cost (variable + fixed)	592.81	316.49	47.53	46.52	295.38	349.62
Gross farm income	441.13	467.26	25.75	37.33	214.56	367.54
Net farm income	403.67	428.14	23.88	37.26	196.51	336.68

SD=standard deviation

We estimated the GM of each farm to highlight their economic performance. The overall average GM generated by both types of farm was 35.1%. When the estimated GM is disaggregated by breed type, commercial line broiler farms generated 39.4% while dual-purpose breed farms generated 31.6% (Figure 30). This shows that commercial line broiler producers generate a higher return than dual-purpose breed users. Among others, the main reason for this variation could be a higher survival rate of chicks at broiler lines and the economies of scale due to a higher volume of production. In general, broiler/cockerel production generates modest income for the producers. According to some sample respondents, this production can be considered as a business opportunity that requires low investment while generating a quick return. If there is better access to market, broiler production can generate good returns within a short period.

Figure 30: Estimated Gross Margin of broiler farms by type of breed



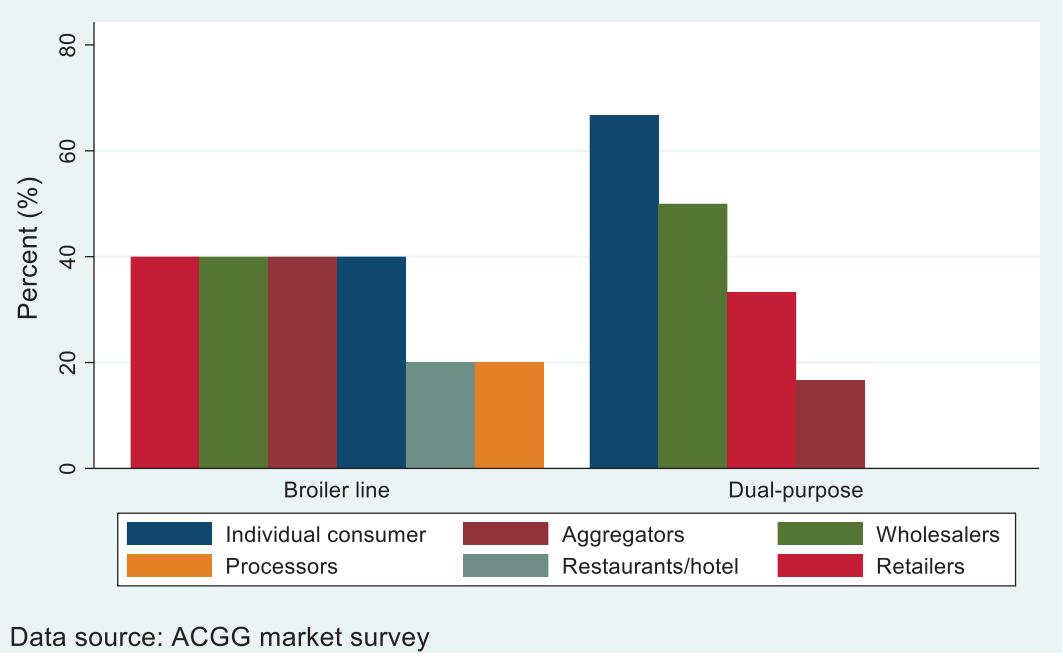
Data source: ACGG market survey

7.4 Major buyers of broilers and price determination

Broiler farms indicated that they have diverse marketing channels for their products. This includes individual consumers, aggregators, traders (wholesalers and retailers), processors and restaurants and hotels. From the total observations, 54.5% indicated individual consumers as the main buyer followed by wholesalers (45.4%), retailers (36.3%) and aggregators (27.3%). Restaurants, hotels and processors were mentioned by a small proportion of producers. Since the sample broiler farms are small-scale producers, most targeted individual consumers as the main buyers of their products. When we disaggregate the buyers by type of broiler farm, a higher proportion of dual-purpose chicken producers sell to individual consumers and wholesalers compared to commercial broiler lines (Figure 31). On the other hand, restaurants, hotels and processors were reported as potential buyers by commercial line broiler producers, indicating better access to diverse marketing channels than dual-purpose producers. However, the overall marketing channels used in small-scale commercial broiler production show that they target local consumers characterised by highly seasonal consumption patterns.

Producers (73.3%) and consumers (18.2 %) were the two main reported actors who determine the price of live birds. Unlike smallholder producers, broiler farms had more say in price determination, and the role of traders in price determination seems extremely limited. Producer (45.5%), also reported that they negotiate with their buyers to determine the final price. Compared to smallholder farmers, a higher proportion of broiler farms (45.5%) indicated the presence of standardisation and grading systems during the marketing of live birds. According to sample broiler farms, live weight or body size (100%), health status (72.7%), breed type (63.6%) and plumage colour (18.2%) were the most important criteria used to determine the price of live birds.

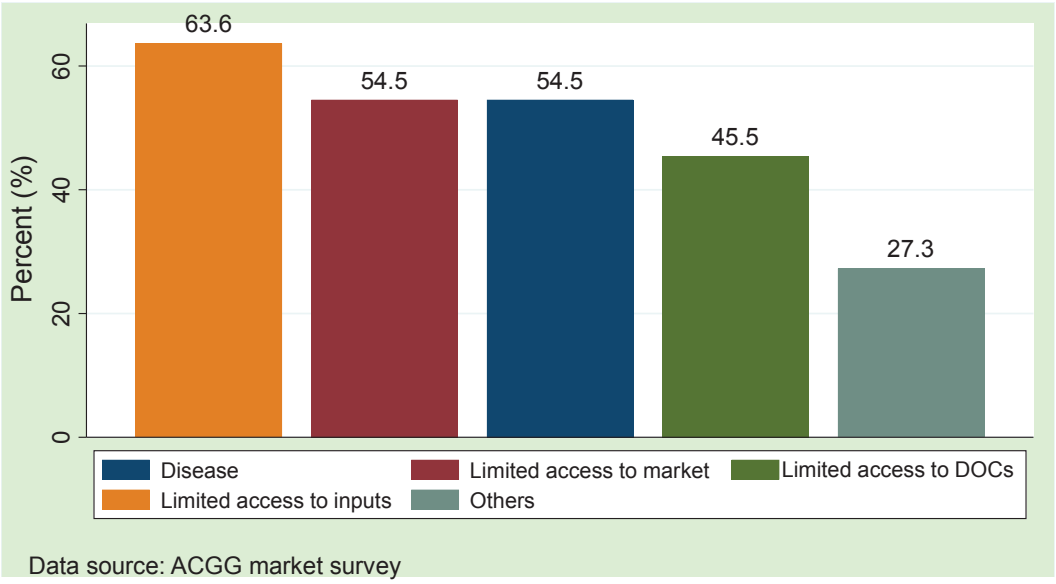
Figure 31: Proportion of broiler buyers reported by sampled respondents



7.5 Challenges and opportunities in broiler production

As an emerging business, small-scale broiler producers experience different challenges either during production or marketing. We asked sample respondents to indicate the three most important challenges during the production and marketing of broiler chickens. Limited access to inputs such as feed and health services was the first main constraint (63.6%), followed by disease and limited access to output markets (54.5%) (Figure 32). Limited access to DOCs was reported as the main constraint by 45.5% of sample respondents. During the assessment, we observed that some farms did not have any chicks due to a lack of replacement stock, similarly to mother unit farms. This imbalance between supply and demand leads producers to wait months to get replacement chicks from hatcheries. This is due to an inadequate number of commercial farms that produce enough chicks for the increasing number of broiler farms in the area.

Figure 32: Major broiler production and marketing constraints reported by producers



Considering their previous experiences, we asked producers about the most important production opportunities they perceived from broiler farming. The majority of producers (81.8%), considered it a very good source of income. Others viewed it as a good business that generated income quickly. Producers reported the availability of a conducive environment such as suitable weather and the availability of water as great opportunities. The sector's role in job creation, more specifically for young people, was an important consideration. Furthermore, the contribution to their own consumption was indicated as an opportunity by some producers. Producers, especially those who keep dual-purpose breeds, showed that they are using some broiler chickens for their own consumption.

8 Other marketing actors

The role of marketing in enhancing the production and productivity of the poultry sector is indispensable. Success in production and productivity without the right marketing strategies is prone to failure. Given higher level input use and limited access to market, higher production, and productivity without adequate marketing strategies may not result in a sustainable gain in income (Michler et al. 2018). A farmer who improved his productivity using improved technologies and better production practices would have little incentive to continue using technologies if there is limited access to market. Better access to market, therefore, needs to be an integral part of any research and development intervention, especially in developing countries. Diverse marketing opportunities help to enhance not only the production and productivity of the sector but serve as an incentive to adopt better production practices and improved technologies.

Poultry product marketing in Ethiopia involves various marketing actors such as aggregators, wholesalers and retailers. During this brief assessment, we interviewed these marketing actors that participate in moving live birds and eggs from the farm gate to other middle actors or final consumers. Data on source of supply, main buyers, marketing costs and pricing mechanisms were collected from each actor. These actors may operate with the same or different types of producers at a different level with specific or multiple roles. For instance, aggregators may not only collect and sell products to retailers or wholesalers but sometimes they may sell directly to consumers. In most places, wholesalers also sell products to consumers. In the following section, present summaries of the main findings and observations for each actor.

8.1 Live chicken aggregators/collectors

Aggregators or collectors are those traders who buy live birds and eggs from smallholder producers at the farm gate and sell to either retailers or wholesalers in central markets. they typically move from village to village and collect live birds or eggs from producers. They play a significant role in the smallholder chicken production system as they help to move products from the farm gate to central markets. As indicated above, aggregators are buyers of eggs and live birds from small-scale commercial producers. However, due to their limited availability during this market chain assessment, we were able to interview only very few live bird aggregators. We discussed their marketing activities more specifically on the type of suppliers, major buyers, selling and buying prices and major challenges and opportunities in live bird aggregation.

Sources of live chickens, major buyers and price margins

Sample aggregators participate in the marketing of products either as a part-time or full-time job. Their major suppliers are smallholder producers and small-scale commercial producers. They consider January, April and September as the main peak supply season for live birds. Aggregators mostly sell live birds to wholesalers in the central market and sometimes directly to individual consumers, restaurants and hotels. Aggregators collect local and dual-purpose improved birds from smallholder producers. On average, they bought an average-sized chicken for ETB200.37 (±49.1) and sold it for

ETB245.52 (±40.27). However, they incurred costs for feed, labour, transportation and sometimes government fees. The overall average marketing cost per bird was ETB5.1 (±2.4). Considering these marketing costs, aggregators generated a 16.3% gross marketing margin. However, since some aggregators sell directly to consumers and hotels, they could get a higher return per bird.

Challenges and opportunities reported by aggregators

The sample aggregators explained the presence of different marketing challenges during live bird collection and selling. Bird mortality, limited transportation facilities, lack of proper marketing places and fluctuating market demand were the main challenges raised during the discussion. One respondent, for example, said that on average he usually experienced a 5% mortality rate from the total purchase. High disease incidence or bird mortality could be resulted from the absence of proper biosecurity measures at the producer level, poor transportation facilities and inadequate management after purchase. As a potential solution, aggregators suggested the need for government or nongovernmental organisation support in improving health services at the producer level and enhancing transportation facilities. Furthermore, organizing aggregators and creating better market linkages were also suggested by the respondents as a solution to enhance their access to better marketing opportunities. Despite the above constraints and challenges, aggregators felt that their business had created employment opportunities and helped them to generate modest income to support their families.

8.2 Live chicken wholesalers and retailers

Source of live chicken supply

Wholesalers and retailers are the other key actors involved in live birds marketing in the three market sheds. Wholesalers are traders who buy live birds from different suppliers and sell in bulk to consumers or other traders such as retailers. Retailers buy live birds either from producers or other traders such as wholesalers or aggregators and sell directly to consumers. Although they may sometimes have overlapping roles, each of these actors has a distinct function along the value chain. During our assessment, we asked these traders about their suppliers, the share of supply from each source, buying and selling prices, their main buyers, price determination mechanisms, collective actions and membership of different associations and possible challenges and opportunities.

Table 33 presents a summary of the main live bird suppliers for each trader. Both wholesalers and retailers bought live birds from smallholder producers, small-scale commercial producers and aggregators. Some retailers and wholesalers buy from other wholesalers. However, most wholesalers and retailers get their supply from smallholder producers. The proportion of retailers and wholesalers that buy live birds from smallholder producers was 82.4 and 88.9%, respectively. Next to smallholder producers, aggregators were the main suppliers of live birds to both wholesalers and retailers. Although the proportion of producers was small, small-scale commercial producers supplied both wholesalers and retailers. However, none of them reported large-scale commercial producers as potential suppliers. This could be associated with the limited availability of large-scale commercial farms in the country.

Table 33: Sources of live chickens reported by traders

Type of suppliers	Retailers (%)		Wholesalers (%)		Total	
	Yes	No	Yes	No	Yes	No
Smallholder producers	82.4	17.6	88.9	11.1	84.6	15.4
Small-scale commercial producers	17.6	82.4	22.2	77.8	19.2	80.8
Aggregators	23.5	76.5	55.6	44.4	34.5	65.5
Retailers	0.0	100.0	0.0	100.0	0.0	100.0
Wholesalers	17.6	82.4	11.1	88.9	15.4	84.6

Average quantity bought and buying price

Considering the seasonality of chicken supply as shown in the previous section, we asked wholesalers and retailers about the average quantity bought and buying price during the peak, average and low supply seasons. This helped us to estimate the annual average value of supply for the previous 12 months. On average, retailers bought 687 chicken/month, while wholesalers bought 1,074 chicken/month (Table 34). For retailers, the largest volume of live birds was supplied by smallholder producers, followed by wholesalers and aggregators. Although smallholder producers were the main source of supply for wholesalers, the largest volume was supplied by aggregators. Compared to retailers, the volume of live birds supplied by small-scale commercial producers was higher for wholesalers. The higher SD for the average reported values suggests the presence of significant variability in the volume of purchase that may depend on the capacity of traders and market shed they work in.

Table 34: Average number of live chickens bought per month

Type of source	Retailers				Wholesalers			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Smallholder producers	291.4	520.6	0.0	2,000.0	276.9	188.9	0.0	516.7
Small-scale commercial	50.5	143.3	0.0	550.0	148.2	337.9	0.0	1,000.0
Aggregators	82.8	268.4	0.0	1,100.0	625.7	848.7	0.0	2,580.0
Wholesalers	261.8	930.1	0.0	3,850.0	23.0	68.9	0.0	206.7
Overall	686.5	1,336.9	23.3	5,500.0	1073.7	993.1	126.7	2,580.0

SD=standard deviation; Min=minimum; Max=maximum

Data on the price of live birds shows existing difference in buying prices between retailers and wholesalers. The average buying price for retailers was higher than for wholesalers. This was to be expected, due to a higher volume of purchase by wholesalers which usually leads to a lower price offer. The average buying price for retailers was ETB176.6 per chicken, with a minimum of ETB165.6 from small-scale commercial producers and ETB221.7 from aggregators (Table 35). For wholesalers, the average buying price was 155.2 per chicken, with a minimum of ETB120.0 from small-scale commercial producers and a maximum of ETB158.8 from smallholder producers. The lower buying price from small-scale commercial producers than smallholder producers could be associated with the type of birds and volume of purchase. For instance, small-scale commercial producers usually supply spent hens that typically fetch a lower price than local cocks due to their old age and poor physical condition.

Table 35: Average buying price of live chickens (ETB/chicken)

Source of supply	Retailers		Wholesalers		Overall	
	Mean	SD	Mean	SD	Mean	SD
Smallholder producers	171.4	24.1	158.8	32.7	166.8	27.4
Small-scale commercial	165.6	81.7	120.0	84.9	147.3	75.9
Aggregators	221.7	52.5	146.5	27.6	174.7	52.3
Wholesalers	192.5	48.3	-	-	192.5	48.3
Overall	176.6	34.5	155.2	34.1	169.2	35.2

SD=standard deviation

Type of buyer, quantity sold and average sale price

The main types of buyers reported by wholesalers and retailers include individual consumers, restaurants and hotels, processors and other retailers and wholesalers. All the retailers surveyed indicated that individual consumers are their most important buyers (Table 36). Next to individual consumers, hotels, restaurants and other retailers were reported by retailers as other types of buyer. Unlike retailers, the major types of buyer for wholesalers were retailers, other wholesalers

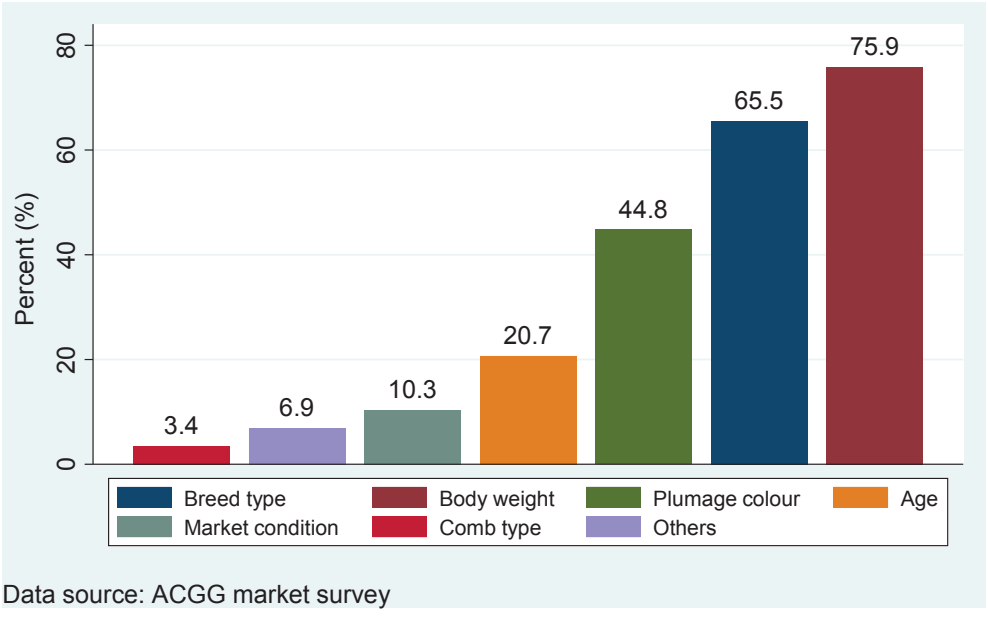
and individual consumers. Only very few wholesalers indicated individual consumers as buyers. The trade among wholesalers was expected, especially between intermediate and primary market sheds. This is a common practice, especially during holidays and festive seasons. The average selling price of both retailers and wholesalers was about ETB206.41 per chicken. The average selling price was higher for individual consumers, followed by restaurants and hotels. Lower selling prices for wholesalers followed by retailers was expected. A higher variability in selling prices could be associated with breed type, age and body size or weight, as previously indicated.

Table 36: Major types of chicken buyers and selling prices reported by traders

Type of buyer	Type of trader						Selling price (ETB)	
	Retailers		Wholesalers		Overall			
	Yes	No	Yes	No	Yes	No	Mean	SD
Individuals Consumers	100.0	0.0	11.1	88.9	69.2	30.8	216.57	42.23
Restaurants/hotels	11.8	88.2	0.0	100.0	7.7	92.3	208.33	25.93
Processors	0.0	100.0	0.0	100.0	0.0	100.0	-	-
Institutional buyers	5.9	94.1	0.0	100.0	3.8	96.2	-	-
Retailers	11.8	88.2	66.7	33.3	30.8	69.2	193.89	44.57
Wholesalers	0.0	100.0	33.3	66.7	11.5	88.5	177.08	14.43
Overall							206.41	43.19

According to sample traders, the price of live birds was determined by producers (48.3%), market conditions (31.0%), wholesalers/retailers (31.0%) and aggregators (17.2%). Furthermore, about 61.7% indicated the presence of quality standards or informal grading techniques to determine the price of live birds. Bodyweight (75.9%) and breed type (65.5%) were the two most important criteria used to determine the price of live birds (Figure 33). Moreover, traders highlighted the importance of plumage colour and the age of chicken in price determination.

Figure 33: Criteria used to determine prices of live chickens reported by traders

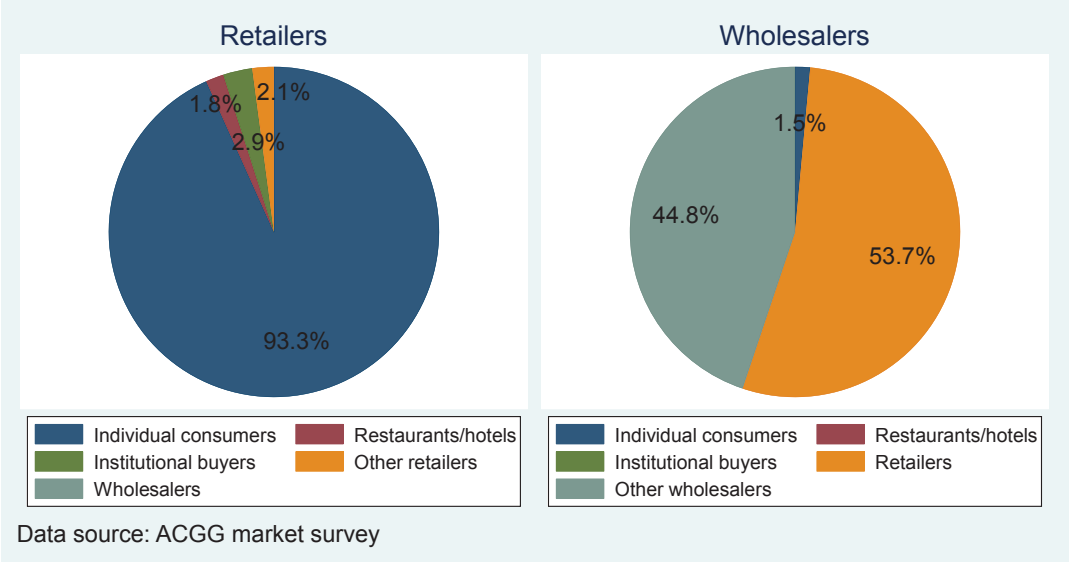


Data source: ACGG market survey

Figure 34 presents the volume of live birds sold to different buyers. Retailers sold 93.3% of live birds to individual consumers and the remaining 6.7% to other retailers, restaurants, hotels and institutional buyers. Unlike retailers, wholesalers sold the largest proportion (53.7%) to retailers, with the remaining 44.8% and 1.5% sold to other wholesalers and individual consumers, respectively. Wholesalers sold a very low proportion of live birds to individual consumers. The

type of buyer and volume of sale data indicate that live bird marketing mainly targets individual consumers, and that the proportion that goes to restaurants/hotels and other institutional buyers is marginal. This suggests the need for designing an innovative intervention to diversify existing marketing channels that consider enhanced production and productivity at the smallholder and small-scale commercial production level.

Figure 34: Proportion of live chicken buyers reported by traders



Data source: ACGG market survey

Type and value of major marketing costs

Live bird trading involves different marketing costs that could be associated with transporting birds from point of buying to point of sale and other management costs related to housing the birds between buying and selling. We asked wholesalers and retailers to estimate the major types of monthly marketing costs they incurred during buying, transporting and keeping birds in the previous 12 months. Feed, disease treatment, transportation, shop rent and water were reported as the main types of marketing costs (Table 37). Feed, transportation and water were the three main costs reported by over 50% of traders. From the total average cost, 43.5 and 36.4% accounted for feed and transportation, respectively. The average total monthly marketing cost reported by all traders was ETB7.11/chicken per month, with a minimum of ETB0.24 and a maximum of ETB18.68 per chicken. As the SD of the mean shows, there is a significant variation in marketing costs among different traders. This could be associated with location, breed type, average time lag between buying and selling and other institutional and infrastructural issues.

Table 37: Types of marketing cost and their estimated values reported by traders

Type of cost	Average marketing cost (ETB/bird per month)				Proportion of traders (%)	Share (%)
	Mean	SD	Min	Max		
Feed cost	3.09	4.04	0.13	16.98	100.00	43.50
Disease treatment	0.38	0.77	0.00	2.50	46.15	5.30
Transportation	2.59	2.83	0.00	8.96	84.62	36.40
Shop rent	0.75	1.78	0.00	7.74	42.31	10.50
Water	0.31	0.52	0.00	2.05	73.08	4.40
Total	7.11	5.34	0.24	18.68	100.00	100.00

SD=standard deviation; Min=minimum; Max=maximum

Marketing margins of live chicken traders

Marketing margin is defined as the difference between the price at a different level in the supply chain, and the farm-retail price spread is the most common indicator used as it accounts for all the marketing activities to move the products from producer to the final consumer (Myers et al. 2010). Table 38 presents a summary of the price spread and margins of traders (wholesalers and retailers) by market shed. The producer price represents the average price of live birds from smallholder and commercial producers. The RP represents to the cost of assembling, transporting, handling, storing and retailing charges added to farm prices (Wohlgenant 2001). There is a variability in producer price and RP among the three market sheds. The average prices in the Wolaita market shed were lower than in Addis Ababa and Bahir Dar. The average RP in Addis Ababa was significantly higher than the prices in the other two markets, which could be associated with higher marketing costs and better marketing opportunities. As a result, the price spread, total GM and TMu are more than double in Addis Ababa than the other two markets. In addition to the lower profit margin of traders, the lower price spread in Bahir Dar may suggest lower marketing costs such as feed, transport and shop rent. On the other hand, PSh in the Addis Ababa market is lower than the other markets and traders in the Addis Ababa market shed share a higher profit margin than elsewhere.

Table 38: Live chicken price spread (in ETB) and marketing margin by market shed

	Addis Ababa		Bahir Dar		Wolaita		Overall	
Indicators	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Producers price	180.3	51.6	182.2	16.8	156.6	28.8	166.3	36.4
Retail price	254.8	28.5	201.1	8.4	188.3	34.0	216.3	42.3
Producer-retail price spread	74.5	28.7	18.9	12.6	36.0	25.2	48.2	32.8
Producer share (%)	69.7	15.0	90.6	6.4	82.2	10.0	78.7	13.7
Total gross margin (%)	30.3	15.0	9.4	6.4	17.8	10.0	21.3	13.7
Total mark-ups (%)	51.8	45.9	10.8	8.1	23.5	16.4	32.4	33.7

SD=standard deviation

We estimated the profit margins for both retailers and wholesalers using the reported buying and selling prices and marketing costs. On average, retailers and wholesalers generated ETB35.3 and 20.4 per chicken, respectively (Table 39). There is a higher variability in the estimated GM between traders. Retailers generated higher profits per chicken than wholesalers, although the overall profit for wholesalers may have been higher than retailers due to the higher volume of sales.

Table 39: Marketing margins of live chicken traders (ETB/chicken)

Indicators	Retailers		Wholesalers		Overall	
	Mean	SD	Mean	SD	Mean	SD
Buying price	176.6	34.5	155.2	34.1	169.2	35.2
Marketing cost	8.5	6.0	4.6	2.6	7.1	5.3
Selling price	220.3	39.3	180.2	39.5	206.4	43.2
Profit margin	35.3	24.7	20.4	18.0	30.1	23.4

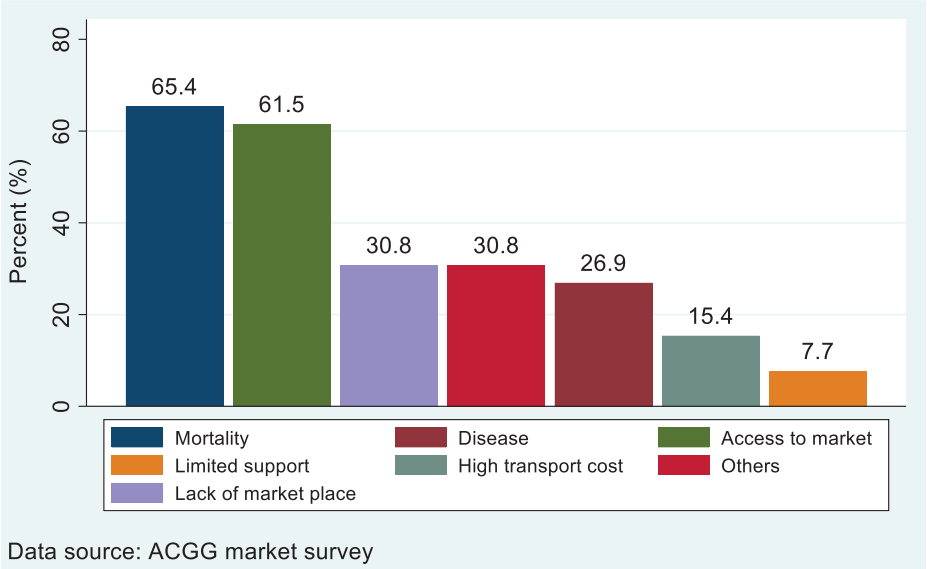
SD=standard deviation

Major challenges and opportunities reported by traders

As with the production aspect, the marketing of live birds represents different sets of challenges and opportunities. We asked traders to indicate the main challenges they face during the buying and selling of live birds. Higher bird mortality, disease, limited transport facilities, high transport costs, limited access to market, price fluctuation and limited access to marketing locations were the main challenges reported by most producers. Like producers, most traders (65.4%)

indicated that bird mortality due to disease and other environmental factors was the largest challenge (Figure 35). After disease, access to a better market was reported as the main challenge by 65.1% of traders. Due to the seasonality of poultry meat consumption in the country, most traders raised access to sustainable markets as a major challenge. Limited marketing places was reported by 30.8% of producers. Producers said that the absence of marketing places with proper facilities was the main challenge in most marketing places. This could be a major entry barrier for potential traders in the value chain. Furthermore, frequent disease incidence and high transportation costs were reported among the most significant challenges they experienced in the previous 12 months. Some traders explained their previous experiences in the loss of chickens during transportation resulted from the inappropriate handling of birds and road accidents. Traders identified limited access to slaughtering services, finance and institutional support as additional challenges.

Figure 35: Major production and marketing challenges reported by live chiken traders



Data source: ACGG market survey

As a solution to the constraints mentioned above, traders proposed interventions by government and nongovernmental organisations such as organizing the marketing system or creating market linkages (65.5%), improving health services (57.2%), offering various types of support from government/nongovernment organisations (34.5%), improving access to finance (24.1%) and others (30.9%). Traders indicated the need for organizing the overall marketing chain, including improving the infrastructures and marketing places, improving market linkages between different actors, and improving pricing mechanisms as important strategies to enhance live bird marketing in their areas. Most traders indicated that overall, live bird marketing appeared disorganised, with unregistered traders present in most locations. Improving the poultry health system from farm through to marketplace was another important recommendation suggested by traders. Establishing a better support system, including improving access to marketing places, controlling informal traders, building the capacity of traders and other similar issues were also suggested as possible interventions.

Traders reported different economic and social benefits of live chicken marketing activities. Better sources of income or employment opportunities (86.2%), improving household food security (13.8%) and enhancing networks (13.8%) were the most important benefits perceived by traders in the business. Similarly, to smallholder chicken producers, some traders indicated that the business could generate a quick profit within a short period and help improve the livelihoods of their families. Other traders reported that they were able to improve the food and nutritional security of their households. A small number of traders reported that trends in increasing production and the availability of different breeds were opportunities to expand their trading activities in the future. According to most sample respondents, live bird trading was a good employment opportunity that generated significant social and economic gain to both traders and producers.

8.3 Eggs wholesalers and retailers

Source of supply

The other important marketing actors along the poultry value chain are egg wholesalers and retailers. As with live bird traders, these traders contribute significantly to enhancing the supply of eggs from producers to consumers, both in the smallholder and commercial poultry production value chains. They typically buy eggs from producers and aggregators and sell to either individual consumers or restaurants, hotels and other users. Table 40 presents the main types of egg suppliers for both retailers and wholesalers. Retailers obtained their supply from smallholder producers, aggregators and small-scale commercial producers. Unlike retailers, wholesalers obtained their egg supply from small-scale commercial producers, aggregators and large-scale commercial producers. For both marketing actors, smallholder producers, aggregators and small-scale commercial producers were the main suppliers of eggs in the sample market shed.

Table 40: Major sources of egg supply reported by traders

Type of suppliers	Retailers		Wholesalers		Total	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Smallholder producers	40.0	60.0	0.0	100.0	34.8	65.2
Small-scale commercial producers	35.0	65.0	33.3	66.7	34.8	65.2
Aggregators	70.0	30.0	66.7	33.3	69.6	30.4
Large-scale commercial producers	0.0	100.0	66.7	33.3	8.7	91.3
Retailers	5.0	95.0	0.0	100.0	0.0	100.0
Wholesalers	0.0	100.0	0.0	100.0	0.0	100.0

Average prices and quantities of eggs bought

As with live birds, we asked egg traders what the average quantity of eggs supplied from different sources was during peak, medium and low supply seasons to estimate the average monthly supply over the year. The average amount of eggs bought from the above sources varied according to the production capacity of each producer. Table 41 presents a summary of the average quantity supplied from various sources and the overall average buying prices. Retailers bought the lowest amount from smallholder producers and the largest amount from small-scale commercial producers. The average amount of eggs bought by wholesalers was far higher than retailers. On average, both wholesalers and retailers bought a crate (30 eggs) of eggs for ETB99.59. The average buying price from aggregators was greater than the buying price from either producer. This was expected, as aggregators buy from producers to make a certain profit margin.

Table 41: Average quantity of eggs bought and buying price reported by traders

Type of actor	Quantity bought (number of crate)						Buying price/crate	
	Retailers		Wholesalers		Overall			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Smallholder producers	84.17	128.10	-	-	84.17	128.10	98.50	7.17
Small-scale	64.31	28.29	116.97	5.00	74.84	33.98	91.50	11.50
Large-scale	-	-	612.22	658.40	612.22	658.40	97.80	1.77
Aggregators	291.93	415.52	1,152.22	1,513.21	393.14	613.04	101.90	7.50
Overall	265.47	378.18	1,215.29	1,061.85	389.36	577.05	99.80	6.90

SD=standard deviation

Type of buyer and average selling price

Wholesalers sold eggs to individual consumers, restaurants and hotels, retailers and other wholesalers (Table 42). Likewise, retailers sold chickens to individual consumers, restaurants, hotels and other retailers. All of the sample respondents sold chickens to individual consumers, but there were significant variations between the proportion of traders who sold to other buyers. Mostly due to the large quantities bought, the proportion of wholesalers who sold to restaurants, hotels and institutional buyers is greater than the proportion of retailers who sold to similar buyers. As with the buying prices, there was a difference in the selling prices for various buyers. The overall average selling price was ETB112.7 per crate. The average selling price for individual consumers was greater than the selling price for restaurants and institutional buyers. This was expected as both traders give price discounts for buyers who purchase in large quantities.

Table 42: Types of egg buyer and average selling prices

Type of buyer	Type of buyer						Average selling price (ETB)	
	Retailers		Wholesalers		Overall			
	Yes	No	Yes	No	Yes	No	Mean	SD
Individual Consumers	100.0	0.0	66.7	33.3	95.7	4.3	114.5	7.4
Restaurants/hotels	35.0	65.0	100.0	0.0	43.5	56.5	111.4	6.0
Retailers	25.0	75.0	100.0	0.0	34.8	65.2	106.1	4.8
Wholesalers	0.0	100.0	33.3	66.7	4.3	94.7	106.7	2.1
Overall	-	-	-	-	-	-	112.7	6.2

Egg price determination

Traders indicated that the price of eggs is determined by themselves (45.5%), producers (34.8%) and market conditions (30.4%). Very few of them indicated the role of aggregators and consumers in price determination. About 43.8% of them have also explained the use of grading or quality standards in price determination. According to sample traders, type of breeds (73.9%) and egg size (52.2%) are the two important criteria to determine the price of eggs. As showed by producers, the price of local breeds egg was higher than improved breeds. Moreover, eggshell colour (21.8%) and yolk colour (17.4%) are reported as the other criteria used to determine prices. According to sample respondents, the average time lag between buying and selling of products was about eight days, with a minimum of 1 and a maximum of 21 days.

Marketing margins of egg traders

We estimated the producer price spread, PSh and traders' gross margin using the reported prices. The average buying price of eggs is higher in the Wolaita market shed, which may be associated with a higher proportion of local breeds egg traders that fetches higher prices (Table 43). The producer-retail price spread is higher in Addis Ababa Market Shed followed by Bahir Dar Market shed. In the Wolaita market shed, the producer shares of the RPis higher that would result in lower traders' gross margin and TMu.

Table 43: Egg price spread and marketing margin by market shed (ETB/crate)

Indicators	Addis Ababa		Bahir Dar		Wolaita		Overall	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PP	94.6	7.3	96.1	6.7	102.0	1.7	97.0	6.4
RP	111.8	5.9	110.5	6.3	111.2	4.9	111.0	5.5
Producer-retail price spread	17.1	8.8	14.4	6.0	9.2	3.8	14.1	6.7
PSh (%)	84.8	7.4	87.0	5.1	91.8	3.0	87.4	5.7
Traders gross margin (%)	15.2	7.4	13.0	5.1	8.2	3.0	12.6	5.7
TMu (%)	18.6	10.3	15.3	6.8	9.0	3.7	14.9	7.7

SD=standard deviation

We estimated the profit margins of egg traders using reported buying prices, marketing costs (transport and labour) and selling prices. On average, egg traders generated ETB10.2 per crate (Table 44). The return generated in the Addis Ababa market shed was higher than the Wolaita and Bahir Dar market sheds. Despite higher marketing costs in Addis Ababa, the lower profit margin in Wolaita and higher profit margin in Addis Ababa could be associated with different selling prices due to access to better markets. The estimated profit margins suggest that these actors generate modest incomes from egg marketing activities.

Table 44: Marketing margins of egg traders (ETB/Crate)

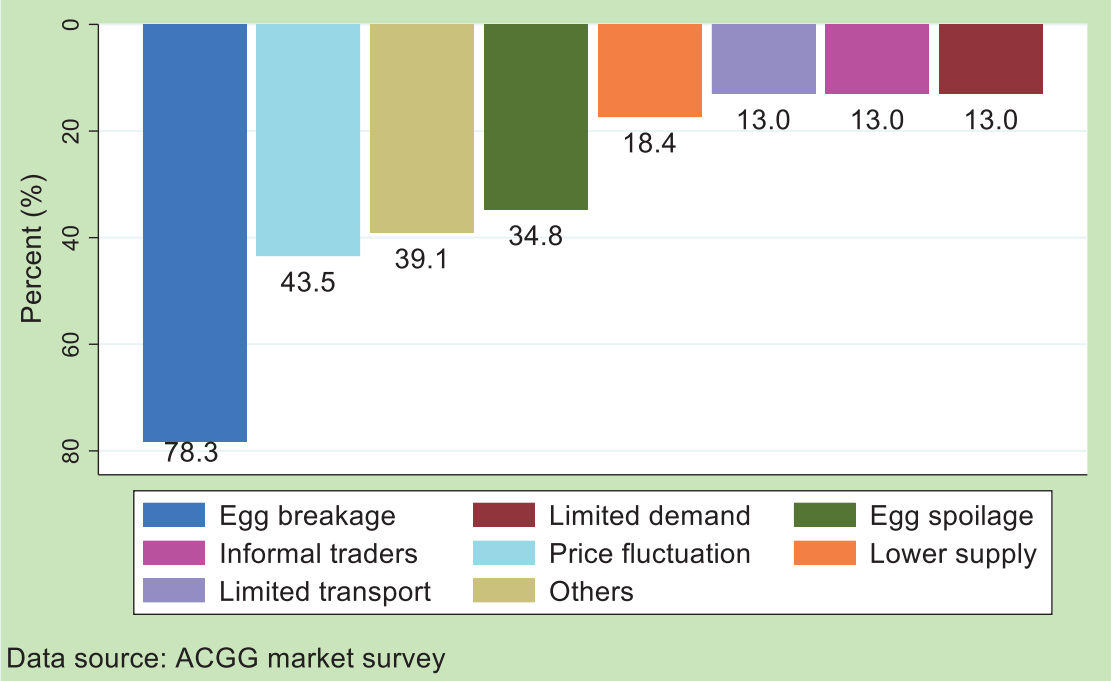
	Addis Ababa		Bahir Dar		Wolaita		Overall	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Buying price	100.5	7.4	95.7	6.7	102.3	3.3	99.4	6.8
Marketing cost	3.5	2.9	2.9	1.8	2.6	2.4	3.1	2.4
Selling price	115.9	7.0	108.9	4.8	111.5	4.1	112.7	6.4
Profit margin	11.9	9.1	10.4	3.9	6.6	2.8	10.2	6.8

SD=standard deviation

Challenges, opportunities and possible solutions

We asked traders to list the main challenges they faced during their egg buying and selling activities. Egg breakage, price fluctuation, egg spoilage, lower levels of supply, lower demand, limited transport facilities, informal traders and other constraints were mentioned as major challenges in egg marketing (Figure 36). Egg breakage was the most important challenge in egg marketing activities, mainly attributed to poor handling, storage and transportation facilities. In most parts of the country, egg traders transport eggs without proper handling facilities, using baskets made from local materials. Furthermore, the quality and durability of eggs during transportation and storage depends on the chemical composition of the egg, which in turn depends on the type of feed the birds consume. As the second most important constraint, price fluctuation could be associated with the seasonality of production and consumption. Egg consumption significantly decreases during fasting periods which leads to lower selling prices. In other seasons such as holidays, the consumption of eggs increases, which leads to an increase in selling prices. Egg spoilage could be associated with poor handling and keeping fertile eggs for a longer duration.

Figure 36: Major challenges reported by eggs traders



Other constraints may include informal traders, limited transport facilities, lack of trust between traders and egg suppliers, limited government support and transportation problems. Lack of trust between different marketing actors has resulted from the absence of a well-defined grading system along the egg marketing chain. Traders were asked if there was any grading system for price determination and only 47.8% indicated the presence of a simple grading system. Challenges related to egg marketing suggest the need for improving the capacity of both producers and traders in handling and marketing activities. This suggests the need for integrating such types of interventions with other interventions that aim to improve the production and productivity of the sector. About 50% of the challenges are associated with physical functions such as handling, storage and transportation that could be solved by innovative interventions along the value chain.

We asked traders to tell us the most important opportunities in egg trading. 95.7% indicated that it was a good source of income and employment that helped to improve their family livelihoods. Improved household consumption (30.4%), minimum labour demand (21.7%) and availability demand (17.4%) were mentioned as other opportunities in the sector. Traders suggested stronger government support (65.2%), improved access to storage and handling facilities (47.8%), capacity building (26.1%), the creation of market linkages (52.2%) and improved transportation facilities (4.3%) as solutions to help minimise marketing challenges and exploit existing opportunities in the value chain. Traders believed that the government should provide adequate support to marketing activities that may include organizing marketing places, providing financial support, setting standards and controlling informal traders. The inadequate availability of egg storage and handling facilities both at the farm and during transportation and selling was the main source of egg spoilage and breakage. Enhancing the supply of these facilities and building the capacity of producers and traders in storage and handling would minimise significant loss at the farm and during marketing activities. This would have an important impact on egg supply and quality. The creation of organised linkages between producers, traders and final buyers of eggs such as consumers and institutional clients was also indicated as a possible solution to minimise the challenges associated with the seasonality of egg supply and demand in particular.

9 Chicken meat processors and slaughtering services

Chicken meat processing is the most underdeveloped value chain activity in the country. During this assessment, we interviewed chicken meat processors with different capital and physical infrastructures. The processing firms observed had different processing capacities that ranged from 700–52,000 birds per month. The difference in processing capacity could be associated with their processing infrastructure and facilities and available market opportunities. Processing firms with a smaller processing capacity worked with low-quality and traditional processing facilities. These firms usually operate the processing activity with casual laborers that have limited formal training. Although they were very few, processing firms with a higher processing capacity appeared to be highly organised and operating with improved infrastructures and improved processing facilities and had employees with formal training. Unlike smaller processing firms, larger firms supplied plucked, eviscerated and frozen meat/carcasses to different customers. The main sources of live bird supply for both processing firms included their own farm, other commercial farms and small-scale producers. The sampled processors supplied meat to restaurants or hotels (61%), retailers or supermarkets (31%), and other buyers such as individual consumers and institutional buyers (8%). The average selling price was ETB111/kg, with a minimum of ETB100/kg and a maximum of ETB120/kg. The selling price appeared stable in different seasons.

One of the processing firms we contacted worked with smallholder farmers based on contractual farming arrangements. The processing company supplied the birds and all the required inputs to the farmers, based on a predefined agreement. Farmers raised the broilers and supplied them to the processing firm based on the agreement. The company provided training and follow-up services to the farmers. According to the company we contacted, live bird processing was carried out year-round with no supply shortages. Although the impact of contract farming on household welfare indicators is ambiguous (Oya 2012; Meemken and Bellemare 2020), in underdeveloped poultry production sectors such as Ethiopia, contract farming may help to minimise the challenges of input supply and output marketing.

The sampled processing firms raised limited access to land, shortage of parent stock, limited access to foreign currency or finance to import parent stock and processing equipment and limited support as the sector's main challenges. For instance, due to limited access to land, the largest processing company we visited used rented buildings constructed for other purposes. According to the company's manager, despite their continued efforts to acquire land to build their facility, the response from the local government was slow. The sampled processing companies suggested enhancing access to land, enhancing the supply of parent stock, developing appropriate policies and strategies for the sector, and improving access to foreign currency and finance as a solution to the reported challenges. Furthermore, the availability of significant marketing opportunities, the potential to create employment opportunities and conducive weather conditions for broiler production were all mentioned as the sector's main opportunities

In urban markets such as Addis Ababa, there was a growing interest from individual consumers or local restaurants and hotels to have slaughtering services near to live bird marketing places. Some individual consumers preferred to buy live birds from the market and obtain the slaughtering services themselves rather than buy processed meat. Consumers

usually associated this with the unknown quality of processed meat or preference for specific breed types. After slaughtering, service providers undertook skinning, evisceration and cutting activities. However, due to limited access to water and heating around the marketing areas, they did not undertake scalding and defeathering. Cleaning activities were usually undertaken by consumers in their houses. The slaughtering service was provided in an open field or smaller shed without adequate slaughtering, cleaning, or waste disposal facilities. As a result, the likelihood of contaminated meat was extremely high.

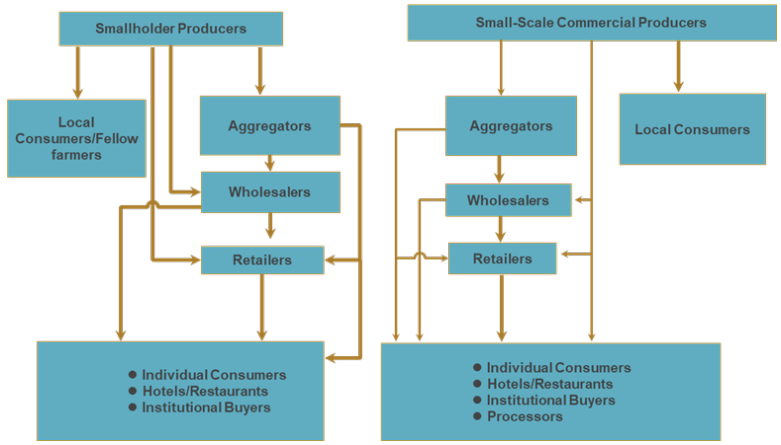
Increasing demand for slaughtering services shows the need for introducing improved processing facilities in the market sheds, as it would enhance both consumption and production of poultry products. Integrating improved processing facilities in the smallholder and commercial value chains has a significant contribution to the overall efficiency and effectiveness of the value chain. Inadequate and highly underdeveloped processing and slaughtering services in the country may suggest designing innovative policy options that attract small- and large-scale processing firms in the area and introducing development interventions that build the capacity of existing slaughtering services. This may include improving access to land, capital, water and electricity and introducing innovative facilities such as mobile processing facilities.

10 Overview of the poultry product market

The producers' return depends on the product flow in the chain and the price paid by consumers. As indicated above, poultry product marketing is characterised by diverse buyers and sellers including smallholder producers, small- and large-scale commercial producers, aggregators, wholesalers, retailers and consumers. Broadly, the supply of poultry products could be categorised into village-based smallholder production and commercial production systems. These producers have different production goals and marketing approaches. Given their consumption and income generation goals, smallholder producers usually sell surplus products to local consumers and fellow farmers mainly in village markets. They supply to urban consumers through aggregators, wholesalers and retailers. Since most of the commercial producers are found in urban or peri-urban areas, they can directly sell products to different consumers in the urban areas or sell to wholesalers and retailers in their market sheds. Commercial producers also sell products to local consumers around their farms.

As indicated above, both smallholder and commercial poultry product marketing may comprise local and central marketing channels (Figure 37). The local market channel refers to markets around or near to the producers' village and the central marketing channel refers to markets in major cities or urban areas. For both type of producer, aggregators, wholesalers and retailers are the major trading intermediaries engaged in the buying and selling of products along the value chain. Aggregators collect products from producers and sell to wholesalers and retailers in the central market or sometimes directly to consumers. Similarly, wholesalers buy products from producers and aggregators and sell to retailers or sometimes directly to consumers that buy in bulk. Retailers usually buy products from producers, aggregators or wholesalers and sell to consumers in the retail market. Compared to smallholder producers, commercial producers have better access to central markets due to a higher volume of production and proximity to urban markets. For instance, unlike smallholder producers, commercial producers can directly supply live birds to processors and institutional buyers as they can produce a higher volume of products with the required quality. Furthermore, commercial producers can easily access urban retailers such as small retail shops and supermarkets.

Figure 37: Marketing chains of smallholder and small-scale commercial producers



A better understanding of the sector's marketing systems helps to identify entry points for interventions that maximise producers return and utility of consumers. Studies on agricultural product marketing systems can adopt functional, institutional, commodity, behavioural and structure-conduct-performance (SCP) approaches (Haji 2014). SCP is a framework that helps to understand the relationship between the structure of the market, conduct of sellers and buyers and overall market performance. The performance of any agricultural market depends on the conduct of the sellers and buyers which in turn depends on the structure of the market. The structure of the market mostly refers to its stable features that affect the behaviour of buyers and sellers. This is mostly affected by the nature of the products and available technologies. The behaviour of buyers and sellers between and among themselves refers to the conduct of the market. The performance of the market indicates its outcomes that can be measured by the quantity and quality of products and resource allocation. Challenges in the market structure and conduct affect the performance of the market. Using the SCP approach, we will outline the organisation of the poultry market, the level of interaction among different actors and the effect of such interaction on different market outcomes and social welfares.

10.1 Market structure

The structure of the market can be measured using different indicators such as the number of buyers and sellers, concentration ratio, barriers to entry and product differentiation (Clodius and Mueller 1961). Poultry products in Ethiopia are supplied by a larger proportion of smallholder farmers and fewer commercial producers around major urban areas. Other value chain actors such as input suppliers and service providers have significant contributions to the production activities. As shown above, poultry product buyers include individual consumers, fellow farmers, hotels and restaurants, institutional buyers, processors and marketing intermediaries. The number and level of participation of these buyers vary along the smallholder and commercial production value chains. There are limited numbers of input suppliers and buyers of poultry products in the smallholder production value chain, particularly in rural areas. As a result, they have better bargaining power and access to resources than smallholder producers. Their smaller number in the market chain may provide them with more opportunities to engage in non-competitive behaviour. Compared to urban consumers, the number of traders is also low, which offers market power during the sale of products in the urban market. This may show that traders have better marketing power during the buying and selling of products, particularly along the smallholder market chain.

In the commercial production system, producers are relatively small in number and there are barriers to entry. Entry barriers may include limited access to land, credit, inputs and the market. These restrict young and unemployed people to join the business. Farms in the commercial production system are larger and can set selling prices to maximise profits. Moreover, farms in the commercial sector appear to be more interdependent, as the actions of one farm affect another. Higher barriers to entry and better knowledge on their cost and market demand help the commercial sector to retain more long-run abnormal profits than smallholder producers. This provides a competitive advantage to commercial producers over smallholder farmers. As with the commercial sector, limited access to inputs such as feed, vaccination and access to capital and land could also be major entry barriers. The smaller number of inputs suppliers such as DOCs, feed and vaccines in the commercial production system may also restrict producers from input use as suppliers would set higher prices. Moreover, limited vertical and horizontal coordination in the smallholder and commercial production system may expose producers to higher input prices or lower output prices.

Market-related challenges reported by producers and traders would also suggest the presence of significant barriers to entry into poultry product marketing, which could significantly affect producers' expected income from any investment made. Inadequate and poor infrastructure is the typical feature of poultry product marketing in the country. Physical challenges such as limited access to handling and storage material, inadequate transportation facilities, inadequate marketing places and unorganised marketing infrastructure could be major barriers to entry. The absence of proper handling materials increases the loss of products that affects marketing costs, which in turn affects producers' return and

consumers' purchasing ability. Inadequate egg and live bird transportation facilities are a major cause of product quality and quantity loss during marketing activities. In Ethiopia, poultry product marketing places are poorly organised, with inadequate feeding and watering facilities. Inadequate marketing places for new entrants were reported as a challenge by some traders. The entry barrier in trading activities may result in fewer traders, allowing them to set higher prices that affect producers return and demand for poultry products in the long run.

10.2Market conduct

Pricing strategies, buying and selling practices, product differentiation and vertical and horizontal coordination and linkages could be good indicators used to evaluate the conduct of the poultry market. For the consumers, price is a good signal of the cost of producing goods, and for the producers, it is a signal for the willingness of consumers to pay the cost of production (Timmer et al. 1983). Understanding the price formation mechanism helps to explore the conduct of the market and design interventions and strategies that enhance the performance of the market in the future. As indicated above, in the smallholder production system, a price is set by sellers and buyers through negotiation, which shows the role of both actors in price formation. The absence of any standardisation or grading system is the main trigger for using negotiation in the price formation process. However, due to better access to information, buyers have higher bargaining power than smallholder producers.

The inadequate standardization and grading systems have various negative consequences on smallholder production and marketing activities. For instance, smallholder producers usually receive different prices for the same products, which could be a bad incentive for adopting better production practices. In the absence of standardization and grading, producers with better quality products could not obtain premium prices for producing higher quality products. In some instances, the absence of standardization and grading systems also exposes producers to cheating, as the quantity and quality of products are usually determined by personal judgments. Therefore. establishing product standardization and grading systems has a significant contribution to enhancing the performance of the marketing system. This could be done in diverse ways. For example, eggs can be graded based on internal and external features that may include shell texture, shell colour, shape, cleanliness, breed type and yolk colour. Similarly, live birds can be graded based on body weight, body size, age, breed type and production systems, which may refer to the type of feed and management system adopted. Better standardizing and grading practices could be an incentive for producers to deliver quality products and enhance consumer satisfaction in diverse ways. There are better product standardization and grading approaches in commercial production than the smallholder production system.

In developing countries where traditional production systems supply the largest proportion of eggs and live birds; poultry products are often poorly differentiated. However, as indicated above, there is a greater opportunity to differentiate poultry products based on quality and quantity parameters such as size, weight, breed type and production system (organic/industrial). Moreover, consumers have a distinct preference for local breed products over improved breed products, representing an existing opportunity to create a niche market for local breed products. This gives the smallholder producers better control over the price of products and could be a good incentive to keep the low productive local breeds, which contributes to biodiversity conservation and sustainable utilization of indigenous breeds.

Vertical and horizontal coordination or linkages are the other indicators of market conduct (Junior et al. 2014). As shown above, there are no adequate horizontal linkages among smallholder producers. Smallholder producers, therefore, have limited bargaining power during price determination due to their limited access to information and inadequate marketing opportunities. Strengthening horizontal coordination creates a better opportunity for smallholder farmers to access input and output markets. Similarly, smallholder farmer linkages with other value chain actors, or vertical coordination, are minimal. As a result, they usually complain about low-quality and higher price inputs such as vaccines and feeds, and higher marketing costs. Traders have better coordination than smallholder producers and consumers. As a result, they can suppress the prices offered to producers or collectively set higher selling prices. Traders selling prices are not

transparent in the existing retail market, and live birds are usually sold through negotiation. This may expose consumers to higher prices and result in lower levels of consumption in the long run. Unfair price setting would affect the production and productivity of the sector as producers may not get the expected return. In summary, the link between different actors along the poultry value chain seems weak, and this affects both the conduct and structure of the market.

10.3Market Performance

The performance of agricultural product marketing could be viewed from the perspective of producers, traders and consumers. The availability of products with affordable or fair prices, optimal profits for traders, sanitary and phytosanitary product standards, price stability and producer prices that cover production costs are useful indicators to evaluate market performance. Producer-retail price spreads, PSh, marketing margins, marketing costs and TMu could all be used as additional quantitative performance indicators. Consumers should not be charged prices above marketing costs, and prices offered to producers should cover the cost of production. Moreover, the marketing system should help to generate favourable and expected community outcomes such as higher product consumption that enhances food security, and enhanced production and productivity that improve producers' income and employment opportunities along the value chain. Empirical studies have used yield, profit, costs, jobs created and value-added as performance indicators of markets (Junior et al. 2014).

Marketing performance can be measured using indicators that show the efficiency and effectiveness of the production and marketing systems. Market efficiency can be measured by the level of costs associated with product marketing and the level of satisfaction that consumers and producers get from production and marketing activities. The efficiency and effectiveness of the poultry market could be evaluated at a different level of the value chain. Although the economic performance analysis of actors involved in poultry product marketing shows a positive return at different levels, challenges reported by different actors suggest the inadequate performance of the market and the need for designing better strategies to maximise social welfare. For instance, wholesalers and retailers indicated high marketing costs associated with the buying and selling of poultry products. High marketing costs increase the selling prices of goods which affects the willingness of consumers to pay for products and that have a substantial effect on the level of production due to reduced demand. Moreover, both producers and traders reported the presence of quantitative and qualitative loss of poultry products during transportation and storage of products. This indicates the level of operational inefficiency producers and traders experienced and shows the need for devising better marketing interventions in the future. Better transportation and storage facilities, for instance, would not only decrease transportation costs but maximise the quality and quantity of products supplied to terminal markets, benefitting consumers and producers alike.

The stability and level of prices could be another indicator of market performance. Consumers need stable and affordable product prices for better livelihood outcomes. Seasonal price fluctuation is among the most important challenges reported by the largest number of producers. Supply and demand for live birds during holiday seasons are extremely high, leading to increased prices. During the fasting season, there is a much lower demand for products due to limited consumption, which leads to lower prices and loss of products. This shows the instability of the marketing system, which affects the production and consumption of products in the longer term. A significant and unreasonable increase in product price from one year to the next may indicate market instability. Based on the above qualitative evidence reported by producers and traders, it is possible to conclude that the performance of the existing marketing system is poor and needs different policy interventions that address challenges associated with the structure and conduct of the marketing system.

11 Business opportunities along the poultry value chain

An increase in population growth, urbanisation, middle-income population and change in consumer preferences from red meat to the white mat have led to increasing demands for poultry products globally (EU 2015; EU 2019). An increase in demand leads to the emergence of small- and large-scale commercial poultry farms around major cities and urban areas in Ethiopia and other developing countries. In developing countries such as Ethiopia, the increasing demand may lead to better business opportunities for smallholder and small-scale commercial producers. This has been an important incentive for smallholder producers to adopt improved technologies and production practices, and for the emergence of small-scale commercial farming in different parts of the country. However, both the traditional and commercial production systems still suffer from various production and marketing constraints. This would suggest the presence of unmet needs and the need for generating ideas to correct them. These would create opportunities to initiate innovative business models that enhance the efficiency of the value chain and create additional employment and job opportunities. To summarize, the results of this brief assessment have demonstrated the presence of substantial business opportunities at different stages of the value and we present some of the possible business opportunities in the following section.

11.1 Input supply and delivery

As shown above, limited access to DOCs, feed, vaccines and drugs are the main production challenges reported by smallholder and small-scale commercial producers. Most producers have reported the poor qualities of different inputs and services along the value chain. The input supply and delivery system seem poorly organised and are mainly concentrated in urban areas. Moreover, improvements in production and productivity bring huge demands for different production inputs and services. As a result, there are immense opportunities to initiate new business activities that create employment and job opportunities and enhance the production and productivity of the sector. Introducing local hatcheries, mother units, feed mixing, and innovative poultry health service providers could be considered as among the most important business opportunities.

Local hatcheries: the growing interest in improved breeds-based production at the smallholder and small-scale commercial production level can create better business opportunities for small and medium-scale local hatcheries in the rural and urban areas. The country's diverse agroecology and production systems demand a sustained supply of replacement stock suitable for different production systems. Currently, DOC supply is dominated by a small number of commercial and government farms, and there are significant unmet needs and limited options for producers, particularly in regional states. Existing DOCs supply mainly focus on few commercial strains and increasing demand for indigenous breed products would require shifting the traditional hen-based chicks production system to a hatchery-based production system. Hence, introducing cost efficient local hatchery services that supply locally adapted and farmer preferred chicken breeds for different production systems and agroecology would create viable business opportunities.

Mother units: chicks mortality and inadequate growth performance due to disease, inadequate nutrition and predators attack are the major productions and productivity constraints in the traditional production system. Hence, transforming the low productive traditional scavenging-based smallholder production systems to improved production systems demands a supply of vigorous chicks that can adapt to a village-based and sub-optimal management system. This requires introducing commercial brooders that raise chicks for a certain number of days with intensive care and management systems. The economic viability of recently introduced mother units and their presence in only a few areas of the country suggests the need for these farms to scale up in diverse agroecology. Establishing dynamic mother units that raise locally adapted, farmer-preferred chicken breeds will create great business opportunities for unemployed young people in rural and urban areas. However, this requires strong institutional support that integrates these businesses with producers and the producers with existing or emerging markets.

Local feed mixers: an adequate supply of feed is one of the major pre-requisites for transforming low-input low-output production systems to high-yielding production systems. However, the higher price of feeds, limited access to feed and inadequate quality of available feed are the main challenges reported by smallholder and commercial producers. Since most feed mills are found around major cities, the largest proportion of smallholder farmers have limited access to quality feeds due to a larger number of intermediaries involved in the supply chain. Moreover, commercial feeds are not usually affordable to smallholder producers as they are intended for intensive production systems and higher marketing costs. This requires introducing an innovative and community-based feed supply system that would be easily accessible and affordable to smallholder producers. Such type of feed supply systems could be established using conventional (by mixing locally produced crops and commercial feeds) and non-conventional feeds available in rural areas. The non-conventional feeds may include insects, worms, and feed from perennial crops and animal and industrial origins. Moreover, the low-quality protein feed requirements and scavenging ability of some improved poultry breeds would create a better opportunity for the emergence of local feed mixing businesses. In additions to supplying easily accessible and affordable feeds, introducing local feed mixers create employment and job opportunity along the value chain.

Poultry health service providers: despite a recurring disease outbreak and higher disease incidence in the country, the overall poultry health service provision has remained incredibly low. Nationally, animal health services are provided by public veterinarians, private veterinarians and para-veterinary professionals. The role of the private sector is not widespread in rural areas and most of the public and private animal health service providers have limited expertise in poultry health. Furthermore, decent quality vaccines and drugs are not widely available in rural areas. As a result, poultry disease continues to be the main production and marketing challenge. On the other hand, smallholder producers have a clear demand for good quality, affordable health services. Introducing trained community health service providers that work with the public and private sectors could provide a sustainable solution to this challenge This shows the existence of an attractive business opportunity for unemployed veterinarians and other interested community level workers. The poultry health service could be provided as a full- or part-time job based on the location and number of producers in each area. To diversify their source of income, health service providers may engage in other poultry-related activities such as the provision of training in routine management and other income-generating activities.

11.2 Smallholder semi-intensive and small-scale commercial production

A rapidly growing population, increased urbanisation and consumer preference for poultry meat and eggs will increase consumer demand for poultry products. Ethiopia's growing poultry product market could be a good opportunity to transform existing traditional smallholder production into improved semi-intensive production and expand small-scale specialised commercial layer and broiler production in urban and peri-urban areas. The economic performance analysis conducted in this study highlights the feasibility of these production systems and their potential contribution to household income generation, food security and employment creation.

11.3 Product collection, grading and distribution

Limited access to better markets, price fluctuation and egg spoilage or damage are among the marketing challenges reported by smallholder producers. These challenges are compounded by smaller selling volumes, an absence of product standardisation and grading practices and traditional price determination processes. Establishing product collection and distribution points that would carry out product collection, grading, packaging, storage and distribution activities would have a significant contribution to address diverse marketing challenges. Other activities such as linking producers to central marketing actors such as wholesalers, retailers and other institutional buyers could be conducted through the collection points. Collection and distribution points could be designed to undertake distinct functions that create value for producers and consumers alike. For instance, at the collection points, eggs can be graded by breed, age and size, as well as cleaned using proper procedures. Likewise, live birds can be graded based on breed type, age and body size. This helps to create a niche market for specific products such as indigenous breed eggs and live chickens. Collection points can be established either by organizing farmers in associations or introducing independent entrepreneurs into the value chain.

11.4 Processing and slaughterhouses

Seasonal market demand, inadequate marketing facilities, high marketing costs and loss of birds due to disease and transportation damage are the main challenges in smallholder live bird marketing. One of the best strategies to address these challenges is introducing small- and large-scale local processing services that process local or improved chickens and supply to local and central markets. Small-scale processing facilities can be established with moderate costs to offer better slaughtering and storage facilities (Silverside and Jones 2011). It is possible to link these processors with smallholder producers for live bird supply and with wholesalers and retailers for processed selling the processed products. Introducing processing facilities would enhance the value chain by creating better marketing opportunities, minimising marketing costs and reducing bird mortality during transportation.

Slaughter services represent a further business opportunity around large and small live bird marketing areas. Traditionally, consumers slaughter live chickens in their homes. But there is a declining interest in carrying out this activity due to an improving trend in the living standards of the urban population and change in socio-cultural conditions. Evidence shows the presence of emerging demand for slaughtering services around the marketing places. Despite their limited availability, existing slaughtering services are provided by individuals with inadequate facilities and hygienic conditions that discourage customers from using these services. Therefore, establishing standardised, hygienic slaughterhouses may increase the number of service users. This helps to saves time and resources of consumers used for slaughtering and waste disposal. Moreover, introducing small-scale processing houses and hygienic slaughter services may enhance the consumption of chicken meat and create better market opportunities for producers.

The aforementioned business opportunities would not only generate employment and jobs but also help to enhance the efficiency and effectiveness of the value chain by addressing most of the reported production and marketing constraints. This would improve the livelihoods of smallholders by enhancing their capacity to use available assets (human, social, natural and physical); reduce their vulnerability to production shocks and seasonality of income; enhance the availability of poultry products throughout the year. Improving smallholder and small-scale commercial production would have a substantial contribution to meet the growing demand for animal-source protein. Moreover, improving the efficiency of production can help to mitigate the adverse effects of climate change due to better feed to human food conversion rate and lower environmental footprint interns of energy and water use (Vaarst et al. 2015). As outlined above, smallholder farmers consider poultry production among the main sources of income to support household expenses such as school fees and health services. Income generated from poultry production can support other livelihood activities such as crop and other livestock production activities. Enhancing the efficiency of the value chain would also help smallholder

producers to create additional assets and engage in other off-farm and on-farm livelihood activities. As indicated by sampled producers, smallholder poultry production contributes significantly to enhancing the nutritional and food security of households, helps to convert household waste into usable protein, and produces manure to enhance soil fertility. The above points highlight the multidimensional contribution of the sector such as in economic, social and ecological dimensions and serves to sustain smallholder livelihoods across the rural and agricultural sectors.

12 Conclusions and policy recommendations

Despite its multidimensional contribution to smallholder farmer livelihoods and the wider economy, the attention given to smallholder poultry production remains inadequate. As a result, the sector is characterised by its low productivity and diverse production and marketing challenges. This calls for an integrated intervention that addresses strategic challenges along the value chain. The findings of our assessments have confirmed the need for integrated interventions that include introducing farmer preferred breeds, enhancing local feed supplies, introducing innovative health services and establishing better marketing systems and market opportunities. Without a better marketing system or improved access to market opportunities, sustainable production and productivity would not be realized at a smallholder level. Based on the empirical evidence we generated from different production and marketing actors, we would like to highlight the following insights to enhances the overall performance of the sector.

- Despite its low productivity, smallholder chicken production remains the main source of eggs and meat in the country. A momentous change in input use under the traditional extensive production system shows the willingness of smallholder producers to invest their limited resources in the sector. This would create a great opportunity to introduce innovative interventions that transform existing low-input low-output based production into a more productive and economically viable semi-intensive production system. The innovative interventions may include introducing dual-purpose TAIBs that would simultaneously maximise the income generation and consumption goals of resource poor smallholder producers.
- Due to limited access to input and output markets in remote rural areas, using self-propagating improved breeds for sustainable smallholder production would have a bigger contribution than hatchery-based production systems. Therefore, besides hatchery-based development interventions, there is a need to develop self-propagating improved breeds in the future.
- The majority of smallholder and commercial producers and marketing actors identified disease as the most important production and marketing constraint in the poultry value chain. Some producers questioned the efficacy of available vaccines and drugs on current pathogen strains. Widespread concern over disease incidence may suggest the overall economic, social and environmental importance of developing integrated disease prevention and control strategies along the value chain.
- Limited access to quality feed and high feed costs were among the main constraints reported by smallholder and commercial producers. This is worse in rural areas due to limited access to infrastructure and higher marketing costs. This could be improved by introducing innovative local feed mixers to produce quality feeds from locally available inputs. Increasing the production and productivity of strategic crops such as wheat, maize and soya bean which constitute the bulk of poultry feed can be considered as a vital strategy for transforming the sector.
- Market related challenges reported more widely by smallholder producers than commercial producers confirm the absence of a better marketing system along the value chain that favours smallholder chicken production. This may suggest the need for integrating enhanced marketing interventions with production and productivity-related interventions. The economic gains from the adoption of improved technologies would be better realized if there are conducive market opportunities for products. Improving access to better markets should therefore be an integral part of production and productivity improvement interventions.

- Compared to commercial producers, smallholder producers are mostly price takers due to their limited access to terminal markets, inadequate access to market information, smaller production volume and inadequate horizontal and vertical coordination, and are therefore at a competitive disadvantage. This has a significant detrimental effect on the prospects of smallholder production if the commercial sector keeps growing rapidly. Improving smallholder access to better marketing opportunities and market information through value chain integration and strengthening their collective action need to be considered among priority interventions.
- Higher marketing costs and entry barriers to poultry product marketing need to be addressed properly to protect urban consumers from higher prices and ensure the food security of the urban community. This could be achieved by improving road infrastructure, product storage and transport facilities, improving marketing places and facilities and establishing better pricing and marketing systems.
- Significant economic and social gains generated by adopting TAIBs based production system suggest the potential contribution these breeds can have in the smallholder and small-scale commercial production system. Surplus eggs and live chicken production have helped smallholder producers to send children to school, cover medical expenses, purchase agricultural inputs and accumulate assets. There is, therefore, a need to design innovative and sustainable scaling out strategies by integrating vital production and marketing activities.
- The economic gain analysis results show that the economic benefits of smallholder chicken production are highly dependent on flock size, which in turn depend on the productivity of breeds and management systems. This implies identifying optimal flock sizes that are better suited to smallholder production and take producer capacity, available inputs and market opportunities into account.
- The presence of multidimensional challenges under the smallholder chicken production system suggests the need for developing innovative business models that integrate both production and marketing interventions and create business opportunities for young and unemployed people. On the production aspect, great consideration needs to be given to the following interventions: the sustainable supply of DOCs; financial and technical capacity building for farmers; connecting farmers to financial institutions; organising farmers for collective actions; introducing local feed mixers; and innovative community-based poultry health services with better access to vaccines and drugs.
- Similarly, the following interventions need to be considered in the marketing aspect: enforcing input (i.e. feed, vaccine, DOCs) quality standards; establishing poultry product collection and grading points; connecting collection points to traders and other institutional buyers; introducing poultry products processing companies; introducing standardised slaughterhouses and processing facilities; improving marketing places and facilities; organizing traders and connecting them with financial institutions.
- The overall findings of this study demonstrate that enhancing the production and productivity of the poultry sector will have a significant contribution to poverty reduction, livelihood diversification and job creation in rural and urban areas. However, policy interventions that aim to improve production and productivity need to create better economic and financial incentives for all value chain actors. This will be realized by establishing an efficient and effective input-output marketing system. Therefore, better marketing and pricing approaches need to be an integral part of agricultural interventions that aim to enhance the production productivity of the poultry sector in developing countries.

Study limitation

As previously indicated, time and resource constraints meant that we considered only three main market sheds in Ethiopia, and the size of sample respondents was small for some of the marketing actors. The interpretation of some of the specific quantitative indicators should therefore consider these limitations.

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