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HPAI HIGHLY PATHOGENIC AVIAN INFLUENZA PRO-POOR HPAI RISK REDUCTION

Overview and Background Paper on Ethiopia's Poultry Sector: Relevance for HPAI Research in Ethiopia

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Preface

Since its re-emergence, HPAI H5N1 has attracted considerable public and media attention because the viruses involved have been shown to be capable of producing fatal disease in humans. While there is fear that the virus may mutate into a strain capable of sustained human-to-human transmission, the greatest impact to date has been on the highly diverse poultry industries in affected countries. In response to this, HPAI control measures have so far focused on implementing prevention and eradication measures in poultry populations, with more than 175 million birds culled in Southeast Asia alone.

Until now, significantly less emphasis has been placed on assessing the efficacy of risk reduction measures, including their effects on the livelihoods of smallholder farmers and their families. In order to improve local and global capacity for evidence-based decision making on the control of HPAI (and other diseases with epidemic potential), which inevitably has major social and economic impacts, the UK Department for International Development (DFID) has agreed to fund a collaborative, multidisciplinary HPAI research project for Southeast Asia and Africa.

The specific purpose of the project is to aid decision makers in developing evidence-based, pro-poor HPAI control measures at national and international levels. These control measures should not only be cost-effective and efficient in reducing disease risk, but also protect and enhance livelihoods, particularly those of smallholder producers in developing countries, who are and will remain the majority of livestock producers in these countries for some time to come.

This report is the first step of the project which has compiled and assessed the current state of knowledge of poultry systems and their place in the larger economy of the study country, the current HPAI situation and its evolution, and institutional experiences with its control (or, where it has not taken place, contingency places should it arise). This information has been written by a multidisciplinary national team in the study country highlighting the current knowledge and knowledge gaps related to the interface of poultry, HPAI, and institutional response as a crucial first step to the analytical research outputs to be generated in the course of this project. In the process of writing the background paper a variety of country-specific data and information sources on poultry systems, HPAI, and mitigation/control efforts, including published and grey literature, national statistics, journal articles, and reports from other research efforts that are ongoing in the country have been complied into a data base located at the project web site http://www.hpai-research.net/index.html.

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Disclaimer

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More information

For more information about the project please refer to www.hpai-research.net.

Executive Summary

This study presents a detailed review of the poultry sector in Ethiopia in order to provide background information for further research related to pro-poor HPAI risk reduction strategies in Ethiopia. The report surveys information that exists in the literature and among the stakeholders in order to identify the research gaps that can be addressed in the project. In preparation of this report, published and grey literature, expert interviews and official documents were used.

The paper presents information on the role of the poultry sector in the economy of Ethiopia and also information related to role of poultry in rural livelihoods. The information related to the role of poultry at the supra-household level is presented taking into account the differentiation within the poultry sector. This differentiation relates to the size, organization and levels of bio-security among other characteristics. The survey distinguishes these characteristics by the types of the poultry sector, poses conjectures regarding the implications for the introduction and spread of the HPAI and subsequently explores the research gaps.

In assessing the information on poultry's role in rural livelihoods, the report synthesizes information at the most disaggregated level possible for example by assessing the evidence related to the impact on women. The report considers livelihood analysis to be not only important as an end in itself but also as critical for the implementation of prevention and control measures related to HPAI. In capturing the role of poultry in livelihoods, based on the existing evidence the report takes a supply chain perspective. Based on a scare that occurred (a false alarm) the report provides summary information on the potentially discrete economic and livelihood impacts of HPAI outbreak.

The paper finds that poultry though not a big component of the aggregate Ethiopian economy, its role has been becoming more important over time. At the micro-economic level poultry is very important especially for women. The structure of the poultry sector has also been changing with more organized segments evolving in urban and peri-urban areas. The vast majority remains as backyard poultry in Ethiopia. Independent of the level of organization and size and whether in the public or private sector, the report finds that there is significant scope to improve bio-security levels.

The report also surveys the literature on the disease risk and synthesizes information on the risk assessment for the introduction and spread of HPAI that exist in case of Ethiopia. The risk pathways relate to migratory birds as well as trade (legal and illegal) of both inputs and outputs. In this segment also, the report first summarizes the existing state of knowledge and methods and subsequently proposes research gaps some of which the project should aim to fill.

Finally, the institutional analysis in the report provides information to assess the response capacity of the public and private institutions and makes preliminary suggestions as to what could be targeted for better efficacy of prevention and control strategies. Assessing the institutions postulated to deal with HPAI threat the report provides information on the whole gamut of institutions and suggests areas where there is scope for improvements. These potential areas for improvement also form part of the research gaps identified.

1. Introduction

Highly Pathogenic Avian Influenza (HPAI) probably offers one of the greatest scopes for inter-disciplinary research particularly when relating to a poor country like Ethiopia. An animal disease though a veterinary problem, it's transmission, control and impacts are contingent upon several socio-economic, cultural and institutional factors. Further, in poor countries like Ethiopia, the disease as well as the control measures need to be sensitive to livelihood and wellbeing (such as nutrition) concerns not only because of equity considerations but also because effectiveness of control measures is strictly contingent upon the welfare outcomes. In situations where organized credit markets cater largely to the upper tail of the income distribution and institutional structures are ill equipped to ensure compliance with the control measures, pro-poor control strategies for animal diseases in general and HPAI in particular are likely to be both efficient and equitous.

The disease threat of HPAI is common to all nations with countries differing only in terms of the intensity and severity of threat. The level of threat is postulated to be a function of several factors such as bird flyways, trading routes and intensity of trading in poultry products. Some of these risks that determine the probability of outbreaks of HPAI are less or more prominent in Ethiopia relative to other countries which have not experienced an outbreak. Yet, as a poor country where livestock often comprises the only asset with the households, a HPAI outbreak in Ethiopia can have a significant impact on the poor households. Additionally, in situations where governments' budget constraints are severe, measures to prevent or control the disease in case of an outbreak are often limited and need to be adapted to the context of the country/region in question.

How significant can the impact be or which segments of the population are likely to be worst affected either by the disease or the prevention/control options are empirical questions on which rigorous research on developing countries in general and Ethiopia in particular is lacking. Similarly, what are the suitable control measures that fit the budgetary and institutional context of Ethiopia is a pertinent research question that has not been addressed in the literature.

Ethiopia's is one of the poorest countries of the world where half of the population lives under the poverty line defined by dollar one a day. Agriculture is the main source of livelihood for more than eight out of ten Ethiopians. Yet agricultural production is extremely vulnerable owing to dependence on weather. Recurring droughts leave poor farmers without food crops, causing periodic famines. Food aid is often crucial in saving the lives of millions of people who are chronically food-insecure or affected by drought, including more than 130,000 internally displaced people from conflict-torn areas.

Within agriculture, livestock comprises an extremely important sector of the economy. The livestock sector contributes an estimated 18.8% to the national GDP and 40% to the agricultural GDP (FAO, 2004), supporting the livelihoods of up to 70% of the country's population (Nzietcheung 2008 citing Halderman 2004). Recent estimates in 2007 put the poultry population in Ethiopia at around 34.2 million with native chicken representing 94.4%, hybrid chicken 3.92% and exotic breeds 0.64% (Central Statistical Agency 2007). The households depending heavily on agriculture and livestock can depend on poultry as a low cost option to diversify and mitigate risks.

Though some modern poultry firms such as ELFORA, Genesis and Alema farms have come up over time (mainly in Debre Zeit region), their share in the poultry sector remains small. Currently, there are about 7 regional poultry multiplication and distribution centers with a total annual capacity of producing about 1,236,000 day-old chicks and about 486,000 pullets and cocks. There are also about 10 commercial poultry farms with estimated annual production capacity of 1,500,000 chicks. Most farms import day old chicks from abroad (MoARD and FAO, 2006). Ethiopia has almost zero poultry exports and the little it exports at times come from firms like ELFORA.

Most poultry in Ethiopia is managed by women in smallholder farms, and is often a rural woman's dominant source of income. In these farms very little of purchased inputs are used with birds kept as scavengers. According to the results of Tadelle and Ogle (1996), the total output of scavenging birds is low, not only because of low egg production, but also due to high chick mortality as half of the eggs are hatched to replace birds that have died, and the brooding time of the mother bird is long in order to compensate for its unsuccessful brooding.

Poultry production though small in scale at the farm level, it plausibly is quite important for the rural economy. Rural poultry production contributed to 98.5 and 99.2% of the national egg and poultry meat production, respectively (Alemu and Tadelle, 1997), with an annual output of 72,300 metric tons of meat and 78,000 metric tons of eggs (Hailemariam et al., 2006).

Village poultry are important providers of eggs and meat as well as being valued in the religious and cultural life of society in general. Sonaiya (1990) pointed out that over time rural poultry have assumed a much greater role as suppliers of animal protein for both rural and urban dwellers. This is because of the recurrent droughts, disease outbreaks (rinderpest and trypanosomiasis) and decreased grazing land, which have resulted in significantly reduced supplies of meat from cattle, sheep and goats.

Poultry is the only affordable species to be slaughtered at home by resource-poor farmers, as the prices of other species are high, and have increased substantially in recent years. Moreover, rural households often cannot afford to slaughter a sheep or goat as the prices are more than 200 birr per head, whereas it is about 22 birr for chicken[1] (CSA 2008). Consumption of pork is not allowed for religious reasons for most Ethiopians (Orthodox Christians and Muslims).

With this background, impact of avian flu, design of pro-poor control and prevention strategies and development of institutions towards these pose several research questions. Though Avian Flu has not struck Ethiopia until now but mortality from animal disease has been quite significant in Ethiopia all along. In poultry, the main disease constraints in the large commercial farms are gastrointestinal helminths (prevalence 91.01%), Marek's disease (72.9%) and Newcastle disease (32.2%). Coccidiosis is the main disease in small farms. In 2007 only 9% of the 15 million diseased poultry were treated for any diseases (Nzieutcheung 2008). In relation to these diseases avian flu can be equally detrimental to the poultry sector. However, it potentially has a greater knock on effect with possibilities of trans-boundary transmission and also the potential to transmit to humans.

Sonaiya (1990), after summarizing the reports from six African countries, reported that the mortality caused by Newcastle disease ranges from 50-100% per annum and that severity is higher in the dry

[1] Average monthly price of sheep (10 -15 kg) was 213.59 birr in Oromiya and 208.14 birr in Amhara regions in January 2008 whereas it was 23.29 and 21.2 birr for chicken in Oromiya and Amhara, respectively

season, whereas the disease is more widespread in the rainy season in the central highlands of Ethiopia (Tadelle and Ogle, 1996). Even with such high mortality, the farmers do not have any preventive medicine or practice for this fatal disease, and only after the start of an outbreak do they treat their birds with socially accepted medicines (Tadelle and Ogle, 1996). However the effectiveness of these treatments is not satisfactory. Similar kind of set up will affect the response to Avian flu outbreak in Ethiopia if it occurs.

Goutard and Magalheas (2006) in their risk assessment study of an HPAI outbreak point out the risk of HPAI outbreak in Ethiopia. They relate it to three main factors i.e. the high number of birds, the low level of bio-security (mainly free range chicken) and the relatively high number of migratory water birds wintering in the rift valley lakes. These factors put Ethiopia at risk of introduction and spread of HPAI.

With the risk of an outbreak, adequate prevention and control strategies need to be put in place in Ethiopia. The control and prevention strategies however have significant associated economic and social costs, including the direct costs of standard disease control measures – such as compensation, vaccination, eradication and bio-security – as well as the indirect costs of building institutions and mechanisms to support those measures (DFID 2008). The control strategies in Ethiopia have to be sensitive to the heterogeneity in poultry sector in terms of size, organizational structure and levels of bio-security.

This background paper provides a synthesis of information relating to the existing knowledge base regarding HPAI research in Ethiopia. The objective of the background paper is to provide baseline information for further HPAI research and also provide a knowledge base that helps in identifying the research gaps for the project: Pro-poor risk reduction strategies for control of HPAI. As discussed above the scope of research on this topic essentially involves multi-disciplinary knowledge. Broadly, the background information could be divided into three components which are not meant to be mutually exclusive viz. economy related, epidemiology/veterinary related and institutions related.

The paper hence includes information about the economy in terms of its structure (including specifically on the poultry sector), its performance and bottlenecks and animal disease related information for example in terms of assessed risks and disease's epidemiology. In providing the information the paper is sensitive to "everything depends on everything else" feature of the scope of research on the topic.

The paper is organized as follows. Section 2 provides a brief overview of the vital country statistics regarding Ethiopia which have a bearing on the research in the project. These include information on the economy taking into account the regional differences. Section 3 highlights the role of the poultry sector in the Ethiopian economy and its structure all of which have a bearing on the risks for introduction of disease, its control and transmission. Assessment of the existing levels of bio-security and documentation of proposals to improve it are topics that are relatively new but are critically important for HPAI research. Section 4 summarizes information on the levels of bio-security in the poultry sector in Ethiopia.

The pro-poor focus of the project makes it imperative that the background paper provide detailed information on the role of poultry in livelihoods. Section 5 briefly discusses the role of poultry in livelihoods. Since the focus of the project is on pro poor strategies, the paper focuses on providing

information on the whole poultry supply chain including on the consumers. Thus for the poor, poultry can play an important role in meat and egg consuming societies as a critical source of micro-nutrients and should be considered an important component of livelihood impact analysis.[2]

Section 6 provides background information for the risk assessment of the introduction and spread of HPAI. Section 7 reviews the existing study on risk assessment. Section 8 then discusses the institutional response in Ethiopia in light of the assessed risks. This includes details on veterinary services, regulatory mechanisms, government's policy preparedness and general governance structures. Section 9 concludes and section 10 presents a brief outline of some clearly identified research gaps for HPAI research.

[2] Note that the impact of any animal disease including HPAI on nutrition is complex. Disease shocks have both price as well as income effects. Price effects owing to changes in the relative price of poultry products has an effect on demand of poultry (own price effect) as well as demand of other products (cross price effect). Additionally, for producing households, the disease outbreaks and control methods have an impact on livelihoods/income and thus affect the consumption of all food products including poultry as well. These effects are in addition to shift in preferences that follows a disease outbreak.

2. Vital Country Statistics

2.1 Geography and Population

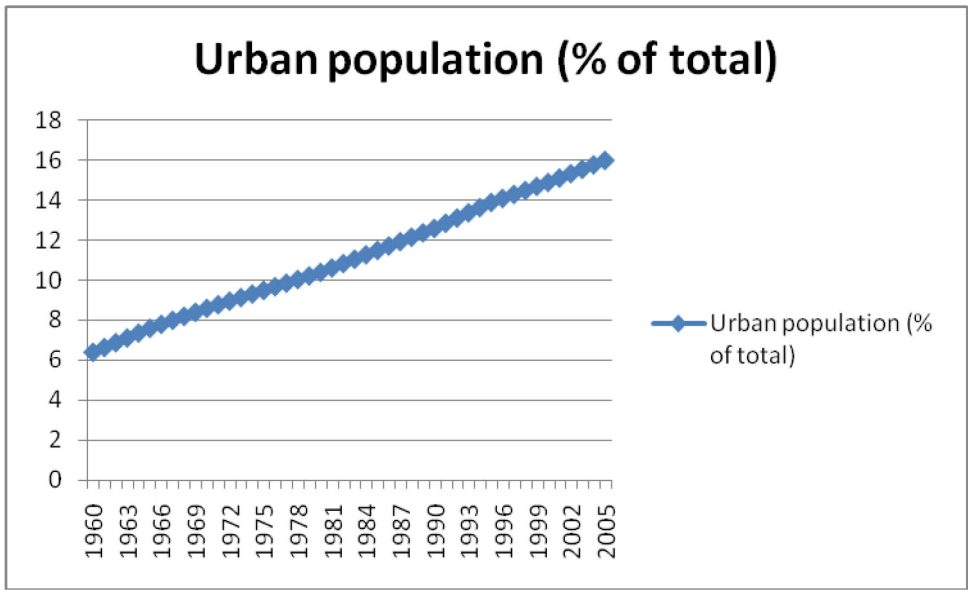
Ethiopia is a landlocked country located in the Horn of Africa. The country covers approximately 1,221,900 square kilometers and shares frontiers with Sudan, Kenya, Somalia, and Djibouti. Much of the Ethiopian landmass is part of the East African Rift Plateau. Ethiopia has a general elevation ranging from 1,500 to 3,000 meters above sea level. The national capital of Addis Ababa is located in the center of the country on the edge of the central plateau. The highlands that comprise much of the country are divided into northern and southern parts separated by the Great Rift Valley.

The Great Rift Valley runs from the Jordan Valley in the Middle East to the Zambezi River's Shire tributary in Mozambique. The southern half of the Ethiopian segment of the valley comprises several large lakes. The water bodies in these lakes are often considered a source of migratory birds which could be carrier of avian flu virus.

In July 2005 the country had a population of about 73 million. The population has been predominantly rural though there has been a steady growth in the rate of urbanization in the country. The percentage of population that resided in urban areas was merely 6% in 1960. It increased to about 16% by 2006. Note that in developing countries such as in Ethiopia, the measure of urbanization is often prone to measurement error. It has been pointed out in several places that estimate of urbanization in Ethiopia could well be an overestimate owing to treatment of several peri-rural areas as urban in Ethiopia.

Even though rate of urbanization has been increasing over time it continues to be one of the lowest in Africa. Figure 1 shows the evolution of urbanization in Ethiopia over time. In sub-Saharan Africa only Burundi and Uganda had levels of urbanization that was below that of Ethiopia. The average annual population growth rate in Ethiopia between 1985 and 2000 was 2.8%. The annual population growth rates for both the rural and urban populations have also generally been declining since reaching a peak in 1990, although the rural growth rates have declined at a faster pace than urban rates (WDI, 2002; OECD 2004).

Figure 1: Evolution of Urbanization in Ethiopia over time



Source: WDI (2007)

In this project, rate of urbanization is an extremely important variable owing to several reasons. First, along with income, urbanization determines the tastes and preferences of the consumers. The primary driving force behind the shift in consumption toward high-value agriculture (fruits and vegetables, livestock products and processed food for example) is rising income but changes in lifestyle with urbanization and shifts in the demographic structure also contribute towards consumption diversification. As incomes rise, the share of the budget allocated to food tends to decline, but the composition of the food budget also changes. Households devote a smaller share of the food budget to grains and other starchy staples and a larger share to meat, eggs, milk, fish, fruits, vegetables, processed and prepared foods.

Alongside, urbanization changes diets because urban consumers purchase a larger share of their food (rather than growing it), because urban consumers face a wider range of foods from which to choose, and because urbanization is associated with women's participation in the workforce, reducing the time available for food preparation. In the context of this project, urbanization is important as it will directly affect the demand of poultry products.

Secondly, urbanization affects marketing of food products and that includes poultry products as well. Urbanization creates demand for differentiated products as greater variety of products are available owing to an access to a wide portfolio of products (for example through imports). The opportunity cost of time also gets altered with urbanization thereby increasing demand for processed products which work both towards value addition as well as product differentiation. Additionally, the collection of buyers at a single location facilitates emergence of modern marketing channels such as supermarkets. In Ethiopia, though on a limited scale, some supermarkets have come up in Addis Ababa. The procurement as well as marketing channels of poultry products are significantly different if the transaction occurs through modern channels.

Finally, urbanization is crucial for the type of poverty, a critical aspect of a project focusing on pro-poor outcomes. Ravallion (2003) has argued that poverty is increasingly getting urbanized. Even though the rate of urbanization is considerably low in Ethiopia, urbanization in Ethiopia is producing changes in the nature of poverty. In 2001, slums represented 99.4% of the total urban population in Ethiopia. Addis Ababa had just one quarter of this population so that the rest of the slum population was mainly distributed in and around another 8-10 urban centers (UN Habitat, 2003).

The overall average population density is around 37 people per square kilometer. However, large variations exist with over 100 people per square kilometer in Shewa, 75 in Arsi and less than 10 in the Ogaden, Bale, the Great Rift Valley and the western lowlands near Sudan (FDR, 2003). There are various ethnic groups in the country whose shares in the population (as in 2006) are as follows: Oromo 40%, Amhara and Tigre 32%, Sidamo 9%, Shankella 6%, Somali 6%, Afar 4%, Gurage 2% and others 1%. Corresponding to different ethnic groups and regions there are also several languages such as Amharic, Tigrigna, Oromigna, Guaragigna, Somali, Arabic, other local languages and English.

2.2 Economic performance and poverty in Ethiopia

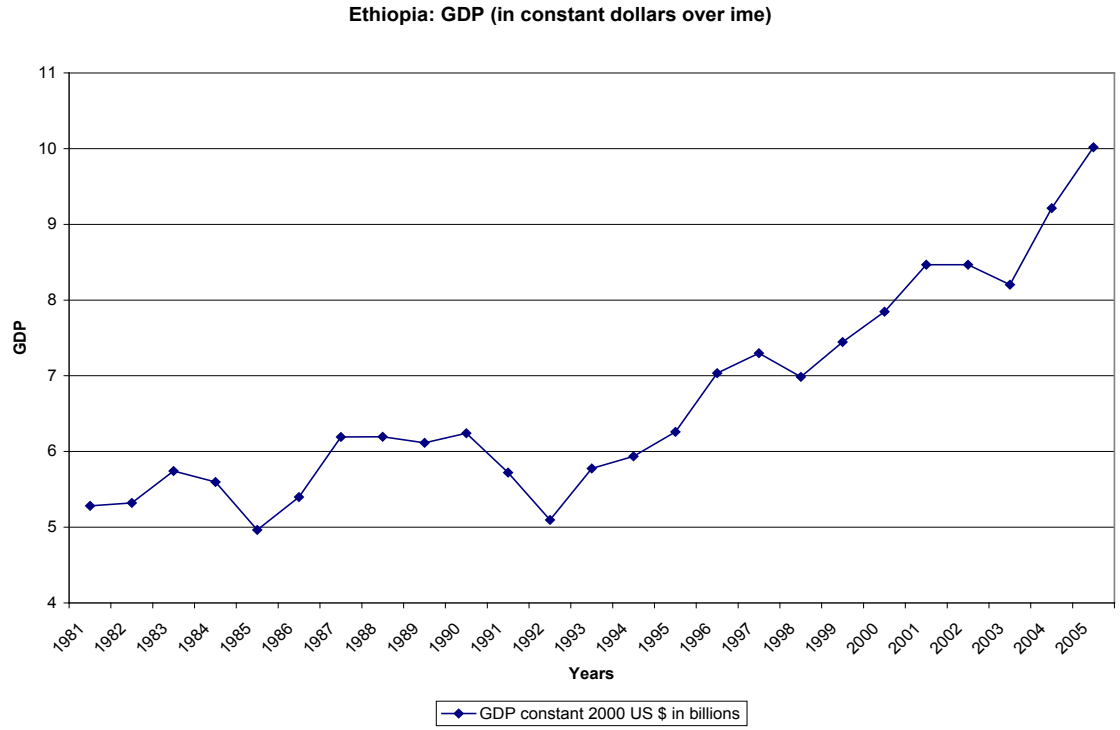
Figures 2-5 present the evolution of gross domestic product (GDP) in Ethiopia both in absolute as well as in per capita terms. All the figures are in constant dollars. Both in absolute as well as per capita terms, GDP growth in Ethiopia has been extremely volatile. Growth volatility is typical of sub-Saharan African (SSA) countries and Ethiopia is no exception. Growth volatility is in fact five times higher in SSA than that observed in low and middle income countries, as given by the coefficient of variation of GDP per capita growth (World Bank 2007).

Till 1993, there was a secular trend decline of real GDP and real GDP per capita in Ethiopia. With regime change in the early 1990s, the secular trend has been reversed and it is now upward though it is still characterized with significant volatility. This is typical of an agrarian economy with little crop and non-crop diversification and dependence on rains.

In export markets also Ethiopia is largely mono-crop with an overwhelming share of coffee in total exports. In fact coffee exports generate more than 60% of total export earnings for Ethiopia. Within agriculture some diversification in exports has occurred with export opportunities in floriculture.

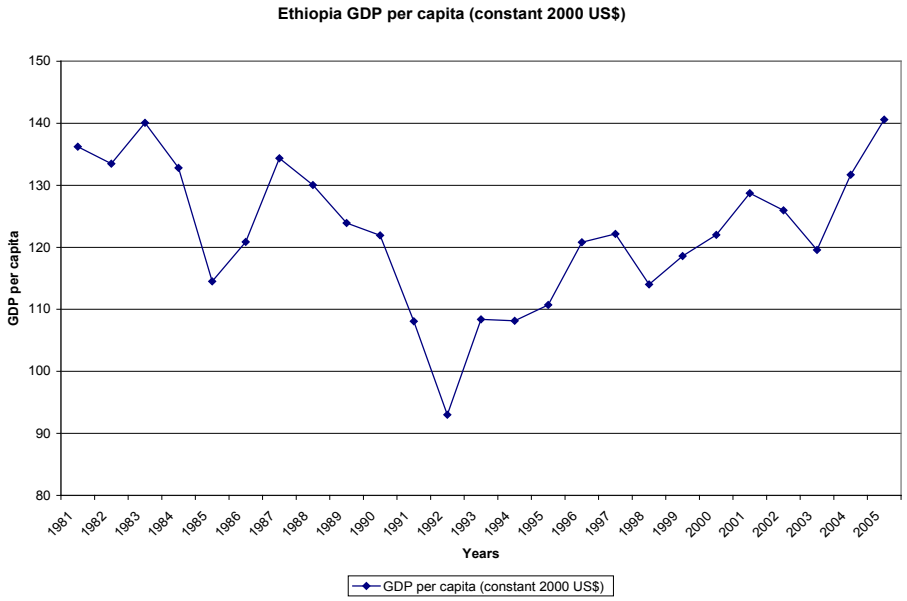
Recently, the economy of Ethiopia has been doing reasonably well (Figures 2 and 3) though what effect the rapidly rising food prices will have on a net food importing country like Ethiopia is still to be borne out. According to the IMF, in 2007, Ethiopia had the fastest growing economy in Africa among countries whose economy is not driven by oil revenue. The International Monetary Fund (IMF) data indicated that Ethiopia had a 10.5% GDP growth in 2007, significantly above the 6.1% average for Sub-Sahara Africa (SSA).

Figure 2: Ethiopia's GDP over time



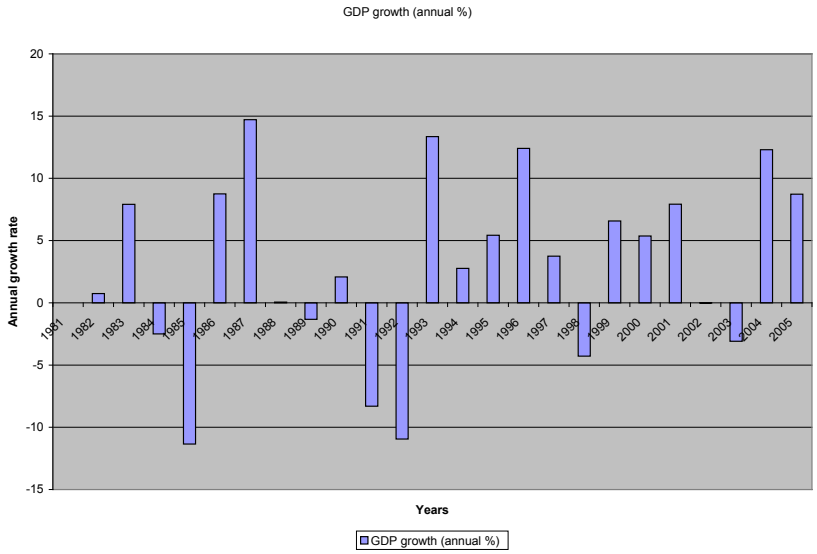
Source: WDI (2007)

Figure 3: Evolution of GDP per capita in Ethiopia



Source: WDI (2007)

Figure 4: Ethiopia's GDP annual growth



Source: WDI (2007)

In assessing the economic performance of a country, there can be several suitable benchmarks. Thus, for Ethiopia it could for example be other poor countries, other countries with very high dependence on agriculture. Sub Saharan Africa (SSA) region comprises the poorest countries of the world where in lies Ethiopia as well. In the post-war period, few SSA countries have made the transition to achieving high standards of living for their populations.

In 1998, only two African countries, Mauritius and Botswana, ranked among the top 50 countries in the world in terms of per capita GDP (calculated on a PPP basis), and none ranked among the top 50 on the UN's Human Development Index.[3] Thus, Ethiopia shares the typical features of performance for a SSA country as much as its shares its characteristics (for example landlockedness, remoteness from world markets, primary commodity dependence, ethno-linguistic fractionalization for most SSA countries). Over time there has been little convergence between Ethiopia's purchasing power parity (PPP) per capita GDP and that of rest of SSA. Even with SSA as a benchmark Ethiopia's economic performance has been inferior and status quo has been maintained for a long time.

Even though in recent years the economy has been doing well, the history of volatility and the added issue of high food prices implies that a priori there is no strong basis for sustained economic growth in Ethiopia. This is especially so as good economic performance has only been a recent phenomenon. The low levels of economic growth and volatility has resulted in a very slow reduction in poverty in spite of food aid and development assistance.

2.3 Agriculture's role in Ethiopian economy

Agriculture accounts for roughly 47 per cent of Ethiopia's GDP and over 80 per cent of the population depends on it for their livelihood (in 2005). In the last decade, the share of agriculture in GDP has

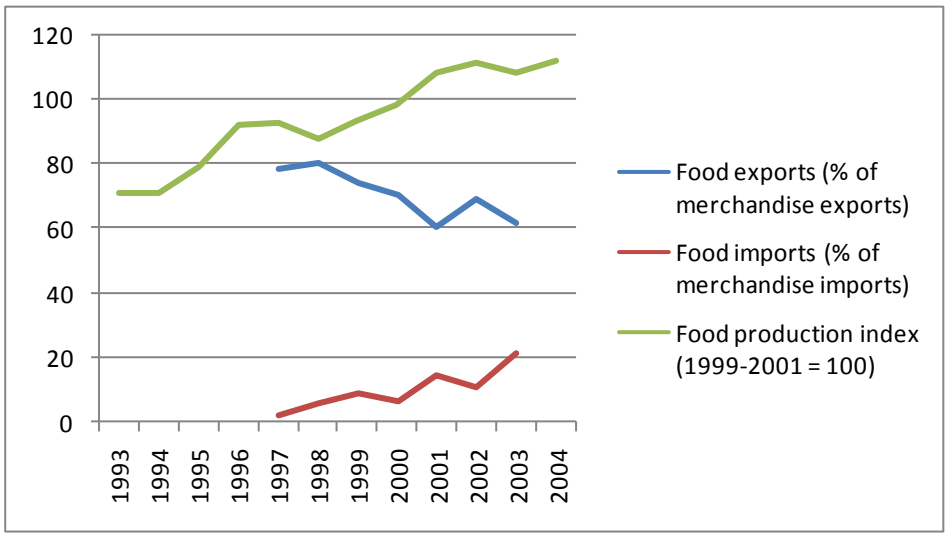
[3] These assessments exclude the Seychelles.

declined from 51% in 1996 to 47% in 2005 (WDI 2007). Most of the agriculture is rain-fed. Only 1 percent of land is estimated to be irrigated.

Ethiopia also has the largest reserves of livestock in Africa; animals sustain an estimated 80 per cent of the rural population of Ethiopia. Exports of live animals have increased from 3000 tonnes in 2003/04 to 33,000 tonnes in 2005/06, with meat exports also doubling over the same period. The meat exports do not comprise poultry products in a significant way. Table 1 shows that both imports and exports of poultry products are miniscule. In fact trade in veterinary products also is negligible which could have implications for the prevalence of bio-security in the country (table 2). Ethiopia does not export any veterinary products and imports mostly from Europe are small.

The main trade items for Ethiopia are food products and share of food products in total imports and exports has remained high all throughout the post war period. Even though the food production index shows a secular upward trend the share of food imports in total merchandise imports has increased steadily over time (Figure 5).

Figure 5: Food production and trade in Ethiopia



Source: WDI (2007)

Table 1: International Trade in poultry products (Ethiopia)

Period	Trade Flow	Reporter	Partner	Commodity Description	Trade Value	NetWeight (kg)
2006	Export	Ethiopia	Djibouti	Birds eggs, in shell, fresh, preserved or cooked	228765	158400
2006	Export	Ethiopia	Italy	Birds eggs, in shell, fresh, preserved or cooked	11263	9000
2006	Import	Ethiopia	China	Pig and poultry fat, unrendered	303	46
2006	Import	Ethiopia	China	Birds eggs, in shell, fresh, preserved or cooked	1517	2840
2006	Import	Ethiopia	China	Birds eggs, other than in shell, egg yolks	113	19
2006	Import	Ethiopia	China	Egg yolks except dried	113	19
2006	Import	Ethiopia	China	Turkey meat, offal prepared or preserved, except liver	162	500
2006	Import	Ethiopia	Italy	Turkey meat, offal prepared or preserved, except liver	611	344
2006	Import	Ethiopia	China	Fowls meat and meat offal	197	71
2006	Import	Ethiopia	Japan	Fowls meat and meat offal	87	22
2006	Import	Ethiopia	Malaysia	Fowl, duck,goose, offal, prepared, preserved not liver	1259	577

Source: UN Comtrade (2006)

Table 2: International Trade in Veterinary products

2006	**Import**	**Ethiopia**	**France**	**Vaccines, veterinary use**	**4589**
2006	Import	Ethiopia	Czech Rep.	Vaccines, veterinary use	68
2006	Import	Ethiopia	Germany	Vaccines, veterinary use	113692
2006	Import	Ethiopia	Kenya	Vaccines, veterinary use	31764
2006	Import	Ethiopia	Netherlands	Vaccines, veterinary use	15955

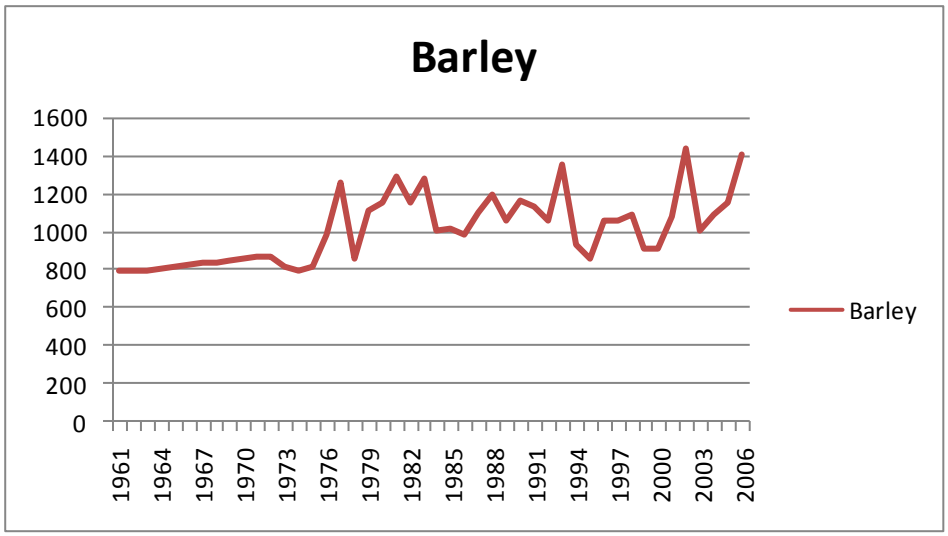
Source: UN Comtrade (2006)

With such a high dependence on agriculture and vulnerability owing to dependence on rainfall, the largest group of the poor people comprises the small-scale farmers in Ethiopia. In Ethiopia, the average size of landholdings has been declining over the last few decades, it shrunk from 1.4 to 0.8 hectares between 1977 and 1990. These trends suggest a continuous process of fragmentation in Ethiopia. With land holdings less than 1 ha, productivity is low and there is increased vulnerability to drought and other adverse natural conditions. Thus, for the main crops, yield per hectare have also varied considerably though in some crops there has been a secular increase in productivity.

The shocks that affect the yields significantly imply an important role for the livestock as their sales can act as a buffer against the shocks. This also implies that shocks to livestock itself such as through AI could have much greater impact on the livelihoods of poor households if it is co-variant with weather shocks. Thus, the potential impact of HPAI on livelihoods is state contingent depending on its co-variance with weather shocks.

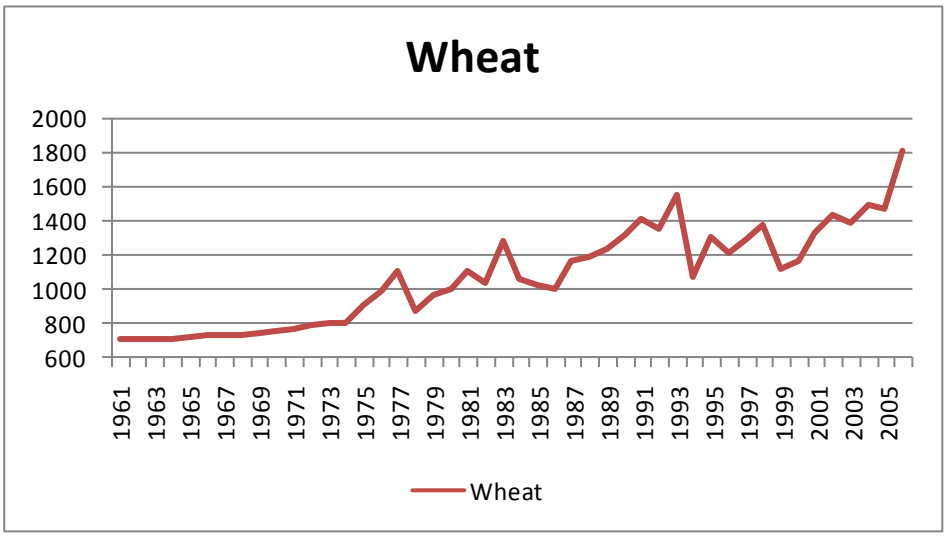
Figures 6, 7, 8 and 9 show that shocks to productivity (mainly owing to weather) to the main crops are quite common in Ethiopia. This has two implications. First livestock have a role to play as a source of insurance and secondly as discussed above the shocks to the livestock sector have state contingent impacts depending on households' income generating portfolios.

Figure 6: Productivity of main crops (Barley)-Kilograms per hectare



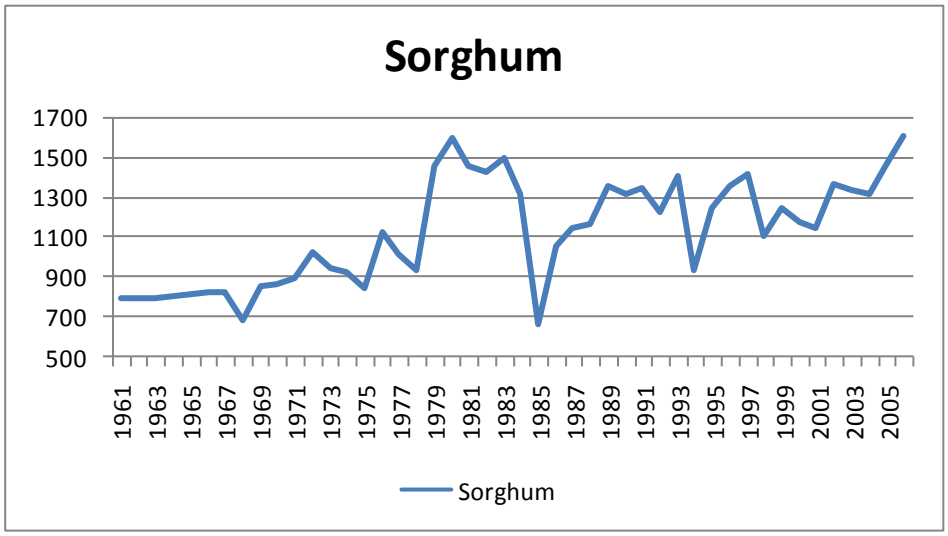
Source: FAOSTAT

Figure 7: Productivity of main crops (Wheat) - Kilograms per hectare



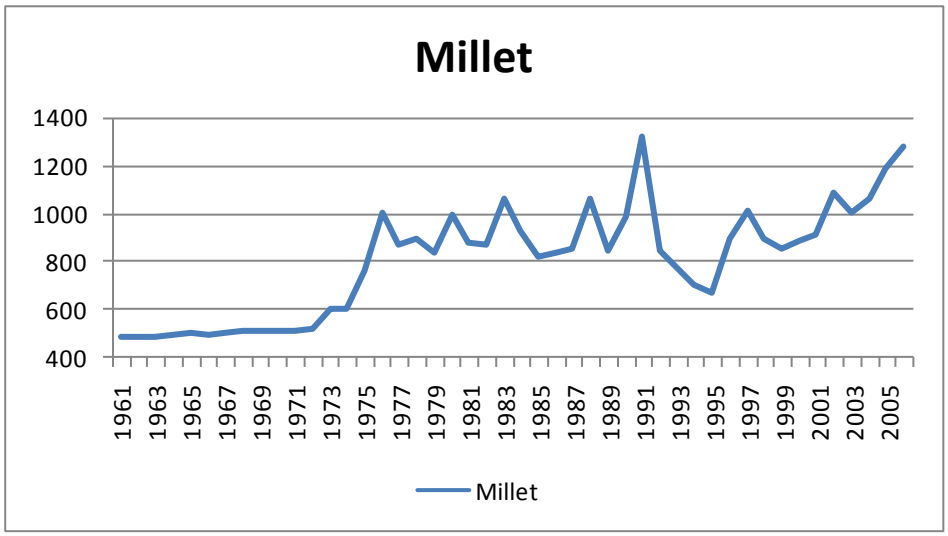
Source: FAOSTAT

Figure 8: Productivity of main crops (Sorghum)- Kilograms per hectare



Source: FAOSTAT

Figure 9: Productivity of main crops (Millet) -Kilograms per hectare



Source: FAOSTAT

Note that the productivity shocks are not covariant across all main crops especially in recent times. However there is a fair degree of specialization across crops in Ethiopia thus risk mitigation by diversification across crops seems less likely. In contrast, the outputs from some poultry products are less affected by shocks that relate to weather. Statistics reported in Table 3 show that since 1993 yields in eggs have been varying over time but the standard deviations are much lower. A disease like HPAI can break the ability of the households to hedge against other shocks by using their livelihood assets through market sales or home consumption that has implications for food and nutrition security.

Table 3: Yield hen eggs

Year	Hen eggs, in shell
1993	4347
1994	4347
1995	4347
1996	4347
1997	4327
1998	4347
1999	4347
2000	4329
2001	4361
2002	4360
2003	4360
2004	4360
2005	5158
2006	5158

Source: FAOSTAT

2.4 Human Development Index and nutrition in Ethiopia

The human development index (HDI) produced by the UNDP provides a composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), being educated (measured by adult literacy and enrolment at the primary, secondary and tertiary level) and having a decent standard of living (measured by purchasing power parity, PPP, income). The HDI for Ethiopia is 0.406, which gives the country a rank of 169th out of 177 countries. Thus, the level of human development is very low in Ethiopia. Some of it has implications for the project straightaway.

Table 4: Human Development Indices for Ethiopia (1990-99)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Unemployment with primary education (% of total unemployment)	35.8	30.7	48	37.8	28.3	24.6	28.4	30	28.8	26.9
Unemployment with primary education, female (% of female unemployment)	33.4	30	33.6	31.2	24.4	26.2	26.7	30	27.9	27.4
Unemployment with primary education, male (% of male unemployment)	37.6	31.3	53.2	41.6	31	23.5	29.7	30.1	29.4	26.5
Unemployment with secondary education (% of total unemployment)	55.9	61	41	52.1	60.3	71.7	60.6	61.1	61.2	61.3
Unemployment with secondary education, female (% of female unemployment)	60.3	63.7	58.1	61.4	65.3	70.7	66.6	64.4	65.6	66.7
Unemployment with secondary education, male (% of male unemployment)	52.7	58.9	34.8	46.9	56.2	72.4	56.2	58.5	57.8	57
Unemployment with tertiary education (% of total unemployment)	6.6	7.3	5.9	6.2	7.7	3	8.7	6.7	4.6	8.1
Unemployment with tertiary education, female (% of female unemployment)	5.1	5.9	5.6	5	6.5	2.8	4.7	4.2	2.4	4.2
Unemployment with tertiary education, male (% of male unemployment)	7.7	8.5	6	6.9	8.5	3.2	11.5	8.8	6.3	11.2
Unemployment with primary education (% of total unemployment)	60.3	63.7	58.1	61.4	65.3	70.7	66.6	64.4	65.6	66.7
Unemployment with primary education, female (% of female unemployment)	52.7	58.9	34.8	46.9	56.2	72.4	56.2	58.5	57.8	57
Unemployment with primary education, male (% of male unemployment)	6.6	7.3	5.9	6.2	7.7	3	8.7	6.7	4.6	8.1

Source: WDI (2007)

GDP per capita captures the average level of deprivation and also provides a measure of vulnerability. The literacy rate provides several useful indicators. First, the level of human capital determines the ability to diversify in employment. The greatest percentage of unemployed are those with secondary education. Moving towards tertiary education, the percentage share among the unemployed falls considerably. Most of the people working in the poultry sector are likely to come with primary and secondary education. Shocks to this sector can render them unemployed very quickly as the economy exhibits little employability for this group. Also note that the poultry sector provides employment to a large number of women.

In addition there has been developed a human poverty index (HPI). The Human Poverty Index focuses on the proportion of people below a threshold level in the same dimensions of human development as the human development index - living a long and healthy life, having access to education, and a decent standard of living.

By looking beyond income deprivation, the HPI-1 represents a multi-dimensional alternative to the $1 a day (PPP US$) poverty measure. The HPI-1 value of 54.9 for Ethiopia, ranks 105th among 108 developing countries for which the index has been calculated. The HPI-1 measures severe deprivation in health by the proportion of people who are not expected to survive age 40. Education is measured by the adult illiteracy rate. And a decent standard of living is measured by the unweighted average of people without access to an improved water source and the proportion of children under age 5 who are underweight for their age.

This index has been modified to make it sensitive to gender issues and is known as gender related development index (GDI). Again, on this index Ethiopia ranks 141 out of 156 countries. These are important information as poultry plays an important source of employment, livelihood and nutrition for women and thereby shocks to this sector can aggravate gender imbalances in Ethiopia.

One of the important welfare indicators that this project focuses on is nutrition. Our conjecture is that poultry has an important role to play as a source of micro-nutrients and thus animal diseases such as HPAI can have far reaching impacts beyond the income shocks that it entails. The discussion below summarizes some of the findings of a nutrition study conducted by United Nations and published in 1994.

Nutrition surveys were conducted in Ethiopia in 1983 followed by one in 1992. This was followed by a nutrition survey in 2000. All these were carried out during the post-harvest season. An analysis done by the Central Statistical Authority (with assistance from Cornell University) comparing 11 regions of the country indicated that the nutrition situation in 1992 was significantly worse than 1983. For all 11 regions combined, the prevalence of underweight in children (6-59 months, <-2 SDs NCHS in both surveys) increased from 37.3% in 1983 to 46.9% in 1992. This prevalence in 1992 of nearly 50% underweight is likely to be (with Mozambique) the highest in Africa. Projected to the entire 0-4 year population, this implies that the number of underweight children rose from 2.7 million in 1982 to about 4.6 million in 1992, or nearly doubled.

The regional trends have also been estimated by comparing the 1983 and 1992 surveys: the prevalence of underweight children increased in all 11 regions surveyed. The regions of Gonder, Gojam, Sidamo, and Welega had an underweight prevalence between 50% to 60% in 1992. These levels are among the highest prevalences reported in Africa, outside of refugee/displaced camp populations.

Stunting (low height-for-age) and wasting (thinness -low weight-for-height) have also been estimated. The mean prevalence of stunting for all the regions in 1992 was 64%. The regions with the highest rates (above 66% stunting) include South Gonder, East and West Gojam, North Welo, Tigray, Sidamo, Ilubador, North Gonder, and South Shewa. South Omo has the highest stunting, with 75% of its preschool children stunted. Such levels of stunting are among the highest in the world, and almost certainly the worst in Africa. Stunting is already prevalent at early ages (6-11 months old infants), although the incidence of low birth weight (12-15%) is not especially high. With its large population

of 53 million in 1993, and with 4.6 million of its 9.7 million preschool children underweight, malnutrition was one of the biggest socio-economic problems in Ethiopia.

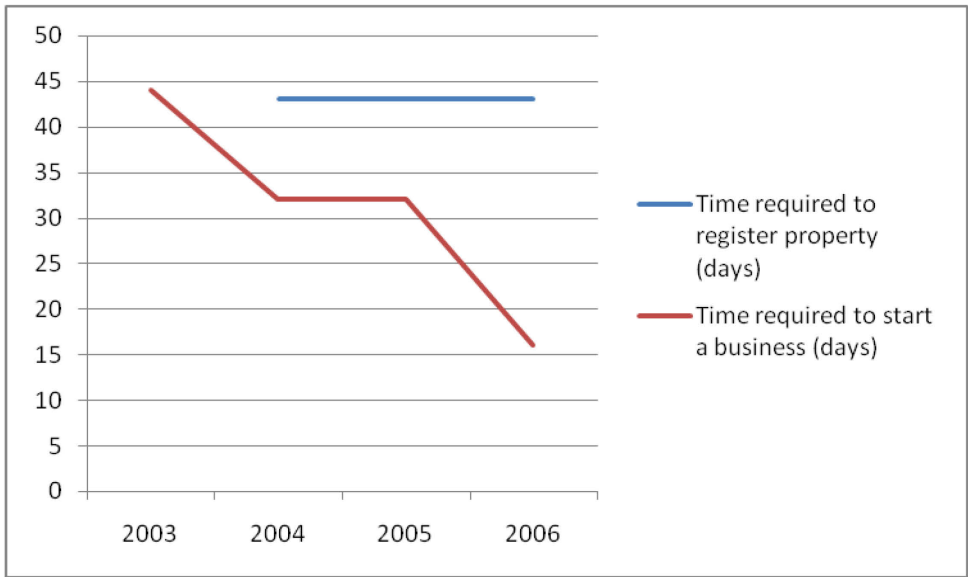
More recently nutrition surveys were conducted in Borania zone – Oromia region in 2000. Note that this is a relatively well off region in the country. Though the study found about 12% of children to be malnourished but the extent of malnourishment among the elderly was severe at 71%. Our conjecture is that role of poultry will be important in determining the nutrition outcomes for the vulnerable sections that include women, children and the elderly.

2.5 Institutional Structure in Ethiopia

The country follows a federal system of government with nine regional states, an administrative council and a city administration. The regional states are subdivided into zones and the zones into weredas. There are 73 zones and 540 weredas in the country. For administrative purposes, the rural parts of the wereda are subdivided into peasant association areas and the urban parts into urban dwellers association areas or kebeles (see Reda 2005 for details).

The effective institutional structure prevalent in Ethiopia has several implications for the project. The design of control options such as compensation for culling has to be sensitive to the institutions that prevail. The timeliness of control options is highly critical in case of an outbreak of HPAI. Like in other developing countries, government in Ethiopia is likely to face constraints relating to quick delivery. Figure 10 shows that timeliness of the programs can be an issue in Ethiopia. Average time required to enforce a contract is perceived to be 690 days while it takes on an average 2.4 years to resolve insolvency. Such figures imply several challenges for the design of control strategies. It should also be noted that in recent years there has been an ongoing transformation of the public institutions to improve the public services in all government offices. Some public institutions have shown concrete improvements in their service provision.

Figure 10: Indicators of timeliness in Ethiopia: Time to start a business and register property



Source: WDI (2007)

3. An Overview of the Economics and Structure of the Poultry Sector

3.1 Economic contributions of the poultry sector: macro perspective

Prior to describing the major economic contributions of the poultry sub-sector, it would be important to outline some of the salient facts on the livestock sector of Ethiopian agriculture.

Ethiopia has one of the largest livestock populations in Africa. The livestock sector accounts for about 18.8% of the national GDP and 40% of the agricultural GDP (FAO, 2004). It is a major source of foreign exchange earnings next to coffee. Livestock is strongly attached to all farming systems of the country by providing major economic and social functions such as food, draught power, fuel, cash income, security, and investment. It is estimated that livestock supports the livelihood of about 80% of the rural poor (FAO, 2004). In the highlands crop-livestock mixed farming system which accounts for over 75% of the livestock population, cattle provide traction power for 95% of grain production and also provide milk, meat, manure, cash income and serve as a hedge against times of drought and other risks (Ibid.).[4] In the arid and semi-arid lowland areas, which are prone to drought, cattle, sheep, goats, and camels are managed in migratory pastoral production systems.

The country has an estimated livestock population of 38.7 million cattle, 18.08 million sheep, and 14.9 million goats (Table 5). Table 6 shows the distribution specifically of poultry (chicken) breed population in Ethiopia. A CSA (2005) report revealed that 97.8% of the total poultry population comprises indigenous birds while 2.2% are exotic breeds. The poultry population is mainly concentrated (in order) of Oromiya, Amhara, SNNR, Tigray, and Benhsangul Regional states. This regional distribution of the poultry population is closely associated with the pattern of human population density in the respective regions. Moreover, it shows that the poultry sector is predominantly characterized by rural poultry farming.

The poultry density in Ethiopia (for year 2007) is shown in Figure 11. The regions with higher poultry population as shown in table 6 (Tigray, Amhara, Oromia and SNNPR) had also higher poultry densities.

Regardless of the large livestock population in the country, the livestock sector is generally characterized by low productivity including in poultry. For instance, the average carcass weight for cattle and sheep is estimated to be 108.8 and 10 kg per animal, respectively (FAO, 2004). An average cow gives about 199.9 kg of milk per annum (FAOSTAT, 2004). The average annual growth rates of meat and milk production were estimated to be very low, i.e. 1.3% and 2.1% per annum during the period 1993-2000, respectively (FAO, 2004).

[4] Nearly 80% of the total population is engaged in the mixed crop-livestock faming system in the highland areas that cover 45% of the total area of the country (FAO/AGL, 2005).

Table 5: Livestock population in Ethiopia ('000 heads)

Species	Number ('000 heads)
Cattle	38,749
Sheep	18,075
Goats	14,859
Poultry	30,869
Asses	3,930
Horses	1,518
Mules	318
Camels	459

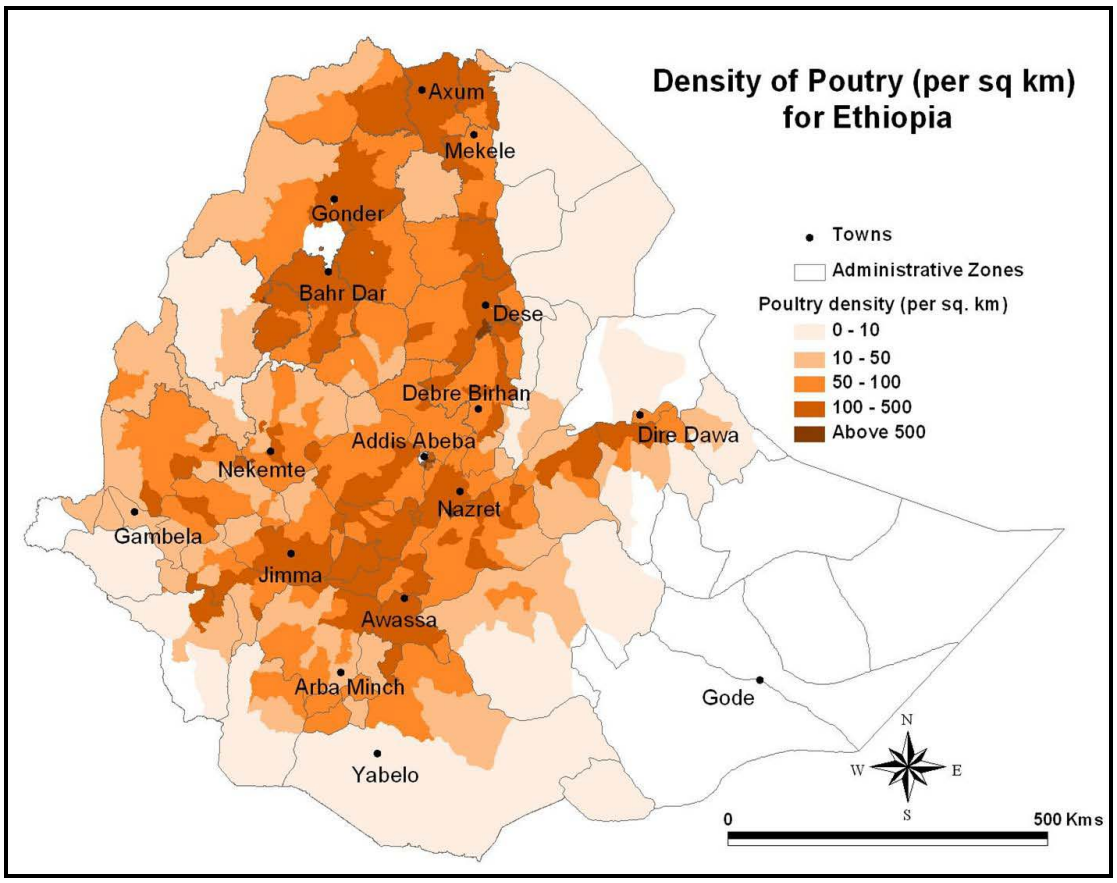
Source: CSA (2005).

Table 6: Population of poultry breeds in different regions in Ethiopia

Region	Native	Hybrid	Exotic	Total
Tigray	302,9519	366,727	78,149	**3,474,394**
Afar	43,720	0	0	**43,798**
Amhara	9,983,180	339,046	46,049	**10,368,274**
Oromia	11,983,432	545,062	75,165	**12,603,660**
Somale	106,414	0	0	**106,534**
Benshangul-Gumuz	735,343	7,260	0	**742,858**
SNNPR	6,437,286	65,978	13,862	**6,517,126**
Harari	30,794	615	0	**31,777**
Addis Ababa	19,607	1569	387	**21,564**
Dire Dawa	45,581	2176	0	**47,852**
Total	**32,414,876**	**1,328,433**	**213,612**	**33,957,837**

Source: CSA (2007) drawn from Nzietcheung (2008). Each breed include cocks, cockerels, pullets, laying hens, non-laying hens and chicks

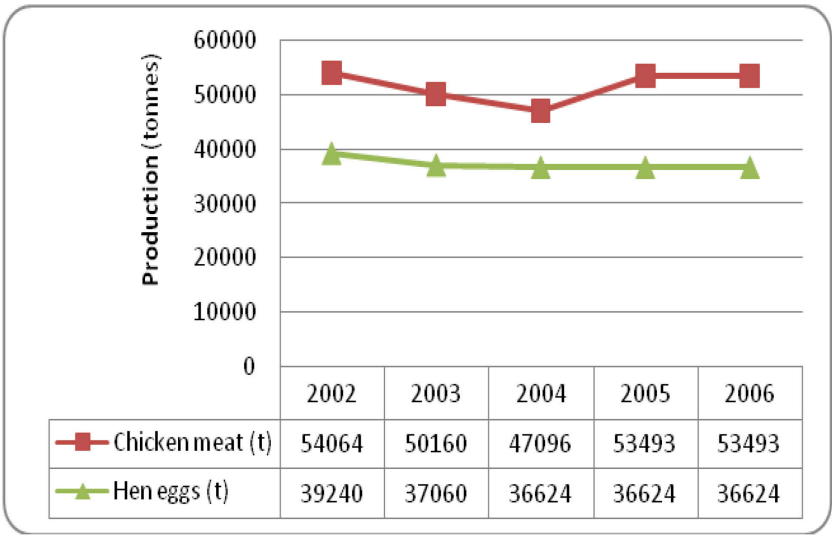
Figure 11: Density of poultry in Ethiopia



Source: Drawn based on CSA (2007) data

Within the livestock sector, though there is considerable poultry population in the country, the performance of the poultry sector has been poor over the past decades. An ILRI (2000) estimate showed that poultry meat production in Ethiopia grew, on an average, only by 0.34% per annum during the period 1985-1994 while the annual hen egg production declined by 0.39% per annum during the same period. This growth rate of poultry production is, indeed, much lower than that of the fast growing population. In recent years some improvements have occurred, yet the poultry sector is characterized by low productivity and production. In 2006, the total poultry meat and egg production were estimated at 53,493 and 36,624 tonnes, respectively (Figure 12). This production mainly comes from the rural poultry based on traditional indigenous chicken farming.

Figure 12: Annual chicken meat and eggs production in Ethiopia (2002-2006)



Source: FAOSTAT (2008)

3.2 Structure of the Ethiopian poultry sector

The poultry sector in Ethiopia can be characterized into three major production systems based on some selected parameters such as breed, flock size, housing, feed, health, technology, and bio-security (Alemu & Tadelle, 1997; Bush, 2006; Goutard & Magalhaes, 2006; AHINTC, 2006). These are village or backyard poultry production system, small scale poultry production system and commercial poultry production system.

Alternatively, the FAO classifies poultry production systems into four sectors, depending on the level of bio-security. Based on this system of classification, Ethiopia has three poultry production systems: large commercial poultry production with “moderate to high biosecurity” (sector 2), small commercial poultry production with “low to minimal” biosecurity (sector 3) and village or backyard production with “minimal biosecurity" (sector 4) (Nzietcheung 2008). Note that the poultry sector in Ethiopia plausibly does not contain any sector 1.

The sector 2 system of poultry production is developing and the main commercial poultry farms – Elflora, Agro Industry, Genesis and Alema – are located around Debre Zeit in Oromia. The sector 3 system is emerging around the urban and peri-urban areas of Ethiopia. In terms of the FAO definition, sector 4 or the village or backyard production represents the main poultry production system in most parts of the country.

3.2.1 Backyard poultry production

This system is characterized by a low input (scavenging is almost the only source of diet), low input of veterinary services, minimal level of bio-security, high off-take rates and high levels of mortality. Here, there is little or no inputs for housing, feeding or health care. As such it does not involve investments beyond the cost of the foundation stock, a few handfuls of local grains, and possibly simple night shades, mostly night time housing in the family dwellings.

The poultry are kept in close proximity to the human population. Mostly indigenous chickens are kept although some hybrid and exotic breeds may be kept under this system (Nzietcheung 2008). The few exotic breeds kept under this system are mainly a result of the government extension programs.

The size and composition of flocks kept by households vary from year to year owing to various reasons such as mortality from diseases, agricultural activities and household income needs. Mortality in local birds results mainly from disease and predators as well. A research report indicated that 62% of small farmers reported disease as the major factor for high mortality while 11% noted predator as a major factor too (Hailemariam, et. al. 2006). Newcastle disease is identified as the major killer in the traditional system while other diseases including a number of internal and external parasites contribute to the loss. The incidence of Newcastle disease is widespread during the rainy season. It often wipes out the whole flocks when it strikes. In particular, it was found that poultry production drops by 50% during the rainy season.

Based on Dessie *et al.*, (2003), Dessie *et al.*, (2001), Bush, (2006) and field interviews in Nzietcheung (2008), typical household flock sizes vary from 2 to 15 chickens. Flocks comprise chicks (0 to 8 weeks), pullets (8 to 20 weeks), cockerels (8 to 20 weeks), mature cocks and layers. In this system, there exists great variation in the size and composition of bird flocks per household and it is a common practice to keep all age and functional groups together.

Most of the birds kept under the backyard system belong to indigenous poultry. Rearing of indigenous poultry offers farmers nutritional, socio-cultural and economic benefits (Nzietcheung 2008). In backyard poultry, women are mainly responsible for rearing poultry. The income earned from poultry keeping is used to buy food and clothes for children. Poultry and egg offer a quality protein source throughout most of the year. Poultry meat and eggs play a role in food security. The level of consumption and sale of chickens and eggs varies during the year. According to Aklilu *et al.* (2007) and field interview, there is an increase in chicken and eggs consumption during the Ethiopian New Year, Christmas and Easter holidays (Nzietcheung 2008).

The backyard poultry production systems are not business oriented rather destined for satisfying the various needs of farm households. In this case, the major purposes of poultry production include eggs for hatching (51.8%), sale (22.6%), and home consumption (20.2%) while chickens for sale (26.6%) and home consumption (19.5%).

Backyard poultry move freely between families in the village. Movement can also be from household to local market for sale, from market to household in case of unsold chicken or in form of gifts from household to household. This free movement of backyard poultry could contribute to the transmission of many infectious diseases in the backyard system (Nzietcheung 2008).

Birds are left for scavenging system and households put little time, and resource for chicken farming. As a result, poultry output is very low. For instance, local birds lay, on average, 40-60 eggs per annum. Moreover, egg sizes are small and chick survival rates are extremely low. Village hens brood and hatch their own eggs. The high chick mortality rates along with the unsuccessful hatching and rearing also accounts for low egg production. For instance, 50% of all eggs laid are destined for hatching.

3.2.2 Small-scale commercial poultry production

In this system, modest flock sizes usually ranging from 50 to 500 exotic breeds are kept for operating on a more commercial basis. Most small-scale poultry farms are located around Debre Zeit town in Oromia region and Addis Ababa. This production system is characterized by medium level of feed, water and veterinary service inputs and minimal to low bio-security. Flock sizes vary from 20 to 1000 and the breeds kept are RIR layers. Most small-scale poultry farms obtain their feed and foundation stock from large-scale commercial farms (Genesis or Alema) (Nzietcheung 2008).

Nzietcheung (2008) points out that there are few studies about diseases affecting poultry in this production system. Kinung'hi *et al.* (2004) mention coccidiosis as a cause of mortality, reduced weight gain and egg production, and reduced market value of affected birds. In all small-scale farms visited during the field interview, poultry were vaccinated against coccidiosis, NCD and Gumboro disease, the vaccination are done by the owner (Nzietcheung 2008).

3.2.3 Large-scale commercial poultry production

It is a highly intensive production system that involves, on average, greater or equal to 10,000 birds kept under indoor conditions with a medium to high bio-security level. This system heavily depends on imported exotic breeds that require intensive inputs such as feed, housing, health, and modern management system. It is estimated that this sector accounts for nearly 2% of the national poultry population. This system is characterized by higher level of productivity where poultry production is entirely market-oriented to meet the large poultry demand in major cities. The existence of somehow better bio-security practices has reduced chick mortality rates to merely 5% (Bush, 2006).

In Ethiopia, the commercial poultry sector is situated mostly in Debre Zeit areas. ELFORA, Alema, and Genesis farms are the major large-scale poultry enterprises in Ethiopia that are located in Debre Zeit. ELFORA, the largest enterprise, supplies about 420,000 chickens and over 34 million eggs per annum to the urban markets in the capital (Abebe, 2006; Bush, 2006). This supply accounts for close to 60% of the total poultry production from the commercial sector in the Debre Zeit areas (Bush, 2006).

Alema Farm is the second largest poultry enterprise delivering about 500,000 broilers per annum to the Addis Ababa market (Abebe, 2006). It has its own parent broiler stock from Holland; feed processing plant, hatchery, on-site slaughtering facilities and cold storage rooms as well as its own transport facility. Genesis farm is the third most important private poultry enterprise operating on average between 10,000 to 12,000 layers and has its own parent layer stock and hatchery (Bush, 2006). Interviews conducted in Nzietcheung (2008) established that Gumboro disease was recently introduced into the country through imported day-old chicks. The farms follow a strict method of prophylaxis against MD, Gumboro disease, NCD, cholera and Salmonellosis.

In the intensive poultry production system, there are also 7 public poultry multiplication and distribution centers (PMDC) that are located in different regions operating with the major objective of distributing improved exotic breeds to smallholder farmers in the country.[5] They have a capacity of delivering nearly 1,236,150 day-old chicks and 485,800 pullets and cocks (Table 7).

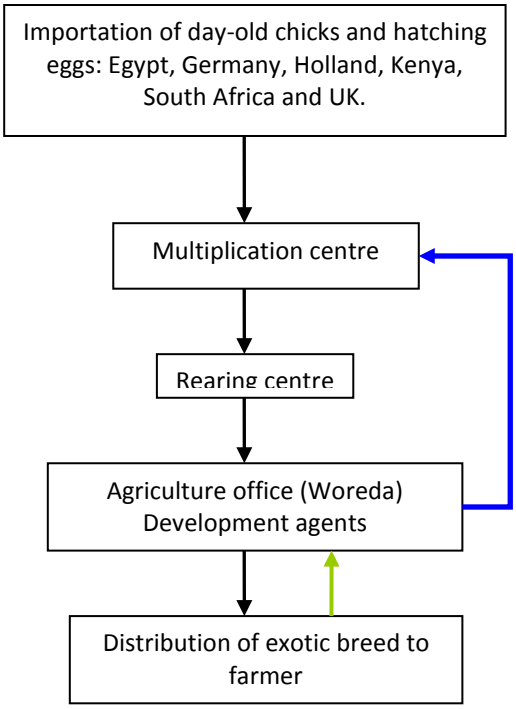
[5] In the 1970s, the Government of Ethiopia introduced exotic poultry breeds (RIR, Bovan Brown and White Leg corn) into the country to increase egg and meat production in rural areas, to genetically improve the native

Table 7: Annual production and distribution of day old chicks from regional public poultry production and multiplication centers, 2005

Name	Region	Annual production and distribution		
		Fertile egg	Day old chicks	Pullets and Cocks
Mekele	Tigray	900,000	180,000	100,000
Kombolcha	Amhara	3,500,000	360,000	140,000
Andassa	Oromia	1,080,000	180,000	46,800
Bedele	Oromia	627,544	108,838	27,000
Nathreth	Oromia	388,331	113,373	54,000
Adele	Oromia	397,485	113,939	18,000
Awassa	SNNP	1,000,000	180,000	100,000
Total		**7,893,360**	**1,236,150**	**485,800**

Source: Adapted from Goutard & Magalhaes (2006)

In all centers, day-old chicks were either imported from Egypt, Germany and Holland, or sourced from Elflora and Genesis commercial farms. Field interviews in Nzietcheung (2008) established that centers in Kombolcha remained closed for two years following an outbreak of Gumboro disease. Currently, some measures of bio-security have been implemented in the centers but research on assessment of the bio-security levels has not been done.



Source: Nzietcheung (2008)

breed and to distribute day-old chicks of improved breeds to farmers. The government set up several poultry multiplication and rearing centres countrywide (Nzietcheung 2008)

3.3 Poultry consumption, marketing and trade

3.3.1 Poultry consumption

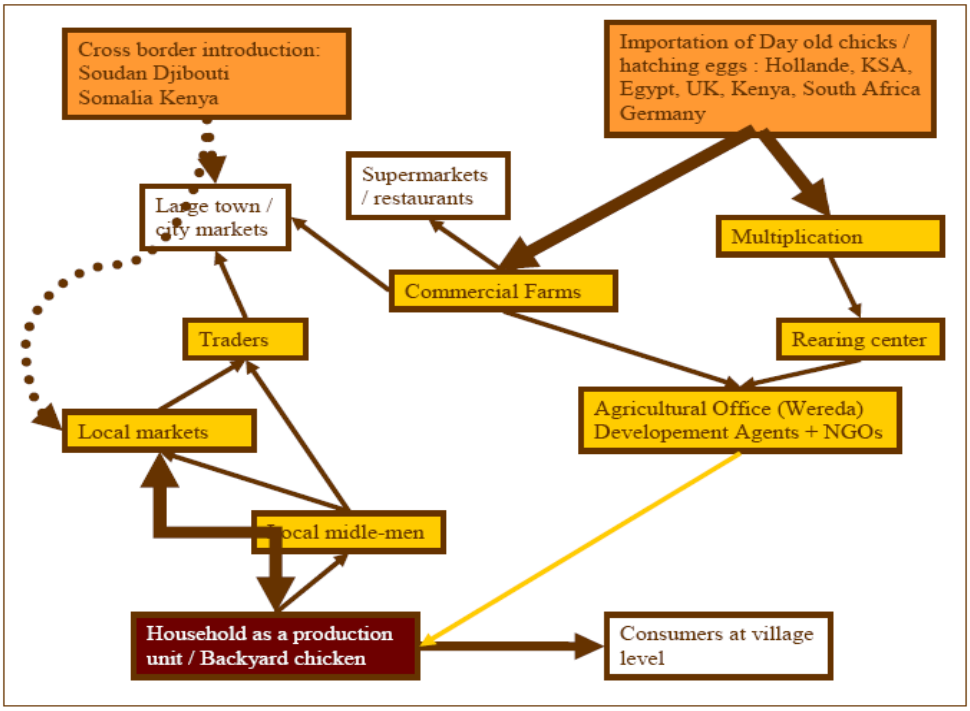
Poultry meat and eggs are relatively cheap and affordable sources of protein for most consumers compared to other animal products such as beef. Consumption of poultry products is more common in urban than in rural areas. Poultry consumption is commonly high during holiday periods. The national poultry meat and eggs consumption is estimated, on an average to be 77,000 and 69,000 tonnes per annum respectively (ILRI, 2000). In the mid 1990s, the per capita egg and poultry meat consumption in Ethiopia was estimated at 57 eggs and about 2.85 kg, respectively (Alemu and Tadele, 1997). This figure is very low by international standards. Currently, the prices of animal products particularly beef and lamb have become dearer particularly for the urban consumers. This could have implications for poultry consumption.

3.3.2 Poultry Marketing

There is generally a scant literature on poultry marketing system in Ethiopia. However, the limited research showed that a large number of marketing agents are involved along the poultry marketing chain. A study conducted on five selected poultry markets in East Shewa Zone (i.e. Debre Zeit, Modjo, Meki, Chefe Donsa, and Saris) revealed that the poultry marketing system is primarily characterized by local selling and buying (Keneal et. al. 2003). The study indicated that there are two major poultry marketing channels where farmers directly sell to consumers as well as directly to small retail traders who take the chicken to large urban markets. Accordingly, it was found that about 42% of all transactions reported were local farmers selling their chickens to local consumers whereas 39.4% of the transactions involved local farmers selling their chickens to traders who re-sold the chickens to urban consumers. Poultry buyers at all sample markets were traders, consumers, restaurants, farmers, and small-scale urban chicken farms.

Goutard and Magalhaes (2006) have identified the major marketing channels of poultry and poultry products (Figure 13). Here, the marketing channel shows that a large number of middlemen are involved in the marketing chain between producers and consumers. It was found that an average trader handles between 40 to 100 chickens per week while the middle man manages 2000 eggs per month. Moreover, it is estimated that the average number of birds that are sold at local markets ranges from 30 to 400 per day.

Figure 13: Trade flow of poultry and poultry products in Ethiopia

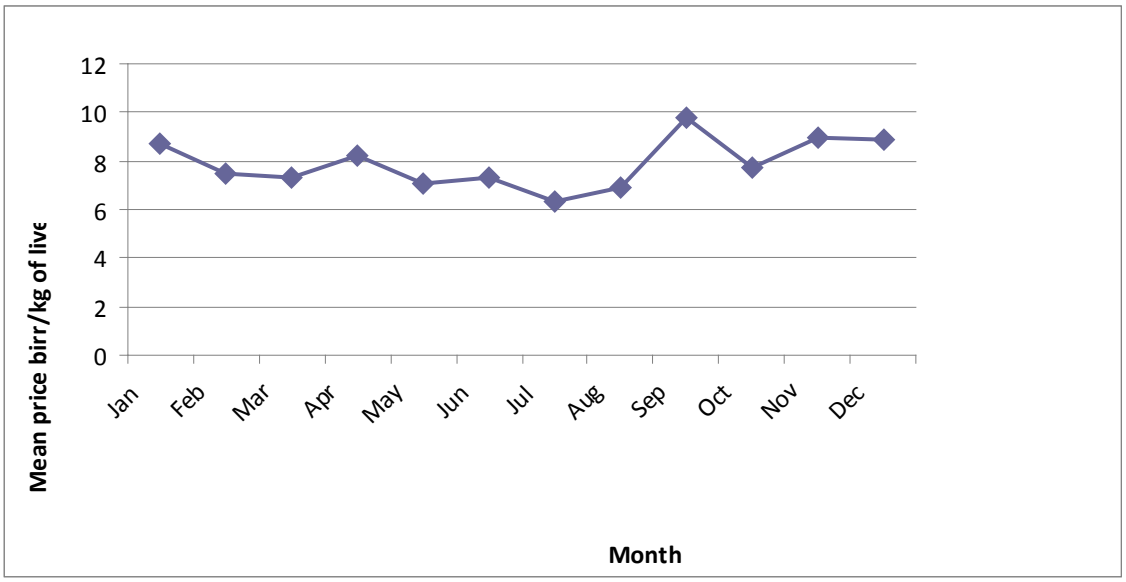


Source: Adapted from Goutard & Magalhaes (2006), p.15

An important feature of the poultry marketing is that there is a large number of small scale traders where volume of trade is small ranging from 10 to 50 chickens (Keneal et. al. 2003). Moreover, there is substantial seasonal variability in poultry prices in the market (Figure 14). The lowest price was observed in July while the highest price level was recorded in mid September. The lowest price level in July is closely associated with the incidence of poultry diseases. During this period supply of chickens to the market increases as the farmers strive to avoid risk of disease. The poultry price starts peaking up in early September and reaches its maximum in mid-September. The price rise coincides with the large demand for chickens during the Ethiopian New Year and ***Meskel*** holidays. The second price rice is in November and this coincides with the Christmas festival.

Nzietcheung (2008) presents prices for 2007. In 2007, the average price of native chicken varies from ETB 20-25, hybrid ETB 35-40, exotic breed ETB 35-45. The price of eggs from indigenous breeds was ETB 0.75-1.00, up from ETB 0.50 to 0.60. In addition of that, a general increase of price is observed the last five years. The price increase is due to increased demand for eggs and poultry meat, increased price of sheep and goat meat, and higher transport cost (Field interviews).

Figure 14: Mean average price of poultry (live chicken) over a year (1999/2000)



Source: Kenea et. al. (2003)

3.3.3 Poultry Trade

Ethiopian trade in poultry and poultry products is limited to the import of live birds. This has important implication for HPAI introduction. The private and public large scale intensive poultry farms are mainly dependent on the import of day old chicks from abroad. In 2005, a total of 736,000 day old chicks had been imported from the Netherlands, Saudi Arabia, Egypt, UK, Germany, and Kenya (Goutard & Magalhaes, 2006).[6] Since 2006 Ethiopia has banned import of poultry products from Egypt, UK, and Germany due to the incidence of HPAI in these countries. In 2006/07, some 1,164 day old ducklings were also imported from France (Abebe, 2006). Day old chicks imported from abroad in 2005-2006 by private and public poultry farms are presented in Table 8.

Goutard and Magalhaes (2006) tried to assess the border trade with Sudan and Djibouti. They observed that there is a considerable flow of goods and people in the cross-border trade with Sudan. It is estimated that some 3000 people cross the border from both sides at the border town, Metema daily. Demand for poultry via this route is high and prices more competitive, (FAO, 2006). Similarly, illegal cross-border trade of live poultry from Kenya and Somalia to Ethiopia are not clearly measured but chances are that these exist.

[6] Ethiopia follows the OIE recommendation for the importation of live birds, i.e. exporting country should be free of HPAI and should present serological test proving freedom for Newcastle, Marek, Gumboro, and fowl cholera for a period of 90 days before exportation.

Table 8: Number of imported day old chicks from abroad in 2005-2006

Year	Month	Exporting country				
		Egypt	**Netherlands**	**UK**	**Saudi Arabia**	**Kenya**
2005	Jan	21000				
	Feb	130000	15500	60000	7000	
	Mar				7000	
	Apr		15400		30000	
	May	12000	25008			
	Jun	68800	15500			
	Jul				81200	
	Aug		14400		16640	
	Sept	5000			39500	90000
	Oct	5000	30000		39500	
	Dec					7500
2006	Jan			11000		7500
	Feb	8400	61680			
	Mar		53900			

Source: Adapted from Goutard & Magalhaes (2006), p.14

4. The Poultry Sector and Bio-Security

4.1 Poultry Bio-security in Ethiopia

A recent study on poultry bio-security in Ethiopia has been done by Abebe Wossene (2006). The study covered interview of people involved in the poultry sector such as poultry farm owners/mangers, farmers, animal health workers and veterinary officials; visit of various poultry farms, open public markets, feed processing plants and supermarkets. The study also conducted a careful assessment of the situation from the point of view of bio-security in selected sites of Addis Ababa, Debre Zeit, Awassa and Wolita Sodo and Benshagul Gumuz Regional state.

Furthermore, private farms (Alema and Genesis Farms from Debre Zeit, four small-scale poultry farms in Addis Ababa), two Poultry Multiplication and Distribution Centers in Awassa and Woiliat Sodo, and backyard farms in Woliata Sodo and Benshangul Gumuz Regional State were visited and respective owners were interviewed. Supermarkets in Addis Ababa, poultry feed processing plants in Debre Zeit and poultry slaughtering plant at Alema farm, and live bird market places in Addis Ababa and Meki were visited and middlemen/ traders were interviewed.

The major findings of this study are:

- *Large-scale Commercial Poultry farms (ELFORA, Genesis and Alema Farms)*

Though certifications that testify freedom from major diseases were used as criteria for importation, follow up quarantine and inspection activities were not in place either at Federal or at the importing farm level. A case in point was the absence of any follow up at Almaz poultry farm which has imported some 5000 day old parent stock from Egypt, just five days before importation ban was issued from countries like Egypt.

The Federal Ministry of Agriculture has issued a circular that forbids importation of live birds and poultry products from infected countries such as Egypt, UK and Germany in connection with HPAI. Recently a second circular was issued that allows the importation of poultry products from any country irrespective of their HPAI status so long as they meet the OIE recommendation. In the absence of effective veterinary service and mechanisms verifications, such provisions could pose potential treat to Ethiopian poultry.

- *Farm and personnel hygiene*

The regular practice of footbath and tyre bath was almost non-existent in most of the visited commercial farms. Almost all the farms lack appropriate sanitary and washing rooms; appropriate working clothes and enough boots. Workers of some farm move to manage many different poultry houses without any restriction. In those farms that were having a footbath with disinfectant (Example Genesis Farms), workers were found not to strictly bath their shoes every time they enter and leave the house. Almost all farms have isolation area for sick birds usually at one corner of the house. However in some farms and poultry houses, the isolation space may not provide real physical isolation.

- *Bio-security in poultry slaughter and feed processing plants*

Most of the large commercial farms such as ELFORA, ALEMA and Genesis Farms have their own feed processing plants and sell these as well. Therefore, exchange of sacks from different farms, frequent visit by individuals from different farms could pose a potential treat for dissemination of any communicable disease.

- *Poultry Multiplication and Distribution Centers (PMDC)*

Most of the PMDC directly import day old chicks from abroad mainly from Holland but some were bought from local private poultry enterprises such as Alema and Genesis Farms. All visited poultry houses have footbath with disinfectant (potassium permanganate). Workers are required to bath and were observed to practice when they enter the house but not when they leave the poultry house or the farm. There is a tyre-bath at the gate of the farm but with no disinfectant. Nevertheless, hygienic facilities for workers are absent and supply of protective clothing and boots is not sufficient. It is not uncommon to see poultry attendants working with their own clothes with animal health assistant using the same gown and boot while visiting different houses. Poultry waste material is sold as animal feed to the surrounding dairy farms. Unless it is closely inspected and decided according to the health status of the farm, this activity could easily pose a health problem.

- *Small scale commercial poultry farms in Addis Ababa*

Among the small scale commercial poultry farms that were surveyed, except Konso integrated poultry farm, all are located in residential areas with no tight barrier or separation from the public. Some farms use the service of community sanitation service providers to dispose poultry excreta and waste. Some of the farms are not even known/ registered by the Wereda Agricultural offices or any other body and two of the three farms are run in rented houses.

Predators, wild birds and vermins can easily get access into the farm. The birds were kept in crowded condition with no ventilation. There are no disinfections and/or sanitation facilities (foot bath, washing facility etc) and workers are not provided with boots or protective clothes. A good example is the Kaliti Poultry farm with no isolation room for sick birds and extremely poor bio-security practice. Some poultry farms use “Berekina” as disinfectant. Whether it meets the standard of a good disinfectant for use in poultry farms should however be investigated.

- *Backyard village poultry farms*

Poultry reared under extensive backyard condition were visited in SNNPR and in Benshangul Gumuz Regional state.

- The bird feed by scavenging and thus mix with people and other livestock where they share their living quarter with their animals. An exception was observed in Gambella Region (housing of chickens in a separate and well protected houses) is exercised.
- As chickens and eggs are immediate source of cash to the farmers, they sell chicken and eggs at public market days in nearby town or roadsides. It is a common practice to bring back birds that are unsold, an activity that could predispose the community birds to any communicable diseases.

Farmers (settlers) in Benshangul Gumuz Regional State are well aware of Avian Influenza and its threat to human being (Abebe Wossene, 2006). The farmers accept advice from media and local extension agents. In controlling communicable avian diseases including HPAI, it is therefore possible

to use local communication as effective means of controlling/prevention of transmission of communicable diseases. The recent experience observed in prohibiting public live hen market following the outbreak of Newcastle disease is a good practical demonstration. Farmers abided to the information and some rural communities were able to protect their flocks.

4.2 Bio-security and Government Policies

The bio-security policy states the quarantine of day old chicks and other poultry for at least 7 days and the SOP suggest keeping birds for three weeks in separate house. However, there is no quarantine post for poultry and poultry products at entrance point (Abebe Wossene, 2006). The attention given to bio-security practices in both private commercial farms and government owned PMDCs is very low. There is a big gap of awareness regarding bio-security and its importance to poultry farming. The potential role of the various PMDC in dissemination of AI and other communicable diseases to the vast majority of backyard poultry and to the rural population should not be under estimated.

5. Poultry and Rural Livelihoods

5.1 Gender and backyard poultry production

Backyard poultry production is an important sector in agriculture and has significant gender implications in general in African countries and in particular in Ethiopia. So, governments implemented a number of rural programs where the poultry component targeted women (Kitalyi, 1998). There are some basic facts that support the premise that improving backyard poultry production will create increased opportunities and more equitable intra- and inter-households distribution of food and income in rural Africa (ibid, 1998). These include:

- the management of village poultry can easily be combined with other activities because of the proximity of the chickens to homesteads;
- poultry products are among the few agricultural products directly accessible to women in rural areas and hence increased food production from chickens will improve household food security;
- village poultry production is not strongly associated with land resource, which is one of the main production constraints among the disadvantaged members of the community.

In Ethiopia, there is scant literature covering the gender effects of developments in the poultry sector. The gender effects would relate to intra-household dynamics in terms of division of labor, access to and control of resources and benefits among household members. In this respect, Bush (2006) tried to assess the gender dimension in an attempt to predict the likely income impacts of avian flu on women based on selected study sites in southern Ethiopia. In this study, it was estimated, based on the results of a village research, that a woman would have an annual cash income of Birr 200. Here, it should be noted that this estimate would be much higher if current poultry prices have been used. Moreover, it was found that variability of poultry income is closely associated with wealth status and women do sell a mix of chicken and eggs to optimize their poultry income.

Poor women tend to sell more eggs and fewer chickens; a poor woman, on average, earns around 100-150 birr per annum from her poultry flock. Yet, better-off women use a different strategy in their consumption and sales activities and their earnings range from 50 – 230 birr/year. Other research reveals even better earning for the poor that about 80% of poor women managed to earn an annual income of more than Birr 100 from village chicken production (Tadelle et al, 2003).

Moreover, the research shows that spending priorities are strongly correlated with woman's wealth status. Poor woman spends primarily on basic household necessities: food grains, cooking oil, etc. while women from better-off households have more choices on their spending decisions. In this case, basic food needs are mainly covered with household crop production; poultry incomes are used to purchase other items in addition to some staple food.

Another research work has also explored the gender dimensions of African rural backyard poultry production systems based on case studies conducted in four African countries, i.e. Ethiopia, the Gambia, Tanzania, and Zimbabwe (Kitalyi, 1998). In this study, the basic gender issues such as division of labor, access to and control of resources have been covered. Results showed that ownership of village chickens is shared among the different gender categories in the farm household. About 92% of the responses on ownership of patterns of village poultry in Tanzania showed that the

chickens are predominantly owned by women and children while this figure in the Gambia is 66%. However, quantitative data showing the ownership patterns of village chickens was very limited in Ethiopia.

Division of labor among household members was another gender aspect that has been addressed in the study. Shelter construction, feeding, cleaning, watering, selling chickens or eggs, and disease control and treatment were the major activities in village poultry production considered in the analysis. It was found that all gender groups are involved in poultry management. Construction of shelters was mainly done by men, or by men and children. Results also showed that, in Ethiopia, management of chickens was fully in the domain of women and children. Women manage and prepare nests for laying and brooding, especially where fostering of eggs or chicks was practiced.

Moreover, information was also generated on decision-making on rural village poultry production, i.e. control of resources by asking who decides on selling or disposing of poultry products. About 80% of the responses obtained from the Gambia unveiled gender plurality (both women and men) in decision-making on village poultry production. Participation of all gender groups was evident in village chickens marketing. However, the survey result in Tanzania shows that men (76%) dominated selling and buying of chickens in local markets.

The works cited above are based mainly on data generated on rapid assessment research techniques involving informal interviews with key informants and with farmers. Therefore, generalizations should be made with caution. In general, the available literature shows that detailed quantitative data at household level is scanty.

5.2 Importance of poultry in household economy: income, nutrition and food security

Even though there is paucity of quantitative data that support the importance of poultry at the household level, it is possible to make some generalizations from the existing qualitative information. The poultry can potentially play several important roles.

First, poultry products offer affordable quality animal protein sources for the smallholder farm households. Research results in Bush (2006) however showed that rural households consume a very limited quantity of poultry products. They rank cash income as the primary purpose of village chicken production (Bush, 2006). Poultry consumption is moreover closely associated with wealth status. The poorer the household, the fewer poultry products are eaten. Chickens are not a daily food even for a better-off household. Chickens are consumed mostly during holidays. In general, poultry consumption accounts for less than 1% of the total annual food needs of farm households (Bush, 2006).

Chickens however are an important source of food for women post-birth; chickens are payment to villagers for local health services; chickens are gifts to newly married couples; and chickens strengthen social networks between women (Bush, 2006). In addition to these, the spiritual benefit of sacrifice of indigenous chicken types has also an important place in the cultural, social and religious functions of the Ethiopian society (Tadelle and Ogle 2001).

In 2005, the DPPA, with technical support from FEWS NET and the Food Economy Group, carried out a complete livelihood baseline survey of SNNPR conducted by Bush (2006). The baseline information

generated by this group was used to predict the impact on livelihoods of any hazard, including avian flu. The predicted impact was assessed assuming three scenarios:

- ***The best case scenario***: supposes that the H5N1 virus, if emerged at all, will be rapidly contained and will not spread beyond the entry point. However, public perception would likely remain fixed on the risk of poultry consumption and the fear would lead to a long-term trend of reduced demand and low market prices for chickens and eggs.
- ***A moderate scenario***: supposes emergency of avian flu outbreaks in certain pockets, perhaps spread to neighboring areas, but contained to a few zones through rapidly implemented security measures that involves culling (supposes 100% chicken losses). In this case, the outcome is less clear and need to make a judgment about the importance of chickens in the local economy
- ***A worst case scenario***: it supposes the emergence and spread of the H5N1 virus in its most virulent form, affecting both chickens and humans. Its outcome would be clear and devastating, economies would collapse, "Nobody would escape the chaos".

The result of the study for the best scenario shows that sales of teff, chaka, firewood, and goats/sheep, as well as casual employment are the main sources of income and outweigh the importance of poultry sales. The loss of a more marginal income source will not change the basic situation in these areas but any loss of income will mean reducing purchases to the bare minimum.

Even under the moderate scenario, chicken and egg income is a relatively small cash earner compared to the main income earners (seasonal agricultural employment; sales of cash crops [peppers, chat, and maize] sales of firewood; and sales of livestock [goats and shared cattle]). These four main income sources comprise 85% of poor household's annual income in the reference year. In this zone, poor households secure about 60% of their food needs through own-crop production. The lowland maize belt has diversified crop base, including food and cash crops, as well as livestock and casual labor opportunities to round out livelihoods. Although the lowland climate tends toward unreliable rainfall, affecting cash crop income, the combination of labor, livestock and crop income is a sufficient buffer to absorb the loss of poultry.

In case of results for the worst scenario, local economies as a whole will stumble as large numbers of households become impoverished from illness. Economic consequences at the household level includes the loss of productive labor that lead to a fall in crop production and a drop in food access from own-crops; Assets (livestock) will be sold to purchase food if crop losses are significant (e.g., if there is a compound hazard of disease and drought), and if the initial food gap cannot be filled simply by switching expenditures; If there is an adult death in the family, the loss of productive labor will have a major income effect as adult farmers are key income earners in the off-season period. Reduced income will affect spending patterns as well as access to food. Furthermore, expenditures on health will increase. In a pandemic, anti-virals and antibiotics are provided free by the government but shortages in government supplies may encourage the emergence of private sales at a higher cost. Related expenditures also increase (anti-pain medication; special food for the ill person; funeral expenses and so on).

Note that the livelihoods of the poor will be impacted not only as poultry producers but as workers and traders in the poultry supply chain. When there was a false alarm in 2006, large scale farms were also affected. With the alarm, in Alema farm, which has a peak capacity of 2000 chickens per day, demand plummeted to 500 chickens per day. In Awasa, Alaba and Tulu markets, prices of chicken

dropped by 50-60% during the Easter season that normally records peak prices. One trader lost out on a contract to supply chickens to a buyer in Addis Ababa during the Easter festival as a result of the unconfirmed announcement of HPAI (Nzietcheung 2008).

6. Previous HPAI Risk Assessment Research and Findings

The Newcastle disease (ND) is one of the major causes for the economic loss of poultry production in Ethiopia (Lenegereshe et al., 1991; Mohammed, 1998; Degefa et al., 2005). For instances, despite the routine vaccination exercised in the biggest poultry farm, ELFORA poultry farm, at least nine outbreaks of ND had been reported from 1984-1995 affecting more than half million chickens and killing 20% of them (Mohammed, 1998). Next to ND other infectious poultry diseases such as Gumboro and Marek diseases have occurred in the last decade particularly most likely related to the importation of live vaccines of the respective diseases.

Epidemiologically HPAI is known to be highly contagious primarily from chickens and turkeys, and it is reasonable to assume all avian species are susceptible to infection. Transmission of the virus is through direct contact with secretions from infected birds, especially faeces; contaminated feed, water, equipment and clothing; clinically normal waterfowl and sea birds may introduce the virus into flocks; and broken contaminated eggs may infect chicks in the incubator (Yemane and Admas, 2005).[7]

6.1 Threats/incidence of HPAI in the country

Based on past experience, it is forecasted that once the influenza originated from birds start human-to-human transmission it can affect up to a quarter of the world population and can rapidly spread around the world in less than three months (Yemane and Admas, 2005). This threat can be averted mainly by early detection of infection among birds and poultry and then culling the infected batches.

Ethiopia is at the fore front of the flu pandemic for many reasons. Many birds that possibly carry the virus migrate from affected areas of Europe and Asia to East Africa and reach lakes and wetland found in the rift valley of Ethiopia (Yemane and Admas, 2005). That potentially increases the risk of spread into the chicken population. As almost every household in rural areas in Ethiopia practices backyard poultry and humans commonly live with their poultry in the same house or in an attachment where there is no barrier the potential for coming in contact with infected poultry droppings and corpses, which are major sources of infection, is very high. Besides, the uncontrolled animal movements exercised under the prevailing management system are the potential danger of risk of AI in Ethiopia.

[7] The most common clinical symptoms of HPAI are severe depression, inappetence; drastic decline in egg production; Facial oedema with swollen and cyanotic combs and wattles; Petechial haemorrhages on internal membrane surfaces; and Sudden deaths (mortality can reach 100%) (Yemane and Admas, 2005).

In chickens lesions may be absent in cases of sudden death while severe congestion of the musculature and dehydration, subcutaneous *oedema* of the head and neck area, nasal and oral cavity discharge, severe congestion of conjunctivae, sometimes with *petechiae*, excessive mucous exudates in the lumen of the trachea, or severe *haemorrhagic tracheitis*, *petechiae* on the inside of the sternum, on the serosa and abdominal fat, serosal surfaces and in the body cavity, severe kidney congestion, sometimes with urate deposits in the tubules, *haemorrhages* and degeneration of the ovary, *haemorrhages* on the mucosal surface of the *proventriculus*, particularly at the juncture with the gizzard, *haemorrhages* and erosions of the gizzard lining, and haemorrhagic foci on the lymphoid tissues in the intestinal mucosa are most common (Yemane and Admas, 2005). The lesions in turkeys are similar to those in chickens, but may not be as marked. Ducks infected with HPAI and excreting the virus may not show any clinical signs or lesions.

There was suspicion of a threat of AI in Ethiopia in Gurage state poultry multiplication center in 2006. The base for the suspicion was the death of hundreds of chickens, where all chickens at the centre were eventually culled. A false positive result emerged from the initial screening in Ethiopia, which subsequent analysis at a lab in Italy showed up negative result for the presence of the H5N1 virus. However, this situation led to massive consumer panic about chickens, depressed demand, and a fall in prices.

Since there has been no actual outbreak, ex ante risk assessments have to be made regarding the introduction of the virus in Ethiopia and its subsequent spread. Goutard and Magalhaes (2006) assess the risk of HPAI introduction and spread in Ethiopia. The results of the study are summarized below.

Legal trade (importation of days-olds chicks), illegal trade of live poultry around the border with Sudan, Kenya, Djibouti and Somalia and wild migratory birds are the potential way of introduction of HPAI H5N1 virus in Ethiopia (Nzietcheung 2008).

6.2 Legal and illegal trade routes

Legal trade of days-old chicks is carried out by large commercial farms that import day-old chicks from Egypt, Germany, Holland, Kenya, Saudi Arabia and the United Kingdom. Illegal cross-border trade results in movement of live poultry from Djibouti and Sudan into Ethiopia. Demand for poultry via this route is high (FAO, 2006). For this reason, the risk of illegal poultry traders introducing HPAI from an infected zone into Ethiopia should be considered. Illegal cross-border trade of live poultry from Kenya and Sudan into Ethiopia are not clearly identified and no estimates for any of this illegal trades exist (Nzietcheung 2008).

6.3 Wild migratory birds

Outbreaks of HPAI among wild birds in Europe in early 2006 showed that wild birds are capable of carrying the virus to new sites. During winter in Europe, millions of birds migrate to Ethiopia's Rift Valley and Blue Nile lakes to breed. Table 9 from Nzietcheung (2008) lists the wild migratory birds most likely to introduce HPAI into Ethiopia. Table 10 from Nzietcheung (2008) lists the resident water birds most likely to be infected with HPAI.

Table 9: Wild migratory water birds capable to be infected by HPAI H5N1 virus out of Ethiopia and able to introducing HPAI H5N1 virus into Ethiopia

Common name	Order	Count in 2005
Ruff	Charadriiformes	**13,758**
Northern shoveler	Anseriformes	**6,041**
Pintail	Anseriformes	**4,912**
European wigeon	Anseriformes	**1,341**
Little Stint	Charadriiformes	**1,278**
Garganey	Anseriformes	**1,189**
Common teal	Anseriformes	**1,184**
Black-winged stilt	Charadriiformes	**1,071**
Avocet	Charadriiformes	**942**
Temminck's stilt	Charadriiformes	**868**
Black-headed Gull	Charadriiformes	**554**
Gull-billed Tern	**Charadriiformes**	**508**

Source: FAO (2006)

Table 10: Resident water birds in contact with domestic poultry in Ethiopia and with a high chance of being infected with HPAI

Species	Gender	Count in 2005
Egyptian goose	Anseriformes	**12,222**
Cattle egret	Ciconiiformes	**5517**
Marabou stork	Ciconiiformes	**4381**
Spur-winged goose	Anseriformes	**2816**
W-faced whistling duck	Anseriformes	**1572**
Sacred ibis	**Ciconiiformes**	**1442**

Source: FAO (2006)

7. Risk Assessment of Introduction of HPAI H5N1 Virus Into Ethiopia

7.1 Risk assessment of HPAI introduction in Ethiopia

This qualitative risk assessment of introduction and dissemination of the HPAI H5N1 virus in Ethiopia by Migratory Wild Birds and quantitative risk assessment of introduction and dissemination of the HPAI H5N1 via the Legal Import of DOC (Day old chicken) was conducted in 2005 by Goutard and Soares Magalhaes (2006).

7.1.1 Epidemiology of HPAI H5N1 Infection

Ethiopia was part of the surveillance study carried in 2006 by CIRAD and Wetlands International (funded by FAO) to evaluate the Avian Influenza carriage among wild bird populations during the northern winter, before the spring migration of birds back to their northern breeding areas. The study covered 14 sites across Africa and east Europe. The HA-NA virus subtypes isolated from the RT-PCR during the survey are summarized in table 11.

Table 11: HA-NA virus subtype isolated

Species	Country	Virus isolate
Anas querquedula	Mali	H5N3 LPAI
	Mali	H11N9
	Mali	H12N5
Dendrocygna viduata	Senegal	H1N1
	Ethiopia	H8N4

Source: Gaidet N. et al., 2007

7.1.2 Findings of qualitative risk assessment of introduction and dissemination of the HPAI H5N1 virus by Migratory Wild Birds

The probability of introduction of H5N1 by a bird species is directly associated with the number of individual birds migrating into Ethiopia. Species that are very common are presumed to have a higher risk (notably if they are susceptible). Congregation site with high density of birds that were found more susceptible to be infected by H5N1 was considered as risk area for the release of the virus in Ethiopia. Assumption was made to estimate the total number of birds at each congregation site whether that bird have a homogeneous distribution around the lake. The lakes considered were Ziway and Awassa.

The conclusion was that the conditional probability that wild water migratory birds infected with H5N1 HPAI enter an Ethiopian congregation site to release the virus can be considered as low to moderate. Furthermore, the conditional probability that wild resident water birds become infected with H5N1 HPAI and that the disease become endemic in Ethiopian congregation site can be considered as low. However, the conditional probability that backyard poultry become infected with H5N1 HPAI in Ethiopia after the wild bird's infection can be considered as high**.** The global risk estimation of backyard poultry production system being infected by H5N1 in Ethiopia as a consequence of migratory wild water birds infected by H5N1 can be considered as null to low**.**

This result is strengthened by the fact that there are no flocks of domestic waterfowl (ducks and geese) rose outside in Ethiopia. Indeed domestic ducks have the tendency of attracting wild ducks and thereby increase the risk of virus introduction. Nevertheless investigation of morbidity and mortality events in wild birds to determine if H5N1 avian influenza virus is the cause of the illness, should be a component of early warning surveillance system in Ethiopia.

7.1.3 Findings of the Quantitative Assessment of the Risk of Introduction of HPAI H5n1 into Ethiopia via the Legal Import of DOC

The results from this quantitative risk assessment suggest that under current conditions the average risk of introducing virus through the legal trade of DOC is low but is likely to occur. The number of parent stock testing positive at the countries of origin of the DOC is suggested to have the highest effect on both risk estimates. Sensitivity analysis of number of parent stock testing positive at the countries of origin has shown that the median rate at which infection would be imported into Ethiopia would never reach zero even with absence of infection in the parent stocks. This is expected to occur as there is still a probability of a DOC acquiring infection during transportation.

The duration and transport from approved countries to Ethiopia and the probability of low compliance of veterinary checks at the border were the second and third most influential parameters for the increase in risk. The results of the simulations suggest that the higher the level of poor compliance of the veterinary authorities at the border inspection posts (BIP) the lower the number of years between virus introductions in Ethiopia. The annual probability of importing HPAI H5N1 may be canceled if full compliance is achieved. The annual risk of importing infection increases faster when the level of compliance is reduced from 100% to 80%.

8. HPAI mitigation strategy in Ethiopia

8.1 The Avian Influenza Prevention and Control Policy for Ethiopia

The Government of the Federal Democratic Republic of Ethiopia (GFDRE) has responded to the HPAI threat in several ways. In March 2006, the GFDRE developed its three year AHIP Strategic Preparedness Plan. Earlier, (January 2006), a project agreement between the Ministry of Agriculture and Rural Development (MoARD) and the UN FAO was put in place. The project's main objectives were to step up surveillance and diagnostic capacity and to respond quickly to outbreaks through containment (FAO 2006: p.4).

The Avian Influenza Prevention and Control Policy for Ethiopia was thus designed by the Ministry of Agriculture and Rural Development with the assistance of FAO. This policy is an integral part of the three-year national strategic preparedness and response plan for Avian Human influenza pandemic threat. It is specifically prepared for the animal health component of the strategic plan with particular emphasis on bio-security, movement control and market restriction, surveillance and diagnosis, stamping out, disposal carcasses and potentially infective materials, vaccination and compensation (MoARD and FAO, 2006).

8.2 National strategic plan

The national strategic plan comprises six functional units (Nzietcheung 2008):

- *Surveillance and epidemiology*: To generate appropriate and timely data that evaluates the level of risk of an HPAI epidemic; plans for measures to manage the risk and efficiently prevent the spread of the disease; and assesses the factors related to the occurrence and distribution of HPAI, associated socio-economic impacts and effectiveness of intervention measures.
- *Laboratory services:* To ensure effective diagnostic capability to test samples collected for surveillance activities, diagnose disease outbreaks and monitor response to vaccination.
- *Infrastructure strengthening:* To enhance government and stakeholder institutional and human resource capacity to prepare for and respond to an HPAI epidemic.
- *Disease management:* To ensure prompt and appropriate response to HPAI outbreaks to prevent occurrence and/or minimize spread.
- Communication and public awareness: To ensure effective communication mechanisms and strategies with stakeholders and communities.
- *Project management*: For the overall management and efficient coordination of activities by sectors and partners.

8.3 Emergency preparedness and response plan

The general objective of the plan is to prevent human and economic losses due to HPAI. Specifically, the plan will prevent the possible introduction of the disease through appropriate quarantine and import control measures; detect the disease as soon as it has occurred; and contain and eliminate the disease before it spreads to other parts of the country. The implementation strategy focuses on four main areas: import control of poultry and poultry products; preparedness and communication; early detection of the disease in cases of occurrence; and early response to control and eradicate the disease in cases of introduction (Nzietcheung 2008).

In case of the H5N1 HPAI outbreak, the mitigation strategy is based on compensation of culled poultry and destruction of poultry products: For the backyard chickens, irrespective of variation in

age a lump sum of 1.5 USD/culled bird in equivalent Ethiopian birr. For semi-intensive and intensive commercial farms, and multiplication centers, irrespective of the variation in age, genetic and production value, a lump sum of 2 USD/culled bird in equivalent Ethiopian birr. The indicated amount (2 USD) also covers the compensation (apart from culled birds) for the destruction of contaminated feedstuffs and poultry products (FAO, 2006).

8.4 Information campaign

Much has been made of the public information campaign after hundreds of chickens died at a state breeding and multiplication centre in Gurarge. Hence, a communication strategy and the production of relevant public information materials are also part of the preparedness plan. The overall goal is for the GFDRE to become fully operational to monitor, identify, notify, and rapidly respond to an Avian Human Influenza pandemic (AHIP) when and where the problem emerges.

The government ran public information bulletins advising people of the risks of touching diseased fowl. Later, these bulletins were replaced with information explaining public safety measures when handling healthy and potentially sick chickens. The impact of these public service announcements was to instill a sense of panic, particularly in Addis. As a result, demand for chickens plummeted.

Demand for chickens is usually low in April during the one-month fasting season for Orthodox Christians but over the Easter holiday, demand rises to peak levels. Orthodox Christians break their fast on Easter Sunday with a traditional chicken-based meal of *doro wot*. Thus, although there is currently no avian flu in Ethiopia, the panic alone caused significant shifts in market demand and price. These shifts in the chicken market provide an excellent case study about the potential impact of an “avian flu outbreak” on the commercial poultry sector. The case of Alema Farms illustrates the likely impact on commercial enterprises.

8.5 Legal and regulatory institutional response

The existing policies, laws and legal and regulatory systems related to the poultry sector and HPAI, include: (i) The implementation of the Strategic Preparedness and Response Plan for the Avian Human Influenza Pandemic Threat; (ii) Regular meetings of the National Technical Task Force on AI; (iii) deployment by MoARD of emergency animal health officers and veterinarians to the regions and zones; and (iv) Workshops by MoH for selected zonal, woreda and hospital directors in SNNPR to disseminate new monitoring and reporting formats. However, in recently time the National Technical Task Force is not functional and this is a concern.

9. Conclusions

Once the HPAI reaches to the status of human-to-human transmission, it can affect up to a quarter of the world population and can rapidly spread around the world in less than three months. This threat can be averted mainly by early detection of infection among poultry and then taking adequate measures to prevent the spread (such as through culling) from the infected batches.

The potential danger of risk of AI in Ethiopia is associated with the following three main reasons:

Many millions of birds that possibly carry the virus migrate from affected areas of Europe and Asia to East Africa and believed to reach lakes and wetland found in the rift valley of Ethiopia

The limited biosecurity measures in the poultry production system, where almost every household in rural areas practice backyard poultry and commonly live with their poultry in the same house or in an attachment where there is no barrier the potential for becoming in contact with infected poultry droppings and corpses, which are major sources of infection, is very high.

The existing uncontrolled animal movements exercised under the prevailing management system

So far Ethiopia has not had a confirmed case of the H5N1 strain in birds or domestic fowl. There was suspicion of a threat of AI in Ethiopia in Gurage state poultry multiplication center in 2006. The base for the suspicion was the death of hundreds of chickens at a state breeding and multiplication centre in Gurage, where all chickens at the centre were eventually culled. A false positive result emerged from the initial screening in Ethiopia, which subsequent analysis at a lab in Italy showed up negative result for the presence of the H5N1 virus. However, this situation led to massive consumer panic about chickens, depressed demand, and price falls.

The government in response ran public information bulletins advising people of the risks of touching diseased fowl. Later, these bulletins were replaced with information explaining public safety measures when handling healthy and potentially sick chickens. The impact of these public service announcements was to instill a sense of panic, particularly in Addis. As a result, demand for chickens plummeted. Though a false alarm it highlighted the potential of a significant impact of HPAI in Ethiopia.

The government of Ethiopia has responded in several ways with both a strategic plan and an emergency preparedness plan as discussed above. The government also ran large scale information campaigns. How far the arrangements can meet the needs of control strategies in a pro-poor fashion will depend on whether or not there is an outbreak, its source and most importantly its extent.

10. Research & Development gaps identified

Overall policy: following the AI outbreak in other countries, huge risk of pandemic in the country and the suspicious death of poultry in SNNP, the country has developed a three year AHIP Strategic Preparedness Plan in 2006 focusing on establishment/Strengthening of influenza surveillance systems; stockpiling of essential supplies and equipments; building the national, sub-national (regional) and local capacity for pandemic responses; public relations, education, and communications; and development of sustainable and integrated management systems. After two years of implementation the experience learned need to be documented for betterment of the future intervention.

The implementation was also through a National Technical Task Force, which is not currently active. In this regard, the institutionalization of the implementation also needs attention together with the current implementation of the business process re-engineering at the MoARD. In addition the issue whether all relevant organizations involved in the poultry sector are working together with clear share of responsibility and accountability, needs to be addressed.

Bio-security: The dominant production system is backyard poultry farming all over the country with limited bio-security measures. Among AI risk reduction measures it is mandatory to put in place bio-security measures. However, there is not any recommendation as to what type of bio-security is economically and socially feasible under the Ethiopian small-scale backyard poultry farming system. Similarly, research has shown that the bio-security practices in both private commercial farms and government owned PMDCs is also very low. There is a big gap of awareness regarding bio-security and its importance to poultry farming. The reason why this is not practiced and why there is limited awareness has to be investigated for targeted intervention.

AI threats in Ethiopia: in general, the study conducted so far document that there are two potential sources/threats of getting HPAI into the country i.e. from migratory wild birds and the legal poultry imports. Here, it is important to ask whether these are the only potential sources. The existence of illegal cross border trade with almost all neighboring countries needs due attention.

Surveillance and diagnostic capacity and responsiveness: the threat of AI in the country is still existent. It is therefore important to document the country's surveillance and diagnostic capacity and responsiveness in design how the capacity and its responsiveness can be improved.

Communication strategy: As a measure of creating public awareness in 2006, the information disseminated has created panic resulting in reduced demand and subsequent collapse of prices. Even though, not documented, this has affected income of poultry farmers. In order to avoid such impacts, there is a need to design a communication strategy that will give the required information to all stakeholders with limited effect on the markets.

References

Abebe Wossene. 2006. Poultry bio-security study in Ethiopia. A Consultancy Report for Food and Agriculture Organization of the United Nations, April 2006, Addis Ababa, Ethiopia. 35p

Alemu Yami and Tadelle Dessie. 1997. The status of poultry research and development. Research Bulletin No 4. Poultry Commodity program, Debre zeit Agricultural Research Center, Alemaya University of Agriculture.

Bush Jennifer. 2006. The Threat of Avian Flu Predicted Impacts on Rural Livelihoods in Southern Nation, Nationalities and Peoples Region (SNNPR), Ethiopia. The Food Economy Group, May 2006.

CSA (Central Statistical Agency). 2008. Report on monthly average retail prices of goods and services. Statistical Bulletin, 416. January 2008.

CSA (Central Statistical Authority). 2005. Agricultural Sample Survey 2004/05. Volume II. Report on Livestock and livestock characteristics. Statistical Bulletin 331.

EARO (Ethiopian Agricultural Research Organization). 2002. Animal Research Strategy. Ethiopian Agricultural Research Organization. Addis Ababa. Ethiopia.

FAO (Food and Agriculture Organization of the United Nations). 2004. Livestock sector brief: Ethiopia. FAO. Livestock information, sector analysis and policy branch AGAL. 2004. Rome.

FAO/AGL . 2005. AQUASTAT: Country profiles. FAO's Information System on Water and Agriculture. Retrieved May 14, 2005, from

Goutard Flavie and Ricardo Soares. 2006. Risk and consequence assessment of HPAI. CIRAD and FAO.

Hailemariam Teklewold, Legesse Dadi, Alemu Yami and Negusse Dana. 2006. Adopting poultry breeds in the highlands of Ethiopia. Ethiopian Institute of Agricultural Research. pp 26.

ILRI (International Livestock Research Institute). 2000. Handbook of livestock statistics for developing countries. Socio-economics and Policy Research Working Paper 26. ILRI, Nairobi, Kenya. 299 pp.

Kenea, Y., Legesse D., and Alemu, Y. 2003: Poultry Marketing Structure, Spatial Variations and Determinants of Prices in Eastern Shewa Zone, Ethiopia. Proceedings of the 10th annual conference of the Ethiopian Society of Animal Production (ESAP), 21-23 August 2002, Addis Ababa, Ethiopia, p.69-80.

Kitalyi, Aichi J. 1998. Village chicken production systems in rural Africa Household food security and gender issues. FAO, Rome.

Lenegereshe Bawke, Mohammed Nasir, Aden Berhanu and Aklilu Mengistu. 1991. Newcastle disease in Ethiopia. In: Newcastle disease vaccines for rural Africa. Proceedings of a workshop held at PANVAC, Debre Zeit, Ethiopia, 22-26 April, 1991.

MoARD and FAO. 2006. Avian influenza prevention and control policy for Ethiopia. Avian and Human Influenza National Technical Committee of the Avian and Human Influenza National Coordination Committee. MinstryMinistry of Agriculture and Rural Development and Food and Agriculture Organization of the United Nations. Addis Ababa, Ethiopia.

MoARD and FAO. 2006a. Emergency preparedness plan for highly pathogenic avian influenza. Avian and Human Influenza National Technical Committee of the Avian and Human Influenza National Coordination Committee. Minstry of Agriculture and Rural Development and Food and Agriculture Organization of the United Nations. Addis Ababa, Ethiopia.

Mohammed Nasir, 1998. Oral Newcastle Disease Vaccination trial and studies of Newcastle Disease in Ethiopia. MSc thesis, Free University Berlin, Berlin, Germany.

Sonaiya, E.B. 1990. The context and prospects for development smallholder rural poultry production in Africa. CTA-seminar proceedings on smallholder rural poultry production 9-13 October 1990. Thessloniki, Greece. Pp. 35-52.

Tadelle D and Ogle B. 2001. Village poultry production systems in the central highlands of Ethiopia. Tropical Animal Health and Production. 33(6), 521-537.

Tadelle, D., Million, T., Alemu, Y., and Peters, K.J. 2003. Village chicken production systems in Ethiopia: Use Patterns and performance valuation and chicken products and socio-economic functions of chicken. Livestock Research for Rural Development 15 (1).

Tamirat Degefa, Legesse Dadi, Alemu Yami, K. G/Mariam and M. Nasir. 2004. Technical and Economic evaluation of different methods of Newcastle disease vaccine administration. Journal of Veterinary Medicine, A 51, 1-5 (2004).

Yemane and Admas, 2005. Ethiopian Journal of Health Development. 2005; 19(3)