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Chicken Production Systems and Market Oriented in Post-Conflict in DRC

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Abstract

Livestock production in DRC is very low and cannot provide sufficient animal proteins and contribute efficiently to poverty alleviation. In this way, a survey was carried out on chicken's production in 7 sites in the country: Bukavu and his hinterland, Minova, Bweremana-Sake, Goma, Kinshasa, Lubumbashi and in Kongo central (Mvuazi-Kolo). Survey was conducted on 8th to 23rd March 2015 at the household and chickens company level using standard methods of interviews and structured questionnaires on chicken's production systems and commercialization. Results confirm that local chickens are yet commonly rearing in the country. They were eating by scavenging, rate of mortality was high, chicken accommodation was not yet well performed and the most disease was New Castle. Extension services had low involvement in the chicken's production. Prices were high in all the sites. This should be an opportunity for the businessmen to boost the chicken industry production in the country. This study aims to survey current chicken industry and the status of technology based on the Korea-Africa Food Agriculture Cooperation Agency (KAFACI) project on the promotion of good management for increased productivity of market oriented small-scale chicken producers in DRC.

Subject Areas

Agricultural Science, Food Science & Technology

Keywords

RDC, Survey, Chickens, Production Systems, Market

1. Introduction

DRC post-conflict situation is characterized by lack of food supply and proteins, especially animal proteins. Instead the end of the wars called African world war in July 1999 with Lusaka peace agreement signed on one site between DRC government and his allies at another site with some East-Africans neighbor's countries, until nowadays troubles persist in the eastern part of the country. Livestock decreased dramatically due to looting during the wars in 1996 à 2009 and in the troubles. This diminution is also due to low diseases control, lack of animal nutrition and extension services. As observed [1], the animal-agriculture production is not enough and livestock production is maintaining in extensive system. The yield crops are also low due to lack of good soil management, small lands of farmers especially in eastern part of the country. Population malnutrition rate is 15% [2]. Then, importation of meat is very high. In 2010, DRC imported 2853 tons of cattle meat, 59,468 tons of chickens, 132,915 tons of frozen fish [3]. However, the current President of DRC decided in 2019 to improve agriculture as one of major motors of the national development. In this way, promotion in the country of poultry industry should boost easily the animal protein's production and income generation due to their short breeding cycle. The poultry and their products are used for home consumption, as gifts, or for religious purposes. Additionally, they are sold to earn some income… Poultry are relatively cheap than the big animals, easy to rear, and easy to manage. Consequently, there has been and there is a growing attention and interest in poultry production in villages as well as in peri-urban and urban areas throughout the developing world [4]. The objective of this survey was to explore the chicken production systems and the constraints related in the way to set up a good chicken industry in the country in the coming peace period.

2. Material and Methods

2.1. Sites Location

Located in Central Africa, the Democratic Republic of the Congo (DRC) has 2,345,409 km^2 and is the second big country in Africa. His inhabitants are estimated at 71,712,867 persons and almost 65% live in rural area. The year increment rate of population is 2.7%. The contribution of agriculture on GDP was 43% in 2009 [5] and the contribution of livestock on agriculture is 9.2% [6]. The surveyed sites were Kinshasa; located in West is the capital town (see **Figure 1**); Lubumbashi the second country town is located in Katanga province in the South-East, in Kongo central province (Mvuazi-Nkolo) in West near Kinshasa, Goma a principal town and Bweremana-Sake villages in Nord-Kivu province and Bukavu the principal town of Sud-Kivu province and his hinterland of around 50km in Sud-Kivu province. The two last provinces are located in the East.

2.2. Survey Establishment

To carry out the survey, two questionnaires were submitted.

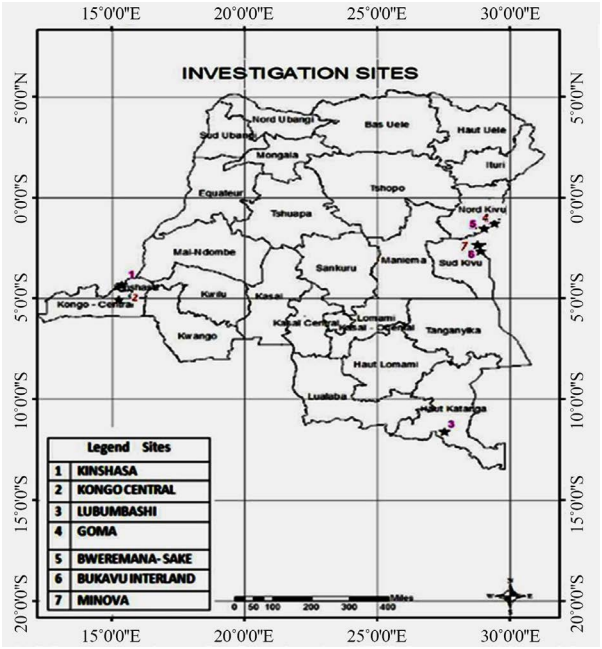

Figure 1. Localization of the study area.

2.2.1. Farmer's Production Systems

During the interview, seven sites described above and sampling were chosen randomly in the countries. Surveys were implemented from 8th to 23rd March 2015. We got at all 245 samples in which 170 samples from farmer's production systems and 75 samples from chickens marketing. About the farmer's production systems, survey was conducted at the household and chicken company level in the sites using standard methods of household interviews and structured questionnaires. About typology on farmer's productions, the number of chickens per farmer was: the big farmer more than 100, the middle farmer between 50 to 100 and the small farmers between 2 to 49. Sample's number per site was 3 households for the big farmers, 7 households for the middle farmers and 15 households for the small farmers. Data were collected on the socio demographic characteristics, on production systems adopted by farmers, type of breeds of chicken reared, sources of stock, flock size and composition, management and housing systems adopted, feeding systems, diseases and production poultry constraints.

2.2.2. Chicken's Commercialization

Samples per site were 8 small traders, 2 wholesalers and 3 restaurants. Prices purchases and sold were collected to get a benefit margin. Information on improved chicken breed, country origin, transport and chicken meat processing, chicken products transportation were collected from the farmers. The number of animals was converted into Tropical Livestock Unit (TLU), where cattle are weighed with 0.7, sheep/goat with 0.1, swine 0.2, and chicken 0.01 [7], rabbit 0.01 TLU, cavy 0.005 TLU [8]. Data were analyzed using descriptive analysis such as frequency distribution, percentages and means comparison. Statistical analyses

were done in IBM SPSS Statistics version 20 software.

3. Results and Discussion

3.1. Farmer's Production Systems

3.1.1. Social Characterization of Chicken's Farmers

Results on Table 1 show that the chicken enterprise of the poultry sub-sector in DRC had a gender dominated by male farmers across the locations with participation level of 63.7% while female farmers constituted 36.3%. In Sud-Kivu, DRC [9] observed that 66.6% of men are chicken farmers. In addition, the repartition of the average age of the chicken's farmers is 44.9 years. They were significant ($P < 0.05$) differences in the average ages across the sites. It shows that farmers still are strong to rear the chickens; the youngest had 17 years old even if the oldest was 82 years old. According to the education level of the farmers, majority of them did the secondary school 48.7%% follow by university 28.9% and primary school 15.1%. Few interviewees were illiterates 7.3%. Many famers reached the secondary school and university level as observed [10] in Sud-Kivu. The average experience of chicken's rearing per group age is recorded up to five years to 3.0 ± 0.6 years, the group age 6 to 10 years of chicken experience had 8.0 ± 1.7 years and the group above 10 years had 20.1 ± 8.2 old. About interviewer's position, they were especially dominated by the responsible of household or enterprise at 63.5%, the household children 24.1%, agents represented 7.9% and spouse 4.3%.

3.1.2. Livestock Production in the Study Area

Table 2 shows that the main TLU number of animals was recorded on cattle 14.5 ± 40.0 TLU followed by the chickens 4.5 ± 40.0 TLU, swine 4.4 ± 83 TLU with high significant ($P < 0.001$) differences between TLU swine averages across the sites.

The high record averages were observed on cattle with 28.5 ± 23.2 TLU in Lubumbashi, swine 19.6 ± 26.6 TLU in Bukavu and his hinterland, sheep 2.4 ± 2.9 TLU in Bweremana-Sake 8.3 TLU, goat 4.0 TLU in Lubumbashi, rabbit 0.9 ± 1.0 in Kinshasa and Cavy in Bukavu and his hinterland.

3.1.3. Chicken's Production Systems

Chickens types reared in DRC, see Table 3, were commonly represented by the local one with 82.4% and the improved chicken at 17.6%. Chickens in Sud-Kivu are mostly rearing in free-range system [10]. Among the improved chickens, Leghorn is first with 29.9%, Derco ponte 22.2%, Sussex hermine 15.5% and Rodes Island Red 13.4%. According to the composition of chicken's flock size, it appeared that at the basic level, the rate of chicks was very important 60.5% but unfortunately from this stage to the mature birds, it decreased very drastically with successively; pullet 10.5%, cockerel 8.0%, cock 10.6% and hen 10.6%. [9] observed that the rate of chickens at weaning period was 57.25% in Sud-Kivu. Chicks were not in generally cured or benefit of diseases prevention and any protection against bad weather or rapt by predators was done. If these gaps

should be avoided, farmer can improve the chicken production from 30 up to 60%. About the chicken house, the common one is the kitchen and free range 38.7% followed by chickens accommodated in human house 23.7%, kitchen with enclosure 19.2% and chicken house built with bricks 18.6%. On-farm, majority of chicken's producers 93.9% doesn't have hatchery, only 6.1% used it. Only hens play the role of incubating eggs. In Uganda, [11] observed that the use of hatchery is low due to lack knowledge of farmers in management, lack of fund and small chicks supply from parental strains.

Table 1. Farmer's social characterization.

Characteristics of Chicken's Farmers	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total	Test Stat. Value (F)
Sex									
Male	20 (80)	17 (68)	11 (44)	13 (54.2)	16 (64)	12 (60)	19 (76)	108 (63.9)	
Female	5 (20)	8 (32)	14 (56)	11 (45.8)	9 (36)	8 (40)	6 (24)	61 (36.1)	
Age of farmers									
Minimum age	20	28	17	29	21	30	20	165	
Maximum age	70	82	70	75	59	73	59	488	
Average age	45.4 ± 13.6	46.2 ± 12.4	43.4 ± 13.5	48.9 ± 11.2	41.8 ± 10.9	51.3 ± 10.4	38.2 ± 11.9	44.9 ± 12.6	2.829**
Education									
Illiterate	1 (4.2)	2 (9.5)	1 (4.5)		2 (10)	1 (5.6)	4 (16)	11 (7.3)	
Primary	6 (25)	5 (23.8)	2 (9.1)	3 (13.6)	1 (5)	2 (11.1)	4 (16)	23 (15.1)	
Secondary	13 (54.2)	12 (57.1)	10 (45.5)	10 (45.5)	10 (50)	6 (33.3)	13 (52)	74 (48.7)	
University	4 (16.7)	2 (9.5)	9 (40.9)	9 (40.9)	7 (35)	9 (50)	4 (16)	44 (28.9)	
Years' experience									
Up to 5 years	2.9 ± 1.7	3.4 ± 1.4	2.1 ± 1.1	4.0 ± 1.3	2.9 ± 1.4	2.0 ± 1.8	3.6 ± 1.2	3.0 ± 0.6	
6 - 10 years	8.2 ± 2.0	7.5 ± 2.0	8.0 ± 2.0	8.4 ± 1.7	8.4 ± 1.7	7.6 ± 1.7	9.0 ± 1.7	8.0 ± 1.7	
Above 10 years	17.8 ± 5.7	23.1 ± 7.7	23.8 ± 13.3	20.5 ± 8.3	17.0 ± 4.1	16.0 ± 4.2	25.3 ± 10.5	20.1 ± 8.2	
Position of the responding									
Responsible of Household /enterprise	21 (84)	14 (56)	20 (80)	10 (40)	14 (56)	10 (50)	20 (80)	109 (66.5)	
Children		9 (36)	5 (20)	12 (48)	7 (28)	5 (25)	3 (12)	35 (21.3)	
Agent	2 (8)			3 (12)	4 (16)	4 (20)		13 (7.9)	
Spouse	2 (8)	2 (8)				1 (5)	2 (8)	7 (4.3)	

** Significant at $P < 0.05$.

Table 2. Animal species reared (Averages in TLU).

Animal Species per Household	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total	Test Stat. Value (F)
Cattle			5.9 ± 6.4	1.4		28.5 ± 23.2	2.8	14.5 ± 40.0	
Chickens	0.5 ± 0.7	0.4 ± 0.8	0.4 ± 0.4	5.1 ± 15.9	0.7 ± 1.0	29.0 ± 114.4	0.5 ± 0.5	4.5 ± 40.0	0.941
Swine	19.6 ± 26.6	0.4 ± 0.1	1.8 ± 1.0	5.6 ± 3.2	2.3 ± 3.0	10.1 ± 8.2	0.8 ± 0.9	4.4 ± 8.3	4.101***
Sheep		8.3		1.5	0.9 ± 0.8	1.7 ± 1.9	1.3	2.4 ± 2.9	
Goat	0.3 ± 0.2	0.4	0.5 ± 0.3			4.0	0.5 ± 0.5	0.6 ± 0.9	
Rabbit		0.3 ± 0.2	0.08 ± 0.1	0.9 ± 1.0	0.4 ± 0.3		0.08	0.3 ± 0.4	
Cavy	0.2 ± 0.5				0.06		0.04	0.1 ± 0.7	

*** Significant at $P < 0.001$.

Table 3. Chicken types and flock organization.

Characteristics per Household	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total
Chicken's types reared								
Local	10 (71.4)	18 (78.3)	11 (85.6)	15 (62.5)	7 (100.0)	20 (90.9)	6 (88.9)	89 (82.4)
Improved	4 (28.6)	5 (21.7)	2 (15.4)	9 (37.5)		2 (9.1)	1 (11.1)	23 (17.6)
Improved chickens' strains								
Leghorn		9 (60.0)	1 (10.0)	2 (16.7)	3 (25.0)	3 (33.3)	9 (64.3)	27 (29.9)
Sussex hermine	2 (25.0)		2 (20.0)	3 (25.0)	2 (16.7)	2 (22.2)		11 (15.5)
Derco ponte	4 (50.0)	4 (26.7)	2 (20.0)	1 (8.3)	3 (25.0)	1 (11.1)	2 (14.3)	17 (22.2)
Rhodes Island Red	1 (12.5)	1 (6.7)	2 (20.0)	1 (8.3)	2 (16.7)	2 (22.2)	1 (7.1)	10 (13.4)
Arbor		1 (6.7)	1 (10.0)	4 (33.3)	1 (8.3)			9 (10.4)
Unknown	1 (12.5)		2 (20.0)	1 (8.3)	1 (8.3)	1 (11.1)		6 (8.6)
Composition of chicken' flocks size								
Chicks	19 (65.5)	18 (75.0)	20 (74.1)	17 (56.7)	4 (25.0)	14 (66.7)	15 (60)	107 (60.5)
Pullet	2 (6.9)	1 (4.2)	1 (3.7)	3 (10.0)	4 (25.0)	3 (14.3)	2 (8)	16 (10.3)
Cockerel	4 (13.8)	1 (4.2)	2 (7.4)	1 (3.3)	3 (18.8)	1 (4.8)	1 (4)	13 (8.0)
Hen	2 (6.9)	2 (8.3)	3 (11.1)	5 (16.7)	3 (18.8)	1 (4.8)	2 (8)	18 (10.6)
Cock	2 (6.9)	2 (8.3)	1 (3.7)	4 (13.3)	2 (12.5)	2 (9.5)	5 (20)	18 (10.6)
Chickens' houses								
Kitchen and free range	73 (1.8)	8 (30.1)	12 (50)	5 (20)	14 (70)	3 (15)	11 (20.1)	60 (38.5)
Chickens in human house	6 (27.3)	6 (28.6)	9 (37.5)	3 (12)	2 (10)	7 (35)	4 (16.7)	37 (23.7)
Kitchen and enclosure	3 (13.6)	3 (14.3)	2 (8.3)	4 (16)	3 (15)	8 (40)	7 (29.2)	30 (19.2)
House built with bricks	6 (27.3)	4 (19.0)	1 (4.2)	13 (52)	1 (5)	2 (10)	2 8.3)	29 (18.6)
Presence or not of hatchery								
Yes, I have		1 (14.3)			2 (28.6)			3 (6.1)
No, I don't have	24 (100.0)	6 (85.7)	2 (100.0)	19 (86.4)	5 (71.4)	13 (100.0)	11 (100.0)	78 (93.9)

Values in parentheses are percentages.

3.1.4. Chicken's Health and Nutrition

Among the major diseases (see Table 4), New Castle was recorded first 68.4%, followed by Gumboro 16.9%, Marek and Salmonellosis 5.4% diseases. The total average of death rate was 23.5% ± 26.0% with high significant ($P < 0.001$) differences in the average of global mortality rates across the sites. According to the seasons per year, the wet season is very hard with 42.7% of death in terms of incidence of diseases attack on-farm level. In dry season, it represented 33.7% and both the two seasons 23.6%. Mortality rate is mostly so high.

Table 4. Health and nutrition management.

Characteristics	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total	Test Stat. Value (F)
Important diseases									
New Castle	14 (82.4)	8 (40.0)	19 (100)	9 (69.2)	5 (83.3)	2 (50.0)	7 (53.8)	64 (68.4)	
Gumboro		3 (15.0)		4 (30.8)	1 (16.7)	1 (25.0)	4 (30.8)	13 (16.9)	
Marek		1 (5.0)				1 (25.0)	1 (7.7)	3 (5.4)	
Parasites		1 (5.0)						1 (0.7)	
Salmonellosis	2 (11.8)	3 (15.0)					1 (7.7)	6 (4.9)	
Bronchitis infectious		1 (5.0)						1 (0.7)	
Diphtheria		1 (5.0)						1 (0.7)	
Coccidiosis		2 (10.0)						3 (5.4)	
Seasonal frequency of diseases									
Wet season	1 (16.7)	11 (57.9)	8 (34.8)	2 (18.2)	2 (33.3)	1 (16.7)	13 (72.2)	38 (42.7)	
Dry season	2 (33.3)	6 (31.6)	6 (26.1)	7 (63.6)	4 (66.7)	2 (33.3)	3 (16.7)	30 (33.7)	
Both seasons	3 (50.0)	2 (10.5)	9 (39.1)	2 (18.2)		3 (50)	2 911.1)	21 (23.6)	
Global rate of death	14 ± 12.6	46.9 ± 26.0	23.7 ± 25.0	9.1 ± 10.2	5.2 ± 2.9	9.0 ± 6.4	53.4 ± 35.7	23.5 ± 26.0	1.25***
Using veterinary services									
Yes, I use it	3 (25)	3 (15.0)	6 (35.3)	7 (58.3)	3 (23.1)	8 (80.0)	2 (14.3)	32 (35.9)	
No, I don't use it	9 (75)	17 (85.0)	11 (64.7)	5 (41.7)	10 (76.9)	2 (20.0)	12 (85.7)	66 (64.1)	
Nutrition systems									
Scavenging	1 (4.3)	3 (16.7)	2 (8.3)	3 (12.5)	6 (26.1)		6 (25.0)	21 (13.3)	
Scavenging/grains/ kitchen residues	10 (43.5)	6 (33.3)	10 (41.7)	11 (45.8)	11 (47.8)	2 (10.5)	7 (29.2)	57 (36.0)	
Concentrate with scavenging	9 (39.1)	6 (33.3)	3 (12.5)	3 (12.5)	3 (13.0)	1 (5.3)	4 (16.7)	32 (30.0)	
Concentrate	3 (13.0)	3 (16.7)	9 (37.5)	(7 29.2)	3 (13.0)	16 (84.2)	7 (29.2)	45 (20.7)	
On-farm feed distribution									
Parents	9 (39.1)	15 (71.4)	9 (36.0)	14 (56.0)	12 (60.0)	5 (26.3)	19 (79.2)	83 (52.6)	
Family members	9 (39.1)	5 (23.8)	7 (28.0)		2 (10.0)	3 (15.8)	1 (4.2)	27 (17.3)	
Children	4 (17.4)		3 (12.0)	4 (16.0)	5 (25.0)	7 (36.8)	2 (8.3)	25 (16.5)	
Agents	1 (4.3)	1 (4.8)	6 (24.0)	7 (28.0)	1 (5.0)	4 (21.1)	2 (8.3)	22 (13.6)	

*** Significant at $P < 0.001$, values in parentheses are percentages.

Through the sites, the rate of death was high as recorded in Minova 53.4% ± 35.7% and Bweremana-Sake 46.9% ± 26.0%. In Uganda, [12] spoke about diseases of high importance which always cause high mortality (kill over 50% - 90% of the stock) and are difficult to treat. In Cameroon, mortality caused by diseases can sometimes attend 100% [13]. On chicken feeds, the most nutrition system is in scavenging. The personnel who nourish the chickens is mostly represented by the parents within the family 52.6% followed by all the family members 17.3%, children 16.5% and agents 13.6% from enterprises and households.

The support of extension services was almost inexistent in the chicken's production systems, 78.2% of interviewees were not assisted, see **Table 5**. The one who assisted few farmers were represented by NGO's at 58.1%, private sector 27.9% and the last one was the public sector 14.1% which was represented mostly by the agricultural scientist in scaling up on some livestock topics. In Colombia, [14] declared that regarding to the training/extension service situation 45% of the interviewed smallholder producers had received formal training (held by a Non-Governmental Organization (NGO), a Governmental Organization (GO), or by a feed supplier). The distance from farm-gate to veterinary pharmacy is high in big towns Kinshasa and Lubumbashi than in middle towns and villages, due probably to size of agglomeration.

3.2. Chicken's Commercialization

3.2.1. Chicken Commercialization and Social Characterization of the Chicken's Traders

Majority of chicken's traders were male 61.3%, see **Table 6**. Regarding to their education, the secondary school 56.3% prevailed followed by primary school 19.7%, university 16.9% and illiterates 7.1%. The trader's experience of the first group age below to 5 years had an average of 3.0 ± 1.3 years old. The second group age 6 to 10 years had an average of 7.6 ± 1.8 years, up to 10 years' group, 21.2 ± 9.4 years old. The average age was 37.9 ± 10.3 years with high significant ($P < 0.001$) differences across the sites.

3.2.2. Chicken Marketing Channel

With regard to **Table 7**, chicken meat was almost not transformed, 94.8%. The chicken prices were for the cock 12.0 ± 2.6$, hen 5.9 ± 1.4$ with significant ($P < 0.05$) differences in average hen prices across the sites and egg 0.24 ± 0.39$ with high significant ($P < 0.001$) differences in the average egg prices across the sites. In Senegal at farm-gate, price of one chicken kilogram in 2011 was 2.1 USD $ and at consumer level was 3.6 USD $ [15]. As chicken price is very high in DRC, it is a good opportunity for the producers who would like to intensify the chicken industry production because market is available. The common transport of chickens, food, eggs and materials was especially done on foot 36.4% followed by car 31.8% and motorcycle 17.1%. The imported chickens were principally coming from Belgium and Rwanda. Among the types of chickens imported were manly broilers 77.5% and spent layers 22.5%.

Table 5. Extension and private services.

Characteristics	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total
Support of extension service								
Yes	2 (9.5)	1 (10.0)	3 (13.6)	3 (17.6)	5 (83.3)	4 (80.0)	1 (16.7)	19 (21.9)
No	19 (90.5)	9 (90.0)	19 (86.4)	14 (82.4)	1 (16.7)	1 (20.0)	5 (83.3)	68 (78.2)
Extension service activities								
Public sector	1 (11.1)		1 (16.7)	1 (25.0)	1 (25.0)	1 (14,3)	1 (11.1)	6 (14.0)
NGO	6 (66.7)	3 (100.0)	3 (50.0)	2 (50.0)	2 (50.0)	3 (42.9)	6 (66.7)	25 (58.1)
Private sector	2 (22.2)		2 (33.3)	1 (25.0)	1 (25,0)	3 (42,9)	2 (22.2)	12 (27.9)
Pharmacy and farmer's gate distance	3.4 ± 7.5	1.7 ± 2.3	1.5 ± 1.4	4.4 ± 4.3		5,9 ± 10.8	2.2 ± 2.2	3.0 ± 5.0

Values in parentheses are percentages.

Table 6. Social characterization of chicken's traders.

Social Characteristics	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total	Test Stat. Value (F)
Sex									
Male	10 (76.9)	5 (71.4)	6 (42.9)	4 (28.6)	6 (100.0)	5 (71.4)	10 (71.4)	46 (61.3)	
Female	10 (23.1)	2 (28.6)	8 (57.1)	10 (71.4)		2 (28.6)	4 (28.6)	29 (38.7)	
Education									
Illiterate	2 (18.3)		1 (7.1)				2 (16.7)	5 (7.1)	
Primary	5 (45.5)	1 (14.3)	4 (28.6)	3 (21.4)		2 (28.6)	1 (8.3)	14 (19.7)	
Secondary	4 (36.4)	6 (85.7)	5 (35.75)	9 (64.3)	6 (100.0)	5 (71.4)	8 (66.7)	40 (56.3)	
University		6 (33.3)	4 (28.5)	2 (14.3)		1 (5.3)	1 (8.3)	12 (16.9)	
Years' experience									
Below 5 years	2.8 ± 1.6	2.7 ± 1.0	2.5.5 ± 1.9		2.7 ± 0.9	3.0	3.5 ± 1.2	3.0 ± 1.3	
6 to 10 years	7.0	7.0		7.4 ± 1.7	10.0	8.0 ± 2.8	7.3 ± 2.3	7.6 ± 1.8	
Up to 10 years	17.5 ± 4.8	13.5 ± 2.1	27.8 ± 12.2	22.0 ± 6.1		17.5 ± 3.5	16.0 ± 3.6	21.2 ± 9.4	
Average age of traders	36.8 ± 5.4	34.0 ± 6.8	40.2 ± 13.9	42.9 ± 7.3	35.2 ± 5.4	47.4 ± 10.3	29.7 ± 8.0	37.9 ± 10.3	4341***

*** Significant at $P < 0.001$, values in parentheses are percentages.

Table 7. Marketing channel and price for chicken products.

Characteristics	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total	Test Stat. Value (F)
Chicken's processing									
No	10 (100.0)	2 (100.0)	10 (100.0)	5 (83.3)	1 (100.0)	4 (80.0)	5 (100.0)	37 (94.8)	
Yes				1 (16.6)		1 (20.0)		2 (5.2)	
Sold price of local chickens ($)									
Cock	12.7 ± 3.5	12.4 ± 2.9	13.7 ± 2.5			11.3 ± 1.3	10.5 ± 2.3	12.0 ± 2.6	
Hen	6.8 ± 1.1	5.5 ± 1.6	7.0	5.5 ± 1.1	3.7 ± 0.3	5.2	6.7 ± 1.1	5.9 ± 1.4	2.688*
Egg	0.15 ± 0.9	0.19 ± 0.1	0.19 ± 0.3	0.15 ± 0.1	0.17 ± 0.1	0.39 ± 0.2	0.18 ± 0.2	0.24 ± 0.4	7.789***
Chickens transport and supplies									
Foot	21 (55)	11 (55)		18 (72.0)	7 (33.3)		1 (7.1)	58 (36.4)	
Lorry	2 (8.3)	2 (10.0)		3 (12.0)	12 (57.1)	7 (70.0)	9 (64.3)	35 (31.8)	
Motorcycle	1 (4.2)	6 (30)	8 (36.4)	2 (8.0)	2 (9.5)	1 (30.0)	3 (21.4)	23 (17.1)	
Train			11 (50.0)					11 (7.1)	
Bicycle		1 (5.0)	2 (9.1)	2 (8.0)		2 (20.0)	1 (7.1)	8 (7.0)	
Mail			1 (4.5)					1 (0.6)	
Country origin of importation									
Belgium	1 (12.5)		1 (8.3)	7 (100.0)	1 (100.0)	1 (16.7)	1 (20.0)	12 (27.3)	
Rwanda	5 (62.5)	3 (60.0)	2 (16.7)				2 (40.0)	12 (27.3)	
Burundi	2 (25.0)		5 (41.7)					7 (15.9)	
Kenya		1 (20.0)	4 (33.3)				1 (20.0)	6 (13.6)	
Zambia						5 83.3)		5 (11.4)	
Uganda		1 (20.0)					1 (20.0)	2 (4.3)	
Chickens imported breed types									
Broiler	7 (10.0)	5 (100.0)	8 (88.9)	5 (45.5)	1 (100.0)	4 (66.7)	1 (100.0)	31 (77.5)	
Spent layers			1 (11.1)	6 (54.5)		2 (33.3)		9 (22.5)	

*Significant at $P < 0.05$, *** Significant at $P < 0.001$, values in parentheses are percentages.

On Table 8, the brut margin benefit of eggs was 0.24 ± 0.39$ per egg with significant ($P < 0.05$) differences of egg averages brut benefit margin across the sites and 3.36 ± 4.18$ per chicken with high significant ($P < 0.001$) differences of brut benefit margin averages across the sites. In the restaurant, price is given for the entire menu and not only the chicken products. The brut margin benefit was calculated by purchase price to minus the sold one without considering the other

expenses related. It seemed that chickens were very profitable than eggs. Management to sell many local chickens is difficult because people like to kill themselves the chickens, except meat from improved chickens sold in the towns.

3.2.3. Weakness of Chicken's Production Systems

Chickens production systems in DRC faced many problems that didn't allow them a good development of chicken industry. The first constraint declaimed by the interviewees was lack of credit 21.6. It was followed by the lack of feeds and medicines 19.6%, lack of chicks supply 17.6%. We noted that DRC didn't have a parental stock in all the country, mortality and morbidity caused by diseases represented 15.7% (Table 9).

The improved chickens are imported mainly from fertile eggs and chicks 1 day-old. To boost chicken's production, in Ethiopia, there are government-owned poultry breeding and rearing centers aimed at providing improved dual purpose chickens of exotic breeds [16]. All these results demonstrate the necessity to begin now the chicken industry program in DRC. It should start first by a local chicken's characterization coupled with genetic molecular analysis in the entire country before the selection begins. Local genetic materials should be conserved. At the same time, promotion of improved chickens with installing parental strains in at least five locations to cover all the country: Kinshasa, Lubumbashi, Kisangani, Bukavu and Bunia should be done. Roads should be good and agriculture improved for applying feeds from crops and processing residues. In Senegal, since 2005, importation of chicken meat was prohibited and then the national production increased [15].

Table 8. Profitability ($) from chicken products en 2014.

Chechen Products	Trader	Wholesaler	Restaurant	Total	Test Stat. Value (F)
Egg	0.12 ± 0.26	0.20 ± 0.31	0.55 ± 0.52	0.24 ± 0.39	6.877**
Hen	1.97 ± 1.90	3.87 ± 4.40	7.95 ± 6.34	3.36 ± 4.18	13.944***

** Significant at $P < 0.05$. *** Significant at $P < 0.001$.

Table 9. Technical constraints of chicken's production.

Characteristics	Bukavu and Hinterland	Bweremana-Sake	Goma	Kinshasa	Kongo Central	Lubumbashi	Minova	Total
Unavailability of credit	1 (16.7)	2 (25.0)	3 (37.5)	1 (16.7)	1 (16.7)	1 (16.7)	2 (18.1)	11 (21.6)
Unavailability of medicines	1 (16.7)	1 (12.5)	2 (25.0)	1 (16.7)	1 (16.7)	1 (16.7)	3 (27.3)	10 (19.6)
Unavailability of feeds	1 (16.7)	1 (12.5)	2 (25.0)	1 (16.7)	1 (16.7)	1 (16.7)	3 (27.3)	10 (19.6)
Chicks supply	1 (16.7)	2 (25.0)		1 (16.7)	2 (33.2)	2 (33.2)	1 (9.1)	9 (17.6)
Disease's consequences	2 (33.2)	1 (12.5)		2 (33.2)	1 (16.7)	1(16.7)	1 (9.1)	8 (15.7)
Market not organized		1 (12.5)	1 (12.5)					2 (3.9)
Inappropriate chicken's house							1 (9.1)	1 (2.0)

Values in parentheses are percentages.

4. Conclusion

Chicken's technology is yet very low in the country; traditional system prevailed by high mortality, lack of animal feeds, inadequate accommodation… Improved chickens are not yet good scaling up and their one-day old chicks were rare. It was due especially to lack of parental stock strains in the country and a lack of local breeding program. The most constraints recorded were lack of credit, lack of medicines, feeds, one-day old chicks supply, high mortality and market access not yet well organized. The high prices of eggs and chickens should be very incentive to promote chicken's production in the country. Challenges enumerated above may be overcome. The high rate of malnutrition among the population should push the government to boost the chicken industry in the way to sustain poverty alleviation and to fight hunger. Government should then improve the local chickens and install some parental stock strains of improved chickens in the country. By the way, health control should be ensured and feeds been available and accessible with an intensification of agriculture and good roads to facilitate the market channel.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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