

Projection of Feed Requirements for the Poultry Industry in Sri Lanka up to 2020

H.P.C.M. DASSANAYAKE¹, S.S.E. RANAWANA² and N.R. ABEYNAYAKE¹

¹ Department of Agribusiness Management, Faculty of Agriculture and Plantation Management,

² Department of Livestock and Avian Sciences, Faculty of Livestock, Fisheries and Food Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila(NWP).

ABSTRACT

Due to the rapid increase in the consumption of chicken meat and eggs in recent years, the poultry sector in Sri Lanka has grown more rapidly than any other agricultural sub-sector. Although the poultry industry has been able to meet the increasing demand for these commodities, it depends on continuous imports of feed ingredients, primarily maize and soybean meal. The demand for these two feed ingredients has grown rapidly in the world due to a huge expansion in the livestock sector in recent years and shortages of supply can be expected.

A study was carried out to project the growth of poultry production up to the year 2020 in Sri Lanka and to estimate the requirements for the main feed ingredients for the industry. Time series data on human population, per capita consumption of chicken meat and eggs were used to make demand projections using a computer package. The estimated use of maize and soybean meal by year 2020 are 312,850 and 179,580 metric tons respectively, which is nearly 3 times the current usage. The value of importing maize and soybean meal are Rs. 18,030 and 21,914 million respectively for this same year. It is clear from these projections that immediate steps should be taken to increase local production of maize and soybean in order to ensure that the poultry industry will continue to meet the demands for their products.

KEY WORDS: Poultry, Per Capita Consumption, Demand, Maize, Soybean Meal

INTRODUCTION

Nearly 7 percent of the agricultural Gross Domestic Production (GDP) in Sri Lanka is contributed by livestock within which the poultry sub-sector is dominant and contributes about 70 percent to the livestock GDP (Ranawana, 2005).

Poultry products that were considered as luxury food items and consumed by a few in the 1980s have shown a rapidly increasing demand over the past 20 years. The consumption of chicken meat is the highest among meats consumed in Sri Lanka (Household Income Expenditure Survey, 2004). The per capita consumption of chicken meat and eggs have increased from 0.4 kg/annum to 2.5 kg/annum and 26 eggs/annum to 28 eggs/annum respectively, between 1986 and 2002 (Rupasena and Ratnayake, 2003). The annual production of chicken meat and eggs have increased from 1260 mt to 77,770 mt and 173 million to 1564 million respectively, between 1960 and 2004 (Rupasena and Ratnayake, 2003). The rate of increase in both consumption and production of chicken meat is higher than that of eggs. It can be seen that the poultry sector has grown much faster than any other agricultural sub sector and has been able to meet the increasing demand; it has now become a significant source of animal protein in the Sri Lankan diet. These changes are in keeping with the rapid expansion in developing countries in the demand for meat, milk and eggs, that has been termed "the livestock revolution" (Delgado *et al.*, 1999).

The poultry sector is domestic market oriented of which 85 percent comprises intensive/commercial production and the rest is back-yard poultry. Commercial poultry production is largely confined to 5 districts, namely, Kurunegala, Gampaha, Colombo, Puttalam and Kalutara. There are more than 65,000 farmer families dependant on poultry production. There are 17 feed manufacturers registered under Animal Feed Act No15 of 1986 and 46 breeder farms

and hatcheries which supply day old chicks (Rupasena and Ratnayake, 2003).

Most of the Companies engaged in the industry are highly integrated supplying day old chicks, feed, vaccines, equipments and collection and processing of finished birds. Broiler and layer parent stocks are imported as day-old chicks from 8 countries under a regulated system and raised for breeding to produce day old commercial chicks which are available for the farmers. The production system of broilers is mainly the buy-back system where the private companies provide day old chicks and other inputs such as feed and vaccines and purchase live birds at a price agreed at the outset. This is popular among farmers due to the market assurance.

Feed industry in Sri Lanka largely depends on continuous imports of feed ingredients. More than 90 percent of the ingredients required for manufacturing poultry feeds are imported. The major feed ingredients used in the poultry production are maize meal, soybean meal, fish meal and rice bran. Among them maize and soybean meals are difficult to replace in poultry rations. Feed cost plays a significant role in the cost of production and it is 63 and 85 percent of the total cost of broiler and egg production respectively (Rupasena and Ratnayake, 2003). The production of maize in Sri Lanka is stagnant and the production of soybean is negligible. In 2004, 19,936 mt from the total maize production of 35,860 mt was used for animal feed production and 113,322 mt was imported at a cost of Rs.19 per Kg to keep pace with the demand in the feed industry (Department of Animal Production and Health). Soybean meal is totally imported to the country and 69,675.48 MT was imported at a cost of Rs.36/Kg in 2004 (Anon, 2005).

Soybean meal is imported from India which produces surpluses of it (nearly all of the soybean meal in the South Asian region) and Sri Lanka is the country

which imports most maize in the region, mainly from India (FAO, 2004). The poultry sector is growing rapidly in the South Asian region and it will greatly increase the demand for maize and soybean meal (Ranawana, 2002). The developing countries will be unable to fully meet their cereal demands from their own production by 2020 (Rosegrant *et al.*, 2001). Therefore the developing countries which currently produce surpluses of soybean and maize will shift to self sufficiency and below. There exists a shortage in the production of maize in India (Anon, 2003). Sri Lanka will be badly affected since it largely depends on imported feed ingredients.

Sri Lanka has favorable conditions for the cultivation of maize and soybean. They are cultivated in the Dry Zone and the drier parts of the Intermediate Zone (Anon, 1998). The domestic production of the feed crops has a vital role to play since the availability and the price of feedstuff will determine the future of the industry.

The objective of this study is to project the future growth of the industry and the requirement of feeds, particularly, maize and soybean meal.

METHODOLOGY

Data Collection

Time series data on total human population from 1960 to 2004 were collected from publications of the Department of Census and Statistics (DCS) and the Central Bank Annual Report for 2004. Data on the annual production of chicken meat and hen eggs were collected from DCS and from miscellaneous publications of the Department of Animal Production and Health (DAPH). Data on exports and imports of chicken meat and eggs were similarly collected from

the DAPH. Annual per capita consumption of chicken meat and eggs were then calculated. Amounts of maize and soybean meal used in rations for commercial layers, commercial broilers and parent stock were calculated according to the feed formulae used by the industry and the Breeder management guides.

Analysis

Time series trend analysis was carried out using a package (Minitab 11.12 version) and Linear, Quadratic, Exponential and S-curve (Pearl-Reed logistic) models were tested to select the best model for the forecasting. According to the Mean Squared Deviation (MSD), best models for the human population, annual per capita consumption of eggs and chicken meat were selected and forecasts were made up to the year 2020.

The total annual consumption of eggs and chicken meat for the projected years were estimated. The required number of commercial layers, broilers and parent stock to meet the projected annual consumption of eggs and chicken meat were determined, assuming a lay of 280 eggs per commercial layer, 1.7 Kg final live weight per broiler, 100 chicks per broiler breeder, 80 chicks per layer breeder and a flock depletion rate of 5 percent.

The requirement of maize and soybean meal were estimated according to the consumption of maize and soybean meal given in Table 1, 2 and 3.

Finally the value of imports of both maize and soybean meal were estimated up to 2020, assuming their production remain constant and 8 percent general interest rate according to the Central Bank Annual Report for 2004.

Table 1. Calculated lifetime consumption of maize and soybean meal by commercial layers and broilers (kg/bird)

	Broiler			Layer			
	Starter	Finisher	Total	Chick Starter	Grower	Pullets	Total
Maize	0.43	0.76	1.2	0.28	1	12.6	14
Soybean meal	0.39	0.49	0.9	0.19	0.6	4.2	5

Table 2. Calculated consumption of maize and soybean meal during the lifetime by broiler breeders (kg/bird)

	Broiler Breeder				
	Starter Feed	Grower Feed	Pre-Breeder Feed	Breeder Feed	Total
Maize	0.476	1.900	1.162	26.453	29.99
Soybean meal	0.357	1.009	0.704	12.017	14.09

Table 3. Calculated consumption of maize and soybean meal during the lifetime by layer breeders (kg/bird)

	Layer Breeder			
	Chick Starter	Grower	Pullets	Total
Maize	-0.237	1.442	12.079	13.76
Soybean meal	0.161	0.865	4.026	5.05

RESULTS AND DISCUSSION

Projection of Human Population

According to the time series trend analysis, values of Mean Squared Deviation (MSD) were obtained for Linear, Quadratic, Exponential and S-curve (Pearl-Reed logistic) models (Table 4).

Table 4. MSD values for models

Model	MSD
Linear model	0.07
Quadratic model	0.04
Exponential model	0.21
S-curve model	0.05

The lowest MSD value of 0.04 was obtained from the Quadratic model. Therefore it was selected as the best model for projecting the human population (Figure 1).

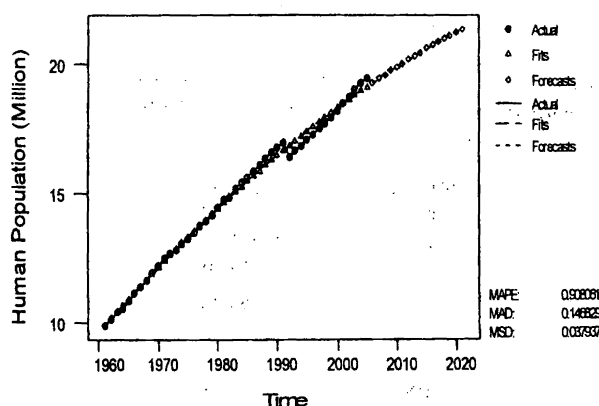


Figure 1. Human Population (Million) Quadratic Model

$$Y_t = 9.67292 + 0.261337*t - 1.14E - 03*t**2$$

t - Time

Yt - Human population at time t

0.26, $1.14*10^{-3}$ - Coefficients

Table 5. Projected human population (Million)

Year	Human Population (Million) (a)	Projected Human Population (Million) (b)	Projected Human Population (Million) (c)
2000	18.467	19.848	
2005		20.743	19.27
2010		21.343	20.03
2015		21.735	20.72
2020		21.932	21.36

Notes:

- (a) Based on Census 2001 by Department of Census and Statistics
- (b) Projected human population(Low variant) by the United Nations,2005
- (c) Based on Time Series Trend Analysis (Quadratic Model) using Minitab

The table 5 shows that the population projections made by different sectors are very close to the projection made by Quadratic function in this study. Therefore population projection figures

according to the Quadratic model were considered for other estimations in this study.

For projected values which are closer to the actual values of the human population can be obtained by employing the age and sex structure of the population with assumptions on fertility, mortality and migration.

Projection of Annual Per Capita Consumption of Eggs

According to the time series trend analysis, values of Mean Squared Deviation (MSD) were obtained for Linear, Quadratic, Exponential and S-curve (Pearl-Reed logistic) models (Table 6).

Table 6. MSD values for models

Model	MSD
Linear model	49.16
Quadratic model	41.80
Exponential model	43.26
S-curve model	46.13

According to the lowest MSD value of 41.8, Quadratic model was the best model to forecast the annual per capita consumption of eggs (Figure 2).

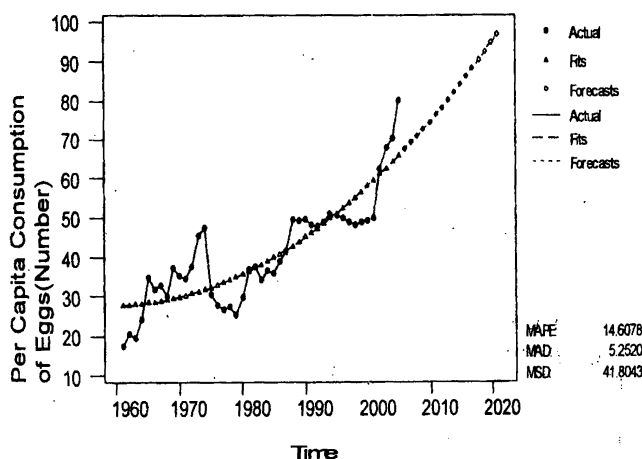


Figure 2. Annual Per Capita Consumption of Eggs (Number) Quadratic Model

$$Y_t = 27.6403 + 3.89E-02*t + 1.80E- 02*t**2$$

t - Time

Yt - Annual Per Capita Consumption of Eggs (Number) at time t

$3.89*10^{-2}$, $1.80*10^{-2}$ - Coefficients

Table 7. Projected annual per capita consumption of eggs (Number)

Year	Annual Per Capita Consumption of Eggs
2005	68
2010	76
2015	86
2020	97

The annual per capita consumption of eggs increases by 43 percent between 2005 and 2020.

Projection of Annual Per Capita Consumption of Chicken Meat

According to the time series trend analysis, values of Mean Squared Deviation (MSD) were obtained for Linear, Quadratic, Exponential and S-curve (Pearl-Reed logistic) models (Table 8).

Table 8. MSD values for models

Trend Model	MSD
Linear model	0.56
Quadratic model	0.07
Exponential model	0.41
S-curve model	3.02

The lowest value of 0.07 for Mean Squared Deviation was obtained from Quadratic Model and it was selected as the best model to fit the time series for projections of per capita consumption of chicken meat (Figure 3).

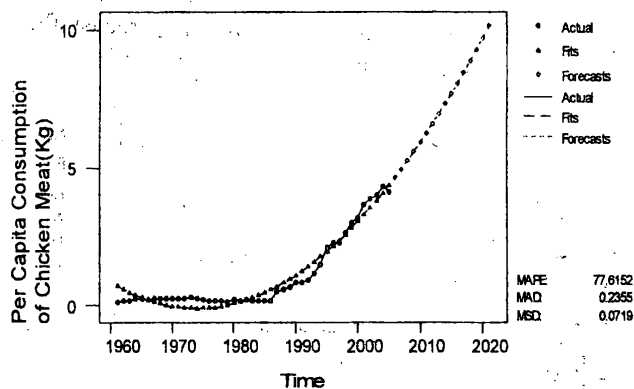


Figure 3. Annual Per Capita Consumption of Meat (kg) Quadratic Model

$$Y_t = 0.812501 - 0.130270 \cdot t + 4.64 \cdot 10^{-3} \cdot t^2$$

t - Time

Y_t - Annual Per Capita Consumption of Chicken Meat at time t

0.13, 4.64*10⁻³ - Coefficients

Table 9. Projected annual per capita consumption of chicken meat (kg)

Year	Annual Per Capita Consumption of Chicken Meat (kg)
2005	4.7
2010	6.2
2015	8.1
2020	10.1

The annual per capita consumption of chicken meat increases by 114 percent between 2005 and 2020. According to Delgado et al (1999), per capita consumption of chicken meat in the developing countries is 8 kg by the year 2020. The value projected from this study for per capita consumption of chicken meat (10 Kg) is higher than the value which has been obtained for developing countries.

The projection values for human population, annual per capita consumption of eggs and chicken meat, made by different types of models were

considered to estimate the total requirement of eggs and chicken meat for future years (Table 10).

Table 10. Total consumption of eggs and chicken meat in Sri Lanka for the projected years

Year	Total Number of Eggs (Million)	Chicken Meat kg (Million)
2005	1301	89.53
2010	1530	125.08
2015	1787	167.40
2020	2071	216.66

The total consumption of eggs and chicken meat increases by 59 and 142 percent respectively between 2005 and 2020.

According to the assumptions of Department of Animal Production and Health, the production of eggs per commercial layer and mortality rate were considered as 280 and 5 percent respectively. The required number of commercial layers and the amount of soybean meal and maize were estimated considering their feed consumption as given in Table 1 (Table 11).

Table 11. Required number of commercial layers and their requirement of maize and soybean meal for the projected years

Year	Commercial Layers (Million)	Amount of Maize '000 mt	Amount of Soybean Meal '000 mt
2005	4.88	68.30	24.39
2010	5.74	80.35	28.70
2015	6.70	93.82	33.51
2020	7.77	108.73	38.83

The required number of layer breeders and the amount of soybean meal and maize were estimated considering their feed consumption as given in Table 3 (Table 12). The production of chicks per layer breeder and mortality rate were considered as 80 and 5 percent respectively according to the assumptions of Department of Animal Production and Health.

Table 12. Required number of layer breeders and their requirement of maize and soybean meal for the projected years

Year	Layer Breeders (Million)	Amount of Maize '000 mt	Amount of Soybean Meal '000 mt
2005	0.06	0.88	0.32
2010	0.08	1.04	0.38
2015	0.09	1.21	0.44
2020	0.10	1.4	0.51

According to the assumptions of Department of Animal Production and Health, final live weight of a broiler was considered as 1.7 kg. Considering their mortality rate as 5 percent and their feed consumption as given in Table 1, the required number of broilers and the amount of soybean meal and maize were estimated (Table 13).

Table 13. Required number of broilers and their requirement of maize and soybean meal for the projected years

Year	Broilers (Million)	Amount of Maize '000 mt	Amount of Soybean Meal'000 mt
2005	55.30	66.36	49.77
2010	77.26	92.71	69.53
2015	103.40	124.07	93.06
2020	133.82	160.58	120.44

The required number of broiler breeders and the amount of soybean meal and maize were estimated considering their feed consumption as given in Table 2 (Table 14). The production of chicks per broiler breeder and mortality rate were considered as 100 and 5 percent respectively, according to the assumptions of Department of Animal Production and Health.

Table 14. Required number of broiler breeders and their requirement of maize and soybean meal for the projected years

Year	Broiler Breeders (Million)	Amount of Maize '000 mt	Amount of Soybean Meal'000 mt
2005	0.58	17.41	8.18
2010	0.81	24.33	11.43
2015	1.09	32.56	15.30
2020	1.41	42.14	19.80

Table 15. Total requirement of maize and soybean for the projected years ('000 MT)

Year	Amount of Maize '000 mt	Amount of Soybean meal '000 mt
2005	152.96	82.67
2010	198.42	110.04
2015	251.66	142.30
2020	312.85	179.58

The requirement of maize and soybean meal increases by 104 and 117 percent respectively between 2005 and 2020.

The future values of the imports of maize and soybean meal were calculated at 8 percent general interest rate. Their present values and current domestic production were considered as Rs.19/Kg, Rs. 36/Kg and 35,860 mt, 1,900 mt. This resulted future values of Rs. 18,030 and 21,914 Million respectively for maize and soybean meal imports.

CONCLUSIONS

By the year 2020, the poultry industry in Sri Lanka will need more than three times the current usage of maize and soybean meal. The imports of maize and soybean will, therefore, continue to increase

rapidly even though the country has favorable conditions for their cultivation. On the other hand, the availability and price of these ingredients can be expected to rise in the world market due to worldwide increase in demand for these commodities. It is necessary, therefore, to take urgent steps to increase the local production through a variety of methods including technology improvements, provision of storage facilities, market regulation and developing contracts between the farmers and feed manufacturers.

ACKNOWLEDGEMENTS

The authors wish to express their sincere thanks to Dr.Pushpa Wijewantha and Dr.Aruni Tiskumara, Department of Animal Production and Health, Peradeniya, Mr.B.P.A.Jayaweera, Lecturer, Faculty of Livestock, Fisheries and Food Nutrition, Wayamba University of Sri Lanka, Mr.J.C.Edirisinghe, Economist, Rubber Research Institute, Sri Lanka and Mr.W.J.Perera, Managing Director, New Bernards Animal Feeds (PVT) LTD, Udubaddawa, Sri Lanka.

REFERENCES

- Anon (2005). Report of Department of Animal Production and Health, Peradeniya, Sri Lanka
- Anon (2003). 'Limited scope for attracting foreign funds to the Indian poultry sector', World Poultry, Vol 19, No. 7, pp. 12-13.
- Anon (1998).HARTI Agricultural Commodity Review. Agricultural Commodity Review Series No.1. Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo, Sri Lanka.
- Central Bank (2005). Annual Report 2004, Central Bank of Sri Lanka, Colombo.
- Delgado, C., M.Rosegrant, H.Steinfeld, S.Ehui and C.Courbosis, (1999).Livestock to 2020 The Next Food Revolution.Food, Agriculture and the Environment discussion paper 28. International Food Policy Research Institute, Washington, DC.
- Department of Census and Statistics, (2004).Household Income Expenditure Survey 2002 available from <http://www.statistics.gov.lk> (Accessed 4 Nov 2004)
- FAO, (2004).Statistical Database on agricultural production, available from: <http://www.fao.org> (Accessed 20 Dec 2004)
- Ranawana, S.S.E. (2002).The demand for animal products, animal feeds and the scope to expand feed crops in South Asian Region. In: Proceedings of a workshop held in Bogor, Indonesia, Sept.3-4. CGPRT Centre, pp.135-151.
- Ranawana, S.S.E. (2005).Personal communication.
- Rosegrant M.W.,M.S.Paisner,S.Meijer and J.Witcover.(2001).2020 Global Food Outlook Trends, Alternatives and Choices. International Food Policy Research Institute, Washington, DC.
- Rupasena, L.P., B. Ratnayake, (2003).Production and Marketing of Eggs and Poultry Meat. Research Study Series No.105.Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo, Sri Lanka.
- UN, (2005).World Population Prospects: The 2004 Revision Population Data Base available from <http://www.un.org> (Accessed 2 Aug 2005)