Difficulties for the entrepreneurial small-scale commercial poultry production in developing countries

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Small-scale family poultry production-SSFPP has been a very important economic and nutritional resource for poor families in rural areas of developing countries in Latin America, Africa and Asia (Sonaiya and Swan (2004), Alimi *et al*., (2006), Abubakar *et al*., (2007), Sharma (2007), Henning *et al*., (2007), Guèye (2009), Alders and Pym, (2009)).

For marketed oriented countries such as United States, Brazil, Thailand and others, SSFPP represents a problem due to the risk of hosting and spreading disease to commercial flocks, which are also very important for their economies. However, commercial flocks should only be established in places where there is no such a risk, and be developed and equipped with the technical means to overcome or reduce biological risks.

In many places where commercial poultry production has been established, there has been a move to eliminate SSFPP, leaving nearby poor families without this means of income generation and household food security. In some cases, family members have been able to find a job in the established companies. For developing countries which are not market oriented for poultry production, SSFPP is very important. Generally such countries are not significant grain or cereal producers, reducing the opportunities for poultry production.

In some market oriented countries there are reasonable job opportunities, even in the rural regions. However, if this is not the case, the rural poor need some agricultural activity to support themselves and their families, especially if the country has poor social programs.

According to Alders and Pym (2009), there are many types of village poultry production systems to provide food and money to the households of the developing countries.

Sonaiya and Swan (2004) defined SSFPP as flocks of less than 100 birds of unimproved or improved breed, raised in either an extensive or intensive farming system, where labor is not salaried but drawn from the family household. Family poultry production is quite distinct from medium to large-scale commercial poultry farming. Families raise chickens and other avian species as sources of eggs, meat and money; primarily, as a food asset for the household and, secondly, as an agricultural enterprise.

Village poultry are hardy, scavenge for their own feed, can run and fly to escape predators, and are capable of reproducing to supply replacement stock for the household flock. All of these points make them very valuable to their owners who frequently lack the capital required to invest in commercial breeds of poultry (Alders and Pym, 2009).

Chickens and other avian species can be very efficient in transforming forage, grains, kitchen leftovers, insects, earth worms and wastage feed into eggs and meat for family nutrition. Well managed systems utilizing these resources can be profitable, and generate high quality food for village people. In addition to eggs and meat from chickens and other avian species, the birds provide feathers and manure which can be utilized. Eggs and meat are incontestable high quality food for all ages/types of people, with their leftovers (bone, shell and other residues usable for supplementing the diets of young animals of other species, providing digestible energy, high quality protein, vitamins such as A, B12, K and choline, important vitamins for brain development (Alders and Pym, 2009). Poultry residues are also useful as fertilizers for vegetable/crop production.

Sonaiya and Swan (2004) suggested that income generation is the primary goal of family poultry keeping. Eggs can provide a regular small income while the sale of live birds provides a more flexible source of cash as required. For example in the Dominican Republic, family poultry contributes 13 percent of the income from animal production.

The deficiencies of the production systems are well documented in many case studies by Sonaiya and Swan (2004). For example, in Ghana, chickens raised in free range systems have high mortality rates due to disease (Newcastle and internal parasites), predators (cats, dogs, birds of prey and snakes), and road accidents. The above authors estimated total losses from these causes to be about 70% of the chicks hatched.

Bangladesh Chickens under village conditions lay 3 clutches of eggs and produce on average 46 eggs per year, and hens need 105-140 days to complete the cycle. Mortality of scavenging chicks averages 57% up to three months of age (Sarkar and Golam, 2009). These figures may well represent what happens in other SSFPP systems in developing countries.

So, despite the great amount of technical information and suppliers supporting commercial poultry production around the world, there is little such support for SSFPP in developing countries other than that through public care policies in the respective countries.

This presentation focuses on the main constraints to the development of SSFPP into a profitable commercial activity in developing countries.

Types of enterprises

Mcleod *et al.*, (2009) classified poultry production into three types of poultry flocks, each with a different function.

1. Industrialized, represented by medium to large size flocks, either intensively reared or kept extensively under strictly regulated conditions, purely as a commercial venture by a firm that provides all necessary inputs and technology;
2. Safety net, which is an example of smallholder poultry. Safety net flocks are small, low-input flocks of indigenous breeds or hardy crossbreds, kept by large number of poor families for eggs and meat, or to be sold, bartered or given away as required. They make an important contribution to livelihoods and social dynamics although their contribution to income is usually small;
3. Asset builder, represented by small to medium size flocks kept by a family as a means of acquiring assets as a route out of poverty. These flocks may be enclosed (typically hybrid chickens) or extensive. They represent quite a large proportion of the total assets and income of their owners, and are often financed from loans. Because of the fast turnover, a successful asset building flock is an attractive way of making money, but it is also highly risky and relies on good management and market connections.

In the case of asset builder, there are two different types of enterprises:

1. Those that brood their own chicks (limited surplus and small output), in Brazil this is called "galinha caipira" producing both eggs and cockerels.
2. Those that buy hybrid chicks (unlimited surplus, but relatively high cost), in Brazil may be free range, market oriented enterprise, with separate enterprises utilizing either egg hybrids or meat hybrids.

Main constraints to SSFPP

There are many constraints restricting the development of SSFPP in developing countries. They can be classified as socio-organizational, technical and economic.

Organizational constraints

With regard to organizational aspects, generally household families are not organized as a group to receive government support.

In countries with an active poultry export industry, it is possible to promote small scale poultry production where small producers are linked to larger companies that provide inputs (including extension services) and market access (Alders and Pym, 2009). This type of organization of production has the potential to facilitate quality assurance activities as all involved in the production process are linked and benefit from the production of a quality product. Small producers that operate independently often lack capital and access to poultry health services and are more likely to encounter problems with poor quality rations and disease.

Public investments associated with support for backyard poultry farming development, remain important for enhancing nutritional status and reducing vulnerability in many rural households (Pica-Ciamarra and Otte, 2010). The promotion of small-scale market-oriented poultry units in rural areas is expected to contribute primarily to improved nutrition and rural economic growth through increased supply and lower prices of animal proteins, and secondarily to higher productivity and levels of employment.

The main types of support that should be provided by governments are technical assistance and financing, but for that to be possible, families need to be organized into some type of associative entity. There are other policies as well that may be offered by governments. In Brazil for example, the Ministery of Agrarian Development-MDA has several inclusion programs for poor families in rural areas. A significant number of them under the PRONAF program. Education, social assistance, business assistance, as in brazilian SEBRAE are also provided by government. In many countries there is always a risk that political arguments among political parties may mislead the objectives and goals of good development programs.

Technical constraints

Technical constraints are well discussed in many published papers such as the FAO series covering countries in all continents. They basically are related to management and disease control (Sonaiya and Swan, 2004).

Abubakar *et al*., (2007) reported that disease followed by predation were the major causes of SSFPP loss in parts of Borno State, Nigeria and the West province of Cameroon. For Henning *et al*., (2007), also disease, predation and exposure to unfavorable environment conditions were the major causes of mortality in chicks. For them the main strategies to improve village chicken production were vaccination against Newcastle disease, confinement rearing and supplementary feeding of chicks.

Sossidou *et al*., (2011) addressed the implications and perspectives for pasture-based systems for poultry production pointing the increased mortality under free range systems due to predation, smothering and endo-parasitic infestation leading. In that study a broad range of diseases in pasture-based systems were mentioned viz. *Pasteurella multocida*, egg drop syndrome (Adenovirus), *Escherichia coli*, *Brachyspira* and *Histomonas meleagridis* (Black head). Fowl cholera, caused by Pasteurella multocida may be present in most species of birds, and transmission from wild birds to domestic poultry has been demonstrated. Due to outdoor conditions and hens staying at a high density close to the house, in large flocks, parasitic diseases are very common such as *Ascaridia galli*, *Heterakis gallinarum*, *Capillaria obsignata* and *Eimeria* spp.

Biswas *et al*., (2010) suggested that the main problems in poultry production in the cold, arid Himalayan region of India included limited availability of feed, lack of subsidies, religious sentiments, lack of suitable germplasm, limited feed ingredients, and poor fertility and hatchability at high altitudes.

Bell (2009) cites an important constraint to the number of chicks produced as cessation of egg production by the hen during the extended time she broods and rears her chicks. Separating the chicks from the hen soon after hatching is possible to more than double egg production without any genetic change. Another constraint is the number of eggs that can be incubated in one batch. To overcome this one has to use hatching basket.

Economic constraints

In general, economic constraints have not been well defined, which may be one of the reasons that SSFPP has not evolved into a successful business in many of the developing countries. In Osun State of Nigeria, the constraints that limited the size and economic sustainability of poultry meat farms were: irregular demand of poultry meat, poor feed quality, high mortality rate, and feed price instability, in that order (Alimi *et al*., 2006).

To move from extensive to intensive production systems and to make the enterprise more profitable, care must be taken to ensure that inputs and expertise are available and affordable; otherwise attempts to intensify poultry production will not be sustainable (Alders and Pym, 2009). As the density of a poultry population increases, more sophisticated disease-control measures are required. Improved breeds need good-quality housing and feed to produce well. Improved breed hens have essentially lost the capacity to go broody and hatch their eggs, so replacement stock must be brought in, which requires a reliable source of day-old chicks or pullets in the case of layers. Feed costs account for approximately 70% of the variable costs associated with the production of commercial poultry. Corn and soybeans are frequently incorporated into poultry rations and these feedstuffs are also used to produce biofuels and food for human consumption.

As the price of these feedstuffs increase, the profit margin for small producers will evaporate and these producers will likely go out of business either temporarily or permanently.

In Turkey (Sipahi *et al*., 2011), following HPAI outbreaks, backyard birds are frequently blamed for the outbreaks and the killing out of all birds represents a great loss for the entrepreneurs. Since the bulk of the revenue deriving from chicken farming is used as pin money by housewives, it was discovered that this periodic mass culling had serious consequences for the independence of women in the countryside. Consequently, the disappearance of chicken farming as a result of the pandemic has serious economic and social consequences.

According to Bell (2009), in the attempt to control HPAI in Egypt, the ban on family poultry farming in the Nile River delta, where the HPAI virus is endemic, has been misguided. This has only increased the risk of HPAI infection of people due to the concealment of poultry in houses to avoid the ban. Similarly small scale poultry has been banned in Jakarta, Indonesia. Although the virus is unquestionably present in family poultry, it seems likely that it originated in the convergence of large scale industrial broiler farms and waterfowl, the natural host for avian influenza virus.

The greatest threat to the poultry industry is currently the global epidemic and dissemination or the influenza virus H5N1 strain (Akidarju *et al*., 2010).

According to Mcleod *et al*., (2009), in Europe in the early 20th century, there were large numbers of safety net and asset builder flocks. The large majority moved indoors to meet the demands of urban markets and to take advantage of technology. Thereafter, the retail systems favored intensive large scale production. Towards the end of the century some flocks moved outdoors again in response to a demand for free range and organic birds, but most are still kept in well regulated conditions. Small number of backyard flocks still exist, but are kept for interest more often than as a safety net. In some countries small scale poultry producers serve a niche market. In the developed countries, changes in production patterns have been reflected by changes in patterns of ownership, since the people keeping extensive poultry today are not the sons and/or daughters of those who once kept small scale flocks (Mcleod *et al*., 2009).

Examples of approaches in different countries

Despite their low productivity in the traditional production system (**Table 1**), the indigenous chickens of Bangladesh may be used in sustainable rural enterprises for households if improved management practices are used, such as early weaning of chicks, creep feeding of chicks and supplemental feeding of hens during the incubation period Sarkar and Golam (2009).

In the above study from Bangladesh, without management interventions, a rural household earns only 47 US$/year from a flock of 18 chickens. Changes in management can result in significantly improved performance. Early weaning contributes to an increase in annual egg production by shortening the length of the production cycle from 124 to 66 days. Egg production can hence be increased from an average of 46 to 99 eggs per hen per year. Creep feeding reduced chick mortality from 57% to 12%. These improved practices elevated the household income to US$ 342/year.

Minimum management practices improve scavenging poultry, as reported by Roberts and Senaratne (1992). In that case scavenging commercial

Table 1 - Size structure and dynamics of village chickens flock in Bangladesh

Flock composition	n	Productivity indicator	Value
Nº of chickens	18.40	Nº of clutches/hen/year, n	3.1
Nº of layers	3.86	Eggs/clutch, n	14.6
Layers in present production	1.40	Incubation duration, d	16.9
Layers incubating	0.80	Brooding and rearing period, d	85.7
Layers brooding	0.73	Production cycle, d	123.6
Off-lay	0.93	Egg/hen/year, n	45.5
Nº of pullets	2.66	Hatchability, %	82.9
Nº of cockerels	1.40	Liveability to 10-12 weeks, %	43.1
Nº of chicks	10.46	Chicks reaching production age, %	29.4

Source: Adapted from Sarkar and Golam (2009).

hybrid layers in Sri Lanka when raised with minimum care, such as brooding and supplementing with local crop by-products (comprising 40% of rice polish, 50% of expeller coconut meal and 10% of broken rice which resulted in an 16% crude protein diet) had the growth rate of the pullets improved to 38 g/bird/day up to 20 weeks of age, and the mortality rate of the chicks reduced to only 4% up to 10 weeks. According to the authors a significant improvement in these indicators related to systems that not provide such a care.

In Brazil, Embrapa, universities and other research institutions have been searching for small-scale poultry production systems that do not threaten the country´s very important commercial poultry meat export industry. Technically it is possible to produce good quality chickens and eggs in areas of rural settlement. Many combinations of genotype and management programs were trialed with small poultry producers in rural regions. Distance to the market and the size of the operation unit were the main constraints to SSFPP enterprises. The size of the operation has to be large enough to worth the mandatory expenses due to the country´s regulation of enterprises. Also, as Brazil is a large country, producers are spread in larger areas what makes the distances to the market one constraint to the development of the rural population.

Related to genotypes and feeding programs for SSFPP, **Table 2** shows the response of a number of genotypes to a range of feeding programs with chickens raised outdoors (Savino *et al*., 2007). The data suggests that for commercial purposes small scale family poultry production may benefit from using a balanced diet all the way through to slaughter at 84 days of age, producing on average one kg live weight with 2.55 kg of feed.

There are a number of examples in Brazil where more productive meat and egg chicken hybrids have been utilized for SSFPP in asset building flocks. Examples in Emparn (Rio Grande do Norte State), and EBDA (Bahia State) with egg layer hybrids Embrapa 051 have demonstrated the potential for this type of improvement. On the other side, in many parts of Brazil, like in the sertao, there is no access to corn and soybean for chicken diets, therefore, hybrids are not recommended for that situation. Embrapa Meio Norte (Piaui State) has good experiences with caipira chicken in production systems for the sertao case. However, in places were such feedstuffs are available, it may be a good option to produce eggs and chicken meat under the regulations of caipira, colonial, organic, agroecological, (which are the regulation for SSFPP in alternative systems in Brazil) because of the added value and returns from this form of production.

Data from the Embrapa work with small scale entrepreneurial chicken production in Quatro Barras-PR are shown in **Tables 3** and **4**, to illustrate the performance of three producers of the same county with their small family enterprises.

There is evidence of recording mistakes in some of the data e.g. in producer 3, lot 03 of 2008, because the feed:gain ratio is excessively high. Analyzing viability figures in these series one can observe that producers tend to improve their skills as they get more experienced. The feed:gain ratio is very difficult to assess accurately as the producer may use some feed or birds for other purposes

Table 2 - Liveweight and feed:gain ratio of a range of otypes from 0 to 84 days of age under *ad libitum* x restricted balanced diet in Brazil.

Genotype	0-28 day Balanced diet		0 – 56 day Balanced diet		0–56 day Restricted diet after 28 d		0 – 84 day Balanced diet		0–84 day Restricted diet after 28 d	
	Liveweight kg	Feed: Gain	Liveweight kg	Feed: Gain	Liveweight kg	Feed: Gain	Liveweight kg	Feed: Gain	Liveweight kg	Feed: Gain
Esalq Caipirão	0.752	1.658	2.09	2.19	1.76	2.54	3.28	2.82	1.87	3.55
Paraíso Pedrês	0.725	1.618	2.10	2.26	1.66	2.58	3.20	2.81	2.05	3.42
7 P	0.663	1.622	1.98	2.14	1.52	2.61	3.19	2.70	1.81	3.43
Embrapa 041	0.564	1.672	1.52	2.21	1.14	2.69	2.55	2.55	1.24	3.78
Paraíso Pelado	0.533	1.622	1.54	2.08	1.11	2.76	2.51	2.74	1.25	3.75
Esalq Caipirinha	0.508	1.702	1.46	2.09	1.04	2.68	2.42	2.66	1.22	3.69
Isa Naked Neck	0.480	1.761	1.43	2.14	1.04	2.71	2.36	2.65	1.23	3.62
Carijó Barbada	0.461	1.857	1.35	2.16	1.04	2.72	2.20	2.69	1.27	3.45

Source: Adapted from Savino *et al*., (2007).

Table 3 - Chicken performance on Producer 1 of Quatro Barras County-PR, Brazil.

Productivity indicators	2008 LOT1	2008 LOT2	2008 LOT3	2009 LOT1	2009 LOT2	2009 LOT3
No. Housed chicks	200	198	203	250	333	225
No. Slaughtered	196	179	195	250	323	217
Viability, %	98.00	90.40	96.06	100	97.0	96.0
Slaughter age, d	98	98	98	91	87	98
Total live weight, kg	493.33	424.23	485.00	552.50	717.06	499.10
Total feed, kg	1,631.00	1,625.00	1,578.00	2,052.15	2,578.20	2,235.90
Feed:gain	3.306	3.830	3.254	3.665	3.595	4.480
Average liveweight, kg	2.517	2.370	2.487	2.210	2.220	2.300

Source: Bassi and Albino (2010).

Table 4 - Chicken performance on of Quatro Barras County-PR, Brazil

Productivity indicators	Producer 2			Producer 3				
	2008 LOT1	2009 LOT1	2009 LOT2	2008 LOT1	2008 LOT2	2008 LOT3	2009 LOT1	2009 LOT2
No. Housed chicks	200	200	205	214	240	200	250	225
No. Slaughtered	199	185*	193	200	165*	190	230*	212*
Viability, %	99.50	98.40	94.15	93.46	94.58	98.00	100.00	97.30
Slaughter age, d	98	98	98	98	91	98	85	85
Total live weight, kg	500.88	446.00	483.08	506.05	377.39	419.96	508.90	418.32
Total feed, kg	1,631	1,459	1,578	1,734.90	1,581.70	2,118.00	1,940.10	1,706.90
Feed:gain	3.256	3.271	3.266	3.428	4.191	5.043	3.812	4.080
Average liveweight, kg	2.516	2.411	2.503	2.530	2.287	2.210	2.212	1.973

Source: Bassi and Albino (2010). *Some birds were slaughtered for home consumption in lots of 2009 (20 and 7 birds, respectively were kept for home comsumption).

forgetting to register that, but the technician skills may help to detect where there are such problems.

In Embrapa, the author ran an indoor observation test on balanced feed, crossing four male lines (Heavy red-V; Barred-C; Rhode Island Red-G; and Assil-I) with four female lines (the broiler breeder female parent-VK; the layer breeder female parent-SG and two reciprocals meat x layer cross line- KG and GK) to monitor the growth potential up to slaughter weight of each cross for different smallholder systems (**Table 5**). It is evident that the VK hen when crossed with the males V, C, G and I produced chicks that were able to grow fast to moderate with feed:gain ratios of 2.098; 2.164; 2.414 and 2.684 and the SG hen produced the slow growing chicks. The KG and GK hens produced chicks of intermediate growth potential. Among the male lines the growth potential rank within female line was V, C, G and I in that order.

Figueiredo *et al*., (2007) in a comparison of two Embrapa hybrids for egg production in intensive and in semi-intensive egg production systems, reported that hens housed in aviaries (in 16 experimental units of 50 hens each) had better total survivability from 17 up to 70 weeks of production than those housed outdoor (99.5 *vs* 95.7%), although the outdoor ones reached higher live weight at egg production peak (2094 *vs* 2043 g), and also produced heavier eggs (55.3 *vs* 54.4g as the average of the total period) than those housed in aviaries. In this study, the genotypes Embrapa 031 and Embrapa 051, respectively weighed 2006 and 2131 g at the peak egg production, ate on average 112.5 and 117.0g of feed/day as the average of the total period, and produced 248 and 255 eggs from 17 to 70 weeks of age. The eggs weighed on average of the total egg production 55.2 and 54.6g each. The genotype Embrapa 051 reached its expected genetic potential listed in the strain advertisement brochure, but Embrapa 031 did not produce 275 eggs in the studied period, as advertised.

Table 5 - Hybrid chicken growth potential for smallholder systems in Embrapa Studies in BrazilHybrid.

	VVK	CVK	GVK	IVK	CKG	VKG	GKG	CGK	IGK	VSG	CSG	ISG
Slaughter age	56	56	63	84	63	63	84	84	84	84	84	90
Liveweight, g	2.504	2.394	2000	2.823	2.293	2.052	2180	2.823	2.035	2.190	2.435	1.820
Feed:gain	2.098	2.164	2.414	2.684	2.185	2.415	2.726	2.684	3.613	2.611	2.838	3.542
%Carcass	72.12	73.44	73.84	74.83	72.30	73.90	73.77	72.25	72.62	72.68	73.40	72.34
% Breast	18.44	19.42	18.69	19.46	18.82	18.82	17.45	16.75	18.76	17.41	16.81	17.69
% Drumstick	9.31	9.71	10.56	10.43	10.15	9.97	11.25	10.60	10.47	10.28	10.58	9.45
% Thighs	11.63	12.31	12.73	12.22	12.60	12.61	12.71	12.44	12.22	12.48	12.48	11.16
Growth rate, g/ day	44.7	42.7	31.7	33.6	36.4	32.6	25.9	33.6	24.2	26.1	29.0	20.2
Performance	Fast	Fast	Moderate	Moderate	Moderate	Moderate	Slow	Moderate	Slow	Slow	Moderate	Slow
Predominat colors	Reddish	Light reddish	Reddish	Reddish-Gray	Reddish- gray, White, Light gray and Dark gray	Barrred, White and red	Dark barred	Reddish- gray, White with paints and Dark red	Reddish-gray, Gray and Black	Red, Barred and White	Red, Light Barred and Dark barred	Barred and White

Source: Data from the author.

Miele *et al*., (2008) demonstrated the economical impact of using improved hybrid hens to produce eggs in small-scale family poultry production as compared to the local not improved genotypes (some of the local genotypes are called "galinha caipira" in Brazil). In that case the estimated economic impact was R$ 2,29 per hen.

Avila *et al*., (2008) found that the brown egg layer Embrapa 031 was able to produce on average 227 eggs from 20 to 60 weeks of age fed on a balanced diet containing 20% corn, 32% toasted soybean, 30% ground sun dried cassava chips plus 5% ground cassava leaves with mineral and vitamin premix. Although hens fed on this diet produced up to 10 eggs less than those fed on other diets containing corn, sorghum, oats or triticale in the place of cassava but, due to the lower cost of cassava, the feed cost per dozen eggs was substantially lower on the cassava diet (**Table 6**).

Schmidt and Figueiredo (2007) simulated examples of small agroecological chicken production systems for slaughtering 500, 1,000, 1,500 and 2,000 birds/day in 22 working days/month (**Table 7**).

The producer flock size was chosen based on potential monthly net return (minimum wage of R$ 450) for the producer, which could have one, two or more 500 chicken-modules according to their available land, investment capabilities and revenue expectancy. For the simulated examples on the studied operation size of the processing units, for slaughtering 500, 1,000, 1,500 and 2,000 birds/day in 22 working days/month the number of birds at any one moment in time, after business stability, would be, respectively, 33,118; 66,237; 99,355; and 132,473 birds, which would generate 21,700; 43,560; 65,340 and 87,120 kg of chicken meat/month, what would require respectively, 79, 158, 238 and 317 tons of feed/month to support small markets of 21.7, 43.5, 65.3 and 87.1 tons of chicken meat/month. In the smallest case (slaughtering of 500/day) there would be a demand of at least 246 hectares cultivated with feed ingredients (corn and soybean) for the total chicken in one stabilized business. To support integrated chicken production systems like the simulated ones it is necessary to obtain funding and to establish technical assistance, feed suppliers, chick suppliers, transportation, slaughterhouse facilities, as well as packing, marketing and delivery systems.

In another analysis of the economical potential for processing small flocks of free range chicken for the

Table 6 - Egg production and cost according to diet ingredients.

Feed ingredients	Total eggs	Total feed consumption, kg	Feed cost/dozen eggs, R$
Corn	227	1613	0.921
Sorghum	237	1611	0.817
Oats	237	1612	0.800
Cassava	227	1614	0.770
Triticale	231	1613	0.855

Source: Adapted from Avila *et al.*, (2008)

Table 7 - Dimensioning small chicken production integration project including chicken and input needed in Brazil.

	Daily slaughter capacity (nº of chicken)			
	500	**1,000**	**1,500**	**2,000**
Production				
Chicks housed/month	11,828	23,656	35,484	47,312
Total chicken in the field, n	33,118	66,237	99,355	132,473
Modules, n	49	98	147	196
Slaughtered chicken/day, kg	1,200	2,400	3,600	4,800
Meat production/month1, kg	21,700	43,560	65,340	87,120
Monthly need of feed, ton	79	158	238	317
Ingredients needed/year (ton.)				
Corn	618	1,236	1,853	2,471
Soybean	285	570	855	1,140
Mineral and vitamin nucleous	48	95	143	190
Cultivated area for diet ingredients (ha)²				
Corn	114	229	343	458
Soybean	132	264	396	528
Total	246	493	739	986

1 - Considering the ratio 70% whole chicken and 30% parts. 2 - It was considered production of 5,4 and 2,16 ton./ha, respectively for corn and soybean. Source: Adapted from Schmidt and Figueiredo (2007).

Brazilian government Pronaf-program, Fernandes and Silva (2005) simulated a slaughterhouse for processing 150 birds/day. They foresaw investment costs of: R$ 26,199.77 for construction; 53,036.24 for equipment; and 25,458.65 for working capital, amounting to a total of R$104,694.67. If someone takes a loan from the bank under Pronaf program, he or she would have to make monthly payments of R$ 3,262.05 only for the borrowed capital down payment. The total annual cost (capital plus monthly production costs) would be of R$ 208,740.99 and the expected gross annual revenue would be of R$ 231,998.71. The studies made by Fernandes and Silva (2005) and by Schmidt and Figueiredo (2007) demonstrated the small margins for SSFPP in Brazil and may be it also represents the situation in other countries as well.

A fundamental requirement for such an investment, is that superior commercial genotypes and properly formulated well balanced diets are used. Indigenous breeds are not appropriate for such a system.

Final considerations

Numerous reports have been published on the importance and potential of as well as the constraints to SSFPP in many countries. Many of the scavenging systems of today in the developing countries and in the rural areas and villages were used in the past by developed countries. Mcleod *et al.*, (2009) concluded that SSFPP will continue as an important form of poultry production in the future, but with better qualification. Rural safety net flocks will certainly exist, particularly in Africa and parts of Asia, wherever there are poor families. In some countries safety net flocks in the rural areas will continue to contribute significantly to the national production of poultry meat and eggs.

For safety net flocks in cities, the question is still open, and this is important in many countries that currently have a highly mixed pattern of production. It is suggested that with sensible biosecurity regulations and reasonable compliance, small enclosed urban flocks could still exist in 2030 at minimum risk to their owners and to the large-scale poultry industry, but this would require a more moderate approach to regulation than has so far been generally applied. For human health reasons, however, free range poultry flocks in cities should be, and probably will be removed.

Asset building flocks will continue in places where they can meet the market demand. Some will target niche markets while others exploit temporary business opportunities provided by changes in human demography (such as development or new settlement in rural areas). There will probably be a range of business models, but fewer than today, some contracted to large companies. For that type of system there is a large body of technology. There is currently an interest in compartmentalization among large scale producers even when their immediate target is not the export market (e.g. Indonesia) as a way of stabilizing their domestic market. Without strong government incentives, it is not evident how small scale asset building flocks could be part of a compartment.

Unfortunately, SSFPP is facing numerous constraints. This situation is exacerbated by the fact that many SSFPP farmers are not provided with comprehensive and objective information about all aspects of the available different husbandry systems and types of flock management. Yet, wide dissemination of views, experiences and results is essential for sustainable SSFPP development, which should be backed up by well-designed research (Guèye, 2009). From the business standpoint, the entrepreneur faces the following challenges to establish and run a small commercial poultry operation:

1. Usually the distances are too great increasing the cost of input and output transportation;
2. Usually a large financial investment is required to establish a legal poultry business operation, and there are likely to be more lucrative investments for that kind of money;
3. It is difficult and costly to obtain certified food inspection prior to sale.
4. It is often difficult to find equipment suitable for small operations;
5. People interested in this type of integration generally lack educational qualifications required to produce the type of product the market demands; According to Guèye (2009) most SSFP farmers are not provided with comprehensive and objective information about all aspects of the different FP husbandry systems and types of flock management.
6. From the production systems standpoint, local breeds have relatively poor performance compared to commercial meat and egg genotypes (although Bell (2009) states that introducing improved genes will not improve production in scavenging poultry), bird health is nearly always threatened by a lack of isolation, and there is insufficient feed to support the flock size necessary to meet the minimum commercial scale size. To raise chicks without the brooding hen requires special care with housing, temperature, control, vaccination, good hygienic conditions and a good and clean water source.
7. A viable chicken business requires year-round production, and as a consequence significant quantities of grain and other crops may need to be stored for extended periods.

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