INTEGRATION IN POULTRY INDUSTRY - A STUDY OF BROILER PRODUCTION IN CHIKKABALLAPUR DISTRICT OF KARNATAKA

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UNIVERSITY OF AGRICULTURAL SCIENCES

GKVK, BENGALURU – 560 065

2019

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Thesis submitted to the

UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE (Agriculture)

in

AGRICULTURAL MARKETING AND CO-OPERATION

BENGALURU **NOVEMBER, 2019**


Affectionately Dedicated
to
My Beloved Family Members
and
My Guide

DEPARTMENT OF AGRICULTURAL MARKETING, CO-OPERATION AND BUSINESS MANAGEMENT
UNIVERSITY OF AGRICULTURAL SCIENCES
GKVK, BENGALURU – 560 065

CERTIFICATE

This is to certify that the thesis entitled "**INTEGRATION IN POULTRY INDUSTRY - A STUDY OF BROILER PRODUCTION IN CHIKKABALLAPUR DISTRICT OF KARNATAKA**" submitted by **Mr. ARAVINDA, B.J., ID. No. PALB 7161**, in partial fulfillment of the requirements of the degree of **Master of Science (Agriculture) in Agricultural Marketing and Co-operation** to the University of Agricultural Sciences, Bangalore is a bonafide record of research work done by him during the period of his study in this University under my guidance and supervision and the research work has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

Bangalore
November 2019

Dr. M.R. GIRISH
Major Advisor

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ACKNOWLEDGEMENT

It is my pleasure to glance back and recall the path I travelled during the days of hard work and perseverance. This thesis is the result of two years of work, whereby I have been accompanied, supported and guided by many people. It is my heart's turn to express deepest sense of gratitude to all of those who directly or indirectly lent a helping hand in this endeavour.

There are no words to express my feelings of adoration, love, respect and obligation to my beloved parents, who moulded me to what I am. My dearest mother - ***Mrs. Sumithramma, B.N.*** *taught me to lead an obedient, trustworthy and simple life, which constantly guided as a lighted lamp. My father -* ***Jayaramareddy, B.S.*** *has always been a constant support for me. My sister,* ***Asha, B.J.*** *and my lovely cousins* ***Chethan, Varsha, Dinesh, Vishnu, Kavya, Girish, Bharath Anna, Mahesh Anna, Shubha Akka, Nagesh, Shravani, Anupama, Shylesh, Harsha Bro and Prathima Akka*** *always backed me by their love, encouragement and support. No words could ever express my sense of gratitude to my family. Most of all, I thank* ***GOD*** *for the blessings showered and the help received which enabled me to complete this thesis work.*

At the very outset, I feel inadequacy of words to express my profound indebtedness and deep sense of gratitude to esteemed Chairperson of my Advisory Committee, ***Dr. M.R. GIRISH****, Associate Professor & PG Co-ordinator – M. Sc. (Agricultural Marketing and Co-operation), Department of Agricultural Marketing, Co-operation and Business Management, University of Agricultural Sciences, GKVK, Bengaluru, for his excellent guidance, constant supervision, close counselling and valuable suggestions throughout my study. His enthusiasm, interest, concern, perfection and constructive criticism have always aroused my spirit to achieve higher altitudes. I am greatly indebted to him. It was a great pleasure and privilege for me to be associated with him during my Master of Science (Agriculture) in Agricultural Marketing and Co-operation degree programme.*

I am overwhelmed with a sincere feeling of indebtedness to one of the Members of my Advisory Committee, ***Dr. Mamatha Girish****, Assistant Professor (Senior Scale), Department of Agricultural Marketing, Co-operation and Business Management, UAS,*

GKVK, Bengaluru. I have been richly benefited by her critical comments, valuable inputs and support during my research work.

I also would like to thank the other Members of my Advisory Committee, viz., ***Dr. M.S. Jayaram****, Former Professor and University Head, Department of Agricultural Marketing, Co-operation and Business Management, UAS, GKVK, Bengaluru; and* ***Dr. K.N. Krishnamurthy****, Professor and Head, Department of Agricultural Statistics, Applied Mathematics and Computer Science, UAS, GKVK, Bengaluru, who provided all the support in completion of the thesis.*

I greatly acknowledge the co-operation and help extended to all the teachers of Department of Agricultural Marketing, Co-operation and Business Management, UAS, GKVK, Bengaluru, for their valuable suggestions and support during the course of study.

The thesis must surely bear the imprint of love and affection showered on me by my friends. I am ever grateful to my dearest friends and seniors, ***Shrinath Anna, Rakshith, Ayesha Banu, Suman, Vishnupriya, Sreelakshmi, Bharati, Abhishek, Pavithra, Shabeer Anna, Yashwanth Anna, Anil Anna, Bablu, Kiran, Sindhu, Narayan, Suchetha, Soumya Varur, Sahana Prasad, Shravani, Spandana, Akshay, Manohar, B.H., Manohar, K.S., Anusha, Suresh, Sathish, Kailash, Ashok, Sagar, Puneeth, Vinay, Govind Raj, Sai, Abhishek Kokare, Tejaswi, Gautam, Jayanth, Om, Ashwini, Pradeep, Naveen, Shrikanth Anna, Priyanka, Karthik, Rahul, Prashanth*** *and* ***Sumanth*** *for their moral support in this journey and their quality time in helping me in bringing this thesis work to a definite form and being close to me, and making my life a memory to be cherished.*

I owe my heartfelt gratitude to my juniors, ***Sahana, Dandu Hari Karthik, Manish, Harsha, Karthik Nanaiah, Ravi, Kruthika, Pavan, Manjunath, Mayank and Prem*** *for the emotional support and encouragement throughout the study.*

Any omission in this brief acknowledgement does not mean lack of gratitude.

Bengaluru

November, 2019 ***(Aravinda, B.J.)***

INTEGRATION IN POULTRY INDUSTRY - A STUDY OF BROILER PRODUCTION IN CHIKKABALLAPUR DISTRICT OF KARNATAKA

ARAVINDA, B.J.

ABSTRACT

The present study was conducted in Chintamani taluk of Chikkaballapur district of Karnataka to analyse the management practices in broiler farming; backward and forward linkages in broiler farming; financial viability of broiler farming; and production and marketing constraints in broiler farming. The primary data for the study was collected from 30 contract broiler farmers. All the farms followed all-in all-out system of rearing of birds and deep litter system of housing in the study area. The average flock size was 12,383 birds per batch. The live weight per bird was found to be 2.26 kg with a FCR of 1.74. The integrator provided major essential inputs, namely, chicks, feed and veterinary care required for broiler production in the study area while the rest of the inputs were managed by the farmer himself. The total cost incurred and the gross returns realised per batch for rearing a flock size of 12,383 birds was Rs. 1,32,627.28/- and Rs. 1,51,101.67/-, respectively, resulting in a net return of Rs. 18,474.37/-. Rearing charges paid by the integrators to the farmers accounted for about 70 per cent of the gross returns followed by sale of manure (29.60 %), sale of feed bags (3.45 %). At 12 per cent discount rate, the NPW, BCR and IRR were found to be Rs. 30,64,889/-, 1.54 and 39.95 per cent, respectively, indicating the financially viability of broiler farming. High mortality of birds was the major production constraint while price fluctuation was the major marketing constraint.

November 2019

Department of Agricultural Marketing,
Co-operation and Business Management
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Dr. M.R. GIRISH
Major Advisor

ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಚಿಕ್ಕಬಳ್ಳಾಪುರ ಜಿಲ್ಲೆಯಲ್ಲಿ ಬ್ರಾಯ್ಲರ್ ಉತ್ಪಾದನೆ: ಕುಕ್ಕಟ ಉದ್ಯಮದಲ್ಲಿ ಅನುಕಲನದ ಅಧ್ಯಯನ

ಅರವಿಂದ, ಬಿ.ಜೆ.

ಸಾರಾಂಶ

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಲ್ಲಿ ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಚಿಕ್ಕಬಳ್ಳಾಪುರ ಜಿಲ್ಲೆಯ ಚಿಂತಾಮಣಿ ತಾಲ್ಲೂಕಿನಲ್ಲಿ ಬ್ರಾಯ್ಲರ್ ಉದ್ದಿಮೆಯ ಅನುಕಲನದ ನಿರ್ವಹಣಾ ಪದ್ಧತಿಗಳ ವಿಶ್ಲೇಷಣೆ; ಬ್ರಾಯ್ಲರ್ ಉದ್ದಿಮೆಯಲ್ಲಿ ಹಿಂಬದಿ ಸರಪಳಿ ಹಾಗು ಮುಂಬದಿ ಸರಪಳಿಗಳ ವಿಶ್ಲೇಷಣೆ; ಬ್ರಾಯ್ಲರ್ ಉದ್ದಿಮೆಯ ಆರ್ಥಿಕ ಕಾರ್ಯ ಸಾಧ್ಯತೆ ಮತ್ತು ಈ ಉದ್ಯಮದಲ್ಲಿ ಕಂಡುಬರುವ ತೊಂದರೆ–ತೊಡುಕುಗಳನ್ನು ಬೇಧಿಸಲಾಯಿತು. ಕೋಳಿ ಸಾಕಾಣಿಕೆಯ ಉದ್ಯಮದ ಅಧ್ಯಯನಕ್ಕಾಗಿ ಬೇಕಾದ ಪ್ರಾಥಮಿಕ ಮಾಹಿತಿಯನ್ನು ಚಿಂತಾಮಣಿಯ 30 ಒಪ್ಪಂದ ಬ್ರಾಯ್ಲರ್ ಉತ್ಪಾದಕ ರೈತರಿಂದ ಸಂಗ್ರಹಿಸಲಾಯಿತು. ಅಧ್ಯಯನದ ವಿಶ್ಲೇಷಣೆಯ ಪ್ರಕಾರ ಕೋಳಿಗಳ ಪಾಲನೆಯನ್ನು ಆಳವಾದ ಕಸದ ವಸತಿ ವ್ಯವಸ್ಥೆ ಹಾಗು ಆಲ್–ಇನ್ ಆಲ್–ಔಟ್ ಪದ್ಧತಿಯನ್ನು ಅನುಸರಿಸುತ್ತಿರುವುದು ಕಂಡುಬಂದಿದೆ. ಹಿಂಡುಗಳ ಗಾತ್ರದಲ್ಲಿ ಪ್ರತಿ ಗುಂಪಿಗೆ ಸರಾಸರಿ 12,323 ಕೋಳಿಗಳಿದ್ದವು, ಪ್ರತಿ ಕೋಳಿಯ ಸರಾಸರಿ ತೂಕವು 2.26 ಕೆಜಿ ಇದ್ದು, ಆಹಾರ ಪರಿವರ್ತಕ ಅನುಪಾತ 1.74 ಆಗಿರುತ್ತದೆ. ಕುಕ್ಕಟ ಅನುಕಲನದ ಸಂಯೋಜಕರು ಕೋಳಿ ಉದ್ಯಮಕ್ಕೆ ಪ್ರಮುಖವಾಗಿ ಬೇಕಾದ ಕೋಳಿ ಮರಿಗಳು, ಆಹಾರ ಮತ್ತು ಪಶುವೈದ್ಯಕೀಯ ಆರೈಕೆಯ ನೆರವನ್ನು ಒದಗಿಸುತ್ತಿದ್ದು ಕೋಳಿ ಸಾಕಾಣಿಕೆಗೆ ಇತರೆ ಅಗತ್ಯ ಸಾಮಗ್ರಿಗಳನ್ನು ರೈತರೇ ನಿಭಾಯಿಸುತ್ತಿದ್ದರು. ಸರಾಸರಿ 12,383 ಕೋಳಿಗಳ ಹಿಂಡು ಗಾತ್ರವನ್ನು ಸಾಕಲು ಒಟ್ಟು ವೆಚ್ಚ ಮತ್ತು ಆದಾಯ ಪ್ರತಿ ಗುಂಪಿಗೆ ಕ್ರಮವಾಗಿ ರೂ. 1,32,627.28/– ಮತ್ತು ರೂ. 1,51,101.67/– ಆಗಿದ್ದರೆ, ನಿವ್ವಳ ಆದಾಯ ರೂ. 18,474.37 ಆಗಿರುತ್ತದೆ. ಅಧ್ಯಯನದ ಪ್ರಕಾರ ಕೋಳಿ ಸಾಕಾಣಿಕೆಯ ಒಟ್ಟು ಆದಾಯದಲ್ಲಿ ಪ್ರಮುಖವಾಗಿ ಅನುಕಲನದ ಸಂಯೋಜಕರು ರೈತರಿಗೆ ನೀಡುತ್ತಿದ್ದ ನೆರವು (ಶೇ. 70), ಗೊಬ್ಬರ ಮಾರಾಟದಿಂದ (ಶೇ. 29.60) ಹಾಗೂ ಚೀಲಗಳ ಮಾರಾಟದಿಂದ (ಶೇ. 3.45) ಆದಾಯವು ದೊರೆಯುತ್ತಿದ್ದುದು ಕಂಡುಬಂದಿದೆ. ಕೋಳಿ ಸಾಕಾಣಿಕೆಯ ಉದ್ಯಮದ ಹೂಡಿಕೆ ಆರ್ಥಿಕ ವಿಶ್ಲೇಷಣೆಯನ್ನು ಶೇ. 12 ರಷ್ಟು ರಿಯಾಯಿತಿ ದರದಲ್ಲಿ ಅಳೆದಾಗ, ನಿವ್ವಳ ಪ್ರಸ್ತುತ ಮೌಲ್ಯವು ರೂ. 30,64,889/– ಆಗಿದ್ದು, ಲಾಭ ವೆಚ್ಚದ ಅನುಪಾತವು 1.54 ಆಗಿದ್ದು, ಆಂತರಿಕ ಆದಾಯದ ದರವು ಶೇ. 39.95 ರಷ್ಟು ಕಂಡುಬಂದಿದೆ. ಈ ಮೌಲ್ಯಗಳು ಕೋಳಿ ಸಾಕಾಣಿಕೆಯ ಆರ್ಥಿಕತೆಯ ಲಾಭ ಸಾಧ್ಯತೆಯನ್ನು ಸೂಚಿಸುತ್ತದೆ. ಕೋಳಿಗಳ ಮೃತ್ಯು ಪ್ರಮಾಣ (ಶೇ. 8.30) ಪ್ರಮುಖ ಉತ್ಪಾದನಾ ನಿರ್ಬಂಧವಾಗಿದ್ದರೆ, ಬೆಲೆ ಏರಿಳಿತವು ಪ್ರಮುಖ ಮಾರುಕಟ್ಟೆಯ ನಿರ್ಬಂಧವಾಗಿದೆ.

ನವೆಂಬರ್, 2019

ಕೃಷಿ ಮಾರಾಟ, ಸಹಕಾರ ಮತ್ತು ವ್ಯವಹಾರ ನಿರ್ವಹಣೆ ವಿಭಾಗ,
ಕೃ.ವಿ.ವಿ, ಬೆಂಗಳೂರು–560065

ಡಾ॥ ಎಂ. ಆರ್. ಗಿರೀಶ್
(ಪ್ರಮುಖ ಸಲಹೆಗಾರರು)

Integration in Poultry Industry – A Study of Broiler Production in Chikkaballapur district of Karnataka

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Introduction

The poultry sector in India has undergone a paradigm shift in structure and operation, involving transformation from a mere backyard activity into a major commercial agro-based industry. India is the third largest egg producer in the world after China and the USA; and the fourth largest chicken producer in the world after China, Brazil and the USA.

As per Livestock Census 2012, the total poultry population in India was 729.2 million, which was 12.39 per cent higher than numbers in the previous Census. Broiler production has been more vibrant than layer production within the poultry sector, with an annual growth rate of 11.44 per cent, production of 3.73 million tonnes and employment of 4.29 million people.

The practice of farmers raising chickens under contract has gained momentum in the recent decades. From the farmer's point of view, contractual arrangement provides them with access to production services, credit as well as knowledge of new technology and moreover, pricing arrangements can reduce the risk and uncertainty involved.

Objectives

a. To study the management practices in broiler production
b. To analyze the backward and forward linkages in broiler production

Methodology

Study Area

The study was conducted in Chikkaballapur district of Karnataka State. Out of six taluks in the district, Chintamani taluk was purposively selected.

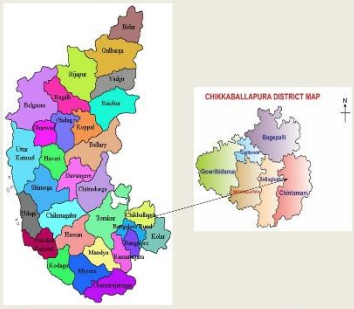

Fig. 1: Map of the study area

Sample: Simple Random Sampling was followed to draw the sample. The primary data was collected from 30 contract broiler farmers.

Data Analysis: The data collected through personal interview method using pre-tested structured schedule, was analyzed using descriptive statistics.

Results

Table 1: Management Practices followed by Poultry Farmers in Chikkaballapur district

Sl. No.	Particulars	Number
1	Rearing system	
	a) All-in all-out	30
	b) Multiple batch	Nil
2	Housing system	
	a) Deep litter	30
	b) Cage system	Nil
3	Average flock size	12,383*
4	Mortality rate (%)	8.30
5	Number of batches reared annually	5
6	Average age at marketing (days)	39.50
7	Live bird weight (kg)	2.26
8	Feed Conversion Ratio (FCR)	1.74
9	Number of times birds fed in a day	
	a) Chicks	2
	b) Matured birds	1
10	Source of poultry feed	
	a) Own preparation	Nil
	b) Readymade feed	30

*Rounded-off average

Discussion

All the sample contract broiler farms followed all-in all-out system of rearing of birds and deep litter system of housing in the study area (Table 1). The all-in all-out system is more hygienic as it involves lesser sub-clinical infections and horizontal spreading of diseases; thereby resulting in lesser mortality rate, better growth rate and improved feed efficiency when compared to multiple batch system. The deep litter system of rearing avoids problems like breast blisters and leg weakness when compared to cage system of rearing. Moreover, deep litter system involves relatively lesser initial investment. The average flock size maintained by the broiler farms was 12,383 birds and the average number of batches reared per year was five. The mortality of birds was found to be 8.30 per cent which is higher than the standard norm of five per cent. The higher mortality of birds was mainly due to relatively higher temperatures in the study area.

The average age of the bird at the time of marketing was 39.50 days which is within the normal range of 36-40 days. The live weight per bird was found to be 2.26 kg with a FCR of 1.74.

In the case of backward linkages, the integrator provided major essential inputs, namely, chicks, feed and veterinary care required for broiler production while the rest of the inputs, namely, credit, water, labour, electricity, charcoal and bedding material were managed by the farmer himself.

In the case of forward linkages, the integrator bought the birds at a pre-agreed price and farmers were paid charges on live bird weight basis (Rs. 56/- per kg). The manure and feed bags were sold to local farmers and local shops, respectively.

Photographs

Fig. 2: Deep litter system of broiler farming

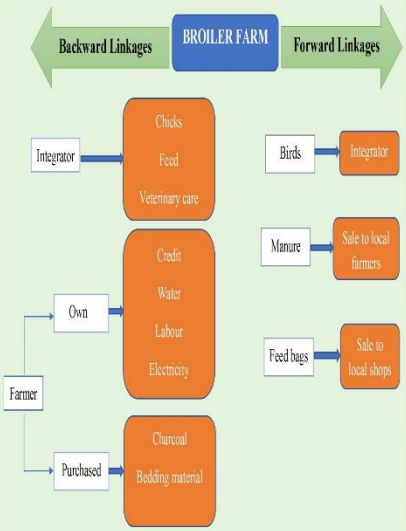

Fig. 3: Backward and Forward Linkages of Broiler Farming in Chikkaballapur district

Summary

- All the sample contract broiler farms followed all-in all-out system of rearing of birds and deep litter system of housing in the study area.
- The average flock size maintained by the sample broiler farm owners in the study area was 12,383 birds per batch.
- The live weight per bird was found to be 2.26 kg with a FCR of 1.74.
- The integrator provided major essential inputs, namely, chicks, feed and veterinary care required for broiler production while the rest of the inputs were managed by the farmer himself.

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I INTRODUCTION

1.1 Background

Agriculture is associated with the production of crop and livestock products that sustain the life of human beings as well as animals. The practice of agriculture is also known as "farming". The process of economic development has accelerated many primary and allied activities of farming which have now become prominent part of agriculture. At present, primary activities are diversified including farming, vegetable and fruit cultivation, dairy, poultry, sheep, goat, fishery, forestry, piggery, mushroom, bee keeping, etc. Marketing, processing and distribution of products from these primary activities have become the challenging aspects for modernization to keep in pace with dynamic consumer tastes and preferences.

Livestock is an integral component of farming system in Indian agriculture. It contributes manifold to the growth and development of agricultural sector. On one hand, it helps to improve food and nutritional security by providing nutrient-rich food products while on the other, it generates employment and income, and provides cushioning effect against crop failure. It also provides draft power and manure for crop production activities; and contributes to the Government revenue through forex earnings from exports.

Livestock production and agriculture are intrinsically linked, each being dependent on the other, and both are crucial for overall food security. The livestock sector is an important sub-sector of Indian agriculture. It forms an important livelihood activity for most of the farmers, supporting agriculture in the form of critical inputs, contributing to the health and nutrition of the household, supplementing incomes, offering employment opportunities and finally being a dependable "bank on hooves" in times of need.

India has vast livestock resources. As per Livestock Census 2012, India's livestock sector is one of the largest in the world with a share of 11.60 per cent of world's livestock population comprising of buffaloes (57.83 %), cattle (15.06 %), goats (17.93 %), sheep (7.14 %), chickens (4.72 %), camels (2.18 %), ducks (1.94 %), equine (1.3 %) and pigs (1.2 %). Livestock plays an important role in Indian economy. The livestock sector

contributed 4.11 per cent to the country's GDP and 25.60 per cent to the country's agriculture GDP.

1.2 Role of Livestock in Indian Agriculture

Livestock products play an important role in the socio-economic life of India. It is a rich source of high quality products such as milk, meat and eggs. As per Livestock Census 2012, the country's livestock population comprised of 190 million cattle, 110 million buffaloes, 133 million goats, 63 million sheep and 730 million poultry. India has the largest population of milch animals in the world and has emerged as the largest producer of milk with 20.17 per cent share in world's milk production of 826.75 million tonnes in 2017. India also accounts for about 5.65 per cent of the global egg production and also livestock provides livelihood to two-thirds of rural community. It also provides employment to about 8.80 per cent of the country's population.

The exports of animal products represent an important and significant contribution to the Indian agriculture sector. The export of animal products includes buffalo meat, sheep / goat meat, poultry products, animal casings, milk and milk products, honey, etc. In 2017-18, India's exports of animal products were Rs. 30,632.81 crores which included major products like buffalo meat (Rs. 25,168.31 crores), sheep / goat meat (Rs. 790.65 crores), poultry products (Rs. 687.31 crores), dairy products (Rs. 2,422.85 crores), animal casings (Rs. 480.66 crores), processed meat (Rs. 13.52 crores), albumin (eggs and milk - Rs. 103.06 crores) and natural honey (Rs. 732.19 crore) (http://apeda.gov.in).

1.3 Indian Poultry Scenario

Poultry farming in a broader sense includes rearing of domesticated birds such as chickens, ducks, turkeys and geese for the purpose of meat, eggs and feather production. Basically, broilers are raised for meat purpose whereas layers for egg production. The poultry sector in India has undergone a paradigm shift in structure and operation, involving transformation from a mere backyard activity into a major commercial agro-based industry. Poultry is one of the fastest growing segments of agricultural sector in India with around eight per cent growth rate per annum. Poultry meat is the fastest growing component of

global meat demand, and India, the world's second largest developing country, is experiencing rapid growth in its poultry sector. The potential in this sector is due to a combination of factors - growth in per capita income, growing urban population and falling real prices of poultry products. Today, India is the third largest egg producer in the world after China and the USA; and the fourth largest chicken producer in the world after China, Brazil and the USA.

Poultry meat is an important source of high quality proteins, minerals and vitamins that balance the human diet. Chickens are fast growing birds. Specially developed varieties of chicken (broilers) are now available with traits of quick growth and high feed conversion efficiency. Depending on the farm size, broiler farming can be a main source of family income or can provide subsidiary income and gainful employment to farmers throughout the year. Poultry manure is of high value as it can be used for increasing the yield of all crops.

Maize is the principal energy source used in poultry diets in most of the countries because of its high-energy value, palatability, presence of pigments and essential fatty acids. Soybean meal contains 47-49 per cent protein and is an excellent source of lysine, tryptophan and threonine and it can be included up to 35 per cent in chick ration and up to 25 per cent in grower and layer ration.

In India, the growth in poultry sector is being driven by rising incomes and a rapidly expanding middle-class, coupled with the emergence of vertically integrated poultry producers that have reduced consumer prices by lowering production and marketing costs. Integrated production, market transition from live birds to chilled and frozen products, and policies that ensure supplies of competitively priced corn and soybean are keys to future growth of poultry industry in India. There are a number of small poultry dressing plants in the country which are producing dressed chickens. In addition to these plants, there are modern integrated poultry processing plants producing dressed chicken, chicken cut-parts and other chicken products. These plants also manufacture egg powder and frozen egg-yolk for exports.

As mentioned earlier, the country's poultry population was 730 million as per Livestock Census 2012. The egg production was 88.14 billion during 2016-17. Andhra Pradesh has the highest poultry population followed by Tamil Nadu, Maharashtra, Karnataka and West Bengal while Tamil Nadu accounts for maximum egg production in the country followed by Andhra Pradesh, Karnataka and Kerala (http://dahd.nic.in).

During the period 2012-17, the per capita consumption of eggs has gone up from 30 eggs per annum to 68 eggs per annum and that of chicken from 400 gms per annum to 2.5 kg per annum. India exported 5,44,985.06 MT of poultry products worth Rs. 687.31 crores during the year 2018-19 (http://apeda.gov.in).

1.4 Integration in broiler farming

A broiler is any chicken that is bred and raised specifically for meat production. The country's broiler production is increasing at a rate of 8-10 per cent per annum due to rising domestic demand for poultry meat. The growth in the broiler segment is expected to remain strong due to consumer preference for poultry, increasing income levels, and changing food habits. The live market sales of broiler meat still constitute more than 90-95 per cent of total volume of sales while the processed chicken meat segment comprises only about five per cent of the total production.

The advantages of broiler farming are

a) Initial investment is lower than that of layer farming
b) Rearing period is 5-6 weeks only
c) More number of flocks can be reared in the same shed
d) Broilers have high feed conversion efficiency, i.e., the amount of feed required for unit body weight gain is lower when compared to other livestock
e) Faster returns from the investment
f) Demand for poultry meat is more compared to sheep / goat meat

More than 80 per cent of India's poultry output is produced by organised commercial farms. Major poultry companies have vertically integrated operations which comprise approximately 60-70 per cent of the total chicken production. Vertical integration is an arrangement in which the supply chain of a company is owned by that company. Usually, each member of the supply chain produces a different product or service, and the products combine to satisfy a common need. Many national and multinational companies are interested in investing in recurring expenditure of contract farming for broiler chicken production by providing financial assistance through material supply to contract broiler farmers. In contract farming, a batch of day-old chicks are supplied along with feed, medicine and technical expertise to contract farmers. Later, the grown-up broilers are procured at an appropriate time and pre-agreed price from the farmers. The farmer will arrange for poultry housing, equipments, water, electricity, labour and other miscellaneous expenses. The farmer gets a good amount of profit in return. Contract farming in broiler production has helped a large number of rural farmers in improving their livelihoods.

There is a growing trend for integration in broiler farming. Contract farming in broiler production was first introduced in and around Coimbatore by Suguna Foods in the early 1990s and by 1995, it spread to the entire state of Tamil Nadu. Later, between 1995 and 2000, it spread to Karnataka and gathered momentum and spread its wings to Maharashtra and Andhra Pradesh in the years 2001 and 2002, respectively and after that it gained inroads in West Bengal and Gujarat states. The spread was due to in-built strengths in integration system. The integrators take care of all aspects of production, right from raising of grandparent and parent flocks, production of day-old chicks for rearing, manufacturing and supply of concentrate feed, providing veterinary services and wholesale marketing of birds. In integration, all the previous profit centres of broiler industry, *viz.*, chick selling, feed selling, hatching, medicine supply and transportation have become cost centres for the integrators who work as a single entity and distribute the benefits among the farmers, consumers and the integration of company by themselves. Hence, the poultry farmers are insulated from the market price fluctuations. However, the farmer may be at a disadvantage if the number of batches supplied by the integrator in a year is less. The integrators operating in the study area are Suguna Feeds Pvt. Ltd., Venkateshwara

Hatcheries Pvt. Ltd., Sneha Farms Pvt. Ltd., Shreya Feeds Pvt. Ltd., Premium Chick Feeds Pvt. Ltd., SKM Animal Feeds and Foods Pvt. Ltd., and CP Feeds Pvt. Ltd.

1.5 Poultry Scenario of Karnataka

Karnataka state has very congenial atmosphere for growth of poultry industry. The factors favourable for growth include better climate, presence of natural wealth, availability of skilled and unskilled labour, technical expertise, access to modern technology, etc., to increase the efficiency of farms. The availability of advanced equipments for automation, good quality feed and substitutes of feed ingredients at lower prices have all added to reduce the cost of production of birds. As per Livestock Census 2012, Karnataka has a poultry population of 53.44 million. The State ranks fifth in both egg and meat production in the country. The districts leading in broiler production are Bangalore rural, Tumakuru, Kolar and Chikkaballapur while the districts popular in chicken egg production include Ballari, Chitradurga, Davanagere, Raichur and Koppal.

The present study makes an attempt to analyse vertical integration in broiler production in Chikkaballapur district of Karnataka.

1.6 Objectives of the Study

1. To study the management practices in broiler production
2. To analyse the backward and forward linkages in broiler production
3. To assess the financial viability of broiler production
4. To examine the constraints in broiler production and marketing

1.7 Hypotheses of the Study

1. All the broiler farms follow deep litter system of rearing.
2. The number of backward linkages are more than that of forward linkages in broiler production.
3. Investment in broiler farming is financially viable.

4. High mortality rate is the major production constraint while price fluctuation is the major marketing constraint.

1.8 Presentation of the Study

The thesis is organised into five chapters. The first chapter provides a brief introduction along with the specific objectives of the study. In second chapter, some pertinent reviews are presented in consonance with the objectives of the study. The third chapter describes main features of the study area, sampling framework, database and statistical tools used in the analysis of data. The empirical results and discussion are presented in the fourth chapter. Finally, the fifth chapter summarizes the major findings of the study and includes implications of the study.

II REVIEW OF LITERATURE

The review of the research work done earlier pertaining to the present study has been presented in this chapter. The review of studies pertaining to other livestock in addition to broiler farming are presented under the following sub-headings.

2.1 Management practices in broiler farming

2.2 Backward and forward linkages in broiler farming

2.3 Financial viability of broiler farming

2.4 Constraints in broiler production and marketing

2.1 Management practices in broiler farming

Kingori *et al.* (2010) conducted a study on indigenous chickens in Kenya and the study revealed that about 22 million birds existed in Kenya, which formed about 76 per cent of the total poultry population accounting for nearly 55 and 47 per cent of the total meat and eggs, respectively. They reported that 90 per cent of the rural communities maintained small flocks of upto 30 birds under free range system. The maintenance of indigenous birds was found to be flexible and did not require more space. As the birds were hardy, they thrived under harsh environmental conditions with minimal feed and other inputs. Most of the birds survived by scavenging and occasionally got benefitted from kitchen and other household wastes. The authors opined that feed supplementation, provision of proper housing and disease control measures would improve growth rate and egg production of indigenous poultry birds in Kenya.

Kalamkar (2012) analysed production-related aspects of broiler farming under contract and independent management practices of broiler units in Maharashtra. About two-thirds of the contracts were of long duration of three years while the remaining were of two years or eleven months duration. The average net returns per kg of live bird weight as well as per bird was found to be higher in non-contract farming vis-a-vis contract farming. The average net returns per bird increased with increase in size of the farm for both the groups. Despite contract for supply of inputs and sale of output, the contract

farmers faced problems like delay in supply of inputs, high feed prices, delay in lifting the produce, delay in payment, low price and sometimes, even rejection of output. Besides these problems, low growing charges, delay in supplying chicks, delay in providing veterinary services, high visiting charges and deduction of tax at source were the other major problems faced by the contract broiler poultry farmers in Maharashtra.

Wainaina *et al.* (2012) studied the impact of contract poultry farming on small holders in Kenya and concluded that on an average, contract farmers earned more net revenue (27 %) per bird compared to that of independent farmers. Contract farming improved the welfare of small holder poultry farmers.

Moreki and Keaikitse (2013) investigated waste management practices in poultry operations in Kgatleng, Kweneng and South-east districts, around the city of Gaborone. The study revealed that 80 per cent of the respondents disposed-off manure / litter by giving it away to other local farmers, 16 per cent used it as a fertiliser on their own fields and the remaining four per cent of the litter was dumped in landfills. The three methods of mortality disposal were landfills (52 %), incineration (20 %) and burning (20 %). The disposal of poultry waste was found to be a challenging task which required adequate waste management practices.

Murthy and Bindu (2013) assessed the performance of Suguna poultry production through contract farming in Andhra Pradesh and found that contract farming greatly benefitted the farmers through reduction in transaction costs involving aggregation of production inputs like chicks, feed, veterinary services, water, labour for maintenance and marketing of birds. Besides, contract farming assured regular income to growers in comparison with non-contract farmers.

Dwivedi *et al.* (2014) studied the management practices adopted by broiler growers in Jammu district of Jammu and Kashmir state. They categorized the growers into three groups on the basis of number of birds reared namely; growers with less than 500 birds, 500-1,000 birds and more than 1,000 birds. The study revealed that 73 per cent of the broiler units were located within a radius of less than five km from residential settlements

while 20 per cent of them were located between a radius of five to 10 km and around seven per cent units were at the distance of more than 10 km to residential settlements. All the broiler farms were managed under deep litter system. Fifty per cent of the broiler units were found to have grass roof, 40 per cent cement roof and ten per cent hut type roof. In majority of the cases, chicks were fed thrice daily while mature birds were fed twice daily. The most frequent marketing channel adopted by broiler farmers was 'producer - trader - retailer - consumer'.

Balamurugan *et al.* (2015) studied the adoption of management practices followed by farmers in intensive native chicken rearing in three selected districts of Tamil Nadu state. The study revealed that multiple batch system was mostly followed and farmers reared their birds under deep litter system with coir pith as a litter material. Asbestos roof with cement flooring was used for rearing the birds. The farmers used water sourced mainly from borewell sanitised with hydrogen peroxide for feeding the birds. The brooding of native chicks was mostly done with charcoal upto 14 days. The native breeder chicken were debeaked twice before spiking the flock; and the first and second debeaking was at the age of 13 and 95 days, respectively. Most of the farmers used mash, crumble and pellet feed during brooder, grower and layer stages, respectively.

Rahman (2015) studied the management of broiler farms in Aizawl district of Mizoram state. The study revealed that farmers were rearing adult birds in raised slatted floor made up of bamboo. Majority (96.67 %) of the farmers did not vaccinate their birds and the mortality rate of broilers was very high (17.67 %) due to the diseases like enlargement of liver, diarrhoea, paralysis, dysentery, etc. Most (60 %) of the farmers sold their birds at the age of above three months or when the birds gained body weight of 3-4 kgs, to wholesalers.

Ram *et al.* (2017) conducted a study in Imphal East and Imphal West of Manipur and found that majority of the farmers had medium training needs on assessment of different aspects of poultry production practices. The study reported that age, family size, average annual income, innovativeness, attitude towards poultry rearing, utilisation of

mass media, contact with extension staff and marketing facilities were the important factors that contributed to the training needs assessment by the poultry farmers.

2.2 Backward and forward linkages in broiler farming

Birthal *et al.* (2007) in their study on linking farmers to markets for high-value agricultural commodities in India, explored the possibilities of linking smallholders to markets through institutions such as co-operatives, growers' associations and contract farming that reduce marketing and transaction costs and alleviate some production constraints. Past studies have indicated that smallholders do participate and make a sizeable contribution to the production of high-value food commodities but their linkages with markets were not strong. They opined that though market institutions like co-operatives, contract farming and growers' associations do not altogether ignore smallholders, some policy support is imperative to strengthen their linkages with the markets.

Ahmad and Iqbal (2010) analysed the market for broiler poultry birds in Allahabad district of Uttar Pradesh state. The study revealed that the broiler enterprise was a remunerative enterprise and those involved in marketing got a substantial share to remain in trade. Among the five main marketing channels studied, Channel I (Producer-Consumer) accounted for the maximum producer's share in consumer rupee (96.36 %) followed by Channel II (Producer-Retailer-Consumer) with 81.40 per cent while the least producer's share in consumer rupee (57.78 %) was found in Channel V (Producer-Wholesaler-Hotels and Institutions-Consumer). The marketing efficiency index (Shepherd's method) was also calculated for all the five channels. Channel I (Producer-Consumer) had the highest marketing efficiency of 27.50 while the lowest marketing efficiency of 2.36 was found in Channel V. The authors opined that broiler farming has good prospects in the district as demand for broiler meat showed an increasing trend over the years.

Gangwar *et al.* (2010) conducted a study on broiler supply value chain in Ghazipur poultry market of New Delhi in the year 2010. They found that the most prominent channel in the unorganized broiler market was: producer-wholesaler-dresser-cum-retailer-consumer while in the organized market, it was: producer-commission agent-supplier-distributor-shopping malls/hotels/retailer-consumer. The regulated wholesale poultry

market at Ghazipur was the key supply centre for chicken in Delhi NCR. The average daily arrivals to the poultry market was found to be over one lakh broilers accounting for about 50 per cent of the sales in Delhi. Over 70 per cent of the broilers at Ghazipur poultry market were manually dressed. The manual dressing of broilers has resulted in value addition of about 50 per cent on live weight basis and production of over 20 chicken meat products / by-products.

Masuku (2011) conducted a comparative analysis of contract and non-contract broiler supply chain in Manzini region of Swaziland. The study revealed that the same type of inputs were used in both the production systems with the only difference being in the quantity of inputs used in each system. However, the productivity was found to be high in the case of contract farmers as they produced birds with an average weight of 1.8 kg in five weeks and also they were able to rear an average of 34,500 birds per batch. The study further indicated that consumers bought live birds mostly from non-contract farmers and processed birds from contract farmers at higher prices. The cost of producing one bird was found to be higher with non-contract farmers vis-à-vis contract farmers. With increasing competition and changes occurring in markets, the author suggested a combination of firm-level actions as well as improvements in the entire value chain backed by adequate political will for transparency in the poultry trade.

Murthy and Madhuri (2013) conducted a study on suguna poultry production through contract farming in Andhra Pradesh. The study revealed that contract farming helps both the parties, i.e., the producers and the companies, which are involved in contract farming system. The study found that contract farming resulted in major benefits due to reduction in transaction costs and assurance of regular income for broiler farmers.

Kumar (2014) analysed the marketing efficiency of broiler poultry birds in Anand district of Gujarat state. It was found that four marketing channels existed in the study area, *viz.*, Channel I (Grower-Trader-I-Retailer-Consumer); Channel II (Grower-Trader-I-Trader-II-Retailer-Consumer); Channel III (Grower-Trader-I-Consumer [Hotels, Institutions, Canteens]); and Channel IV (Grower-Retailer-Consumer). Though Channel III was the most efficient, it had very less share in the total volume of broiler marketed

because of fixed demand by limited number of consumers in this channel. The study found that Channel I was the most prominent marketing channel in the district.

Mathialagan (2015) studied technological needs of layer poultry farmers in Namakkal district of Tamil Nadu. The study examined various major technological needs perceived by farmers, extension personnel and technology developers. Egg price fluctuations and difficulty in pullet eggs selling were the major technological needs in marketing. Other technological needs perceived by farmers include less rate in dull season, unprofitable price for spent hen, and exploitation by middlemen in spent hen selling. It was felt necessary that special emphasis should be given by the Universities and research stations to fix research priorities and direct their scientists towards technological need based research in areas, *viz.,* egg price fluctuations, difficulty in pullet eggs selling, exploitation of middle men, etc. so as to fill up the gap between the technologies available and technologies needed.

2.3 Financial viability of broiler farming

Singh *et al.* (2010) analysed broiler production in three districts, *viz.*, Ludhiana, Hoshiarpur and Muktsar districts of Punjab state, during the year 2008-09. They reported that the total cost of production per bird was highest on small farms followed by medium and large farms. In tune with these results, the net returns per bird over variable costs was the highest on large farms implying economies of scale of these farms. The meat-feed price ratio and benefit-cost ratio were found to increase with increase in size of broiler farms, indicating better utilisation of inputs on large farms. On the basis of net present value, benefit-cost ratio and internal rate of return, investment in broiler farming was most profitable on large farms followed by medium and small farms. The small broiler farms were found to be highly sensitive to increase in input costs thereby leading to decrease in net returns.

Shaikh and Zala (2011) assessed the production performance of broiler farms in Anand district of Gujarat state for the year 2005. The average cost of production per bird was found to be Rs. 64/-. The variable cost and fixed cost constituted 84.50 per cent and 15.50 per cent of the total cost, respectively. The major costs were feed cost (58.60 %),

chick cost (21.50 %) and depreciation on buildings (10.70 %). The benefit-cost ratio was 1.11 for the sample as a whole and it increased with increase in farm-size, indicating that as farm-size increases, the net margin per rupee invested on broilers also increases. The break-even analysis revealed that the producers had to maintain minimum of 1,531; 2,611; and 10,437 birds, respectively, on small, medium and large farms to meet the cost incurred in production of broilers.

Balamurugan and Manoharan (2013) evaluated the investment in integrated broiler farming in Theni district of Tamil Nadu state for the year 2011-12. The study reported that the total fixed investment per bird was highest on small farms followed by medium and large farms. The total cost of meat production per bird and returns per bird over the variable costs were found to be highest on small broiler farms followed by medium and large farms. On the basis of net present value and internal rate of return, investment in broiler farming was found to be profitable across all farm-sizes, with large farms being most profitable followed by medium and small farms. The small broiler farms were found to be highly sensitive to increase in costs and decrease in net returns.

Pawariya and Jheeba (2015) analysed the cost-return structure, employment and income from poultry enterprise in Jaipur district of Rajasthan state. They reported that the expenditure incurred towards feed was the major cost accounting for about 47 per cent and around 69 per cent of the total cost in broiler and layer production, respectively. The BC ratio of layer farms was higher than that of broiler farms. They opined that the growth potential of this sector was bright due to regular flow of income throughout the year in the rural economy of the State.

Dwivedi *et al.* (2016) studied the economics of small broiler units in Jammu district of Jammu and Kashmir state for the year 2013-14. The study revealed that majority of the broiler farms were clustered around Jammu city of Jammu district. The broiler farms were categorised into three sizes; less than 500 birds**,** 501-1000 birds and more than 1000 birds. The major expenditure included the cost of chicks in all the three categories of farms followed by cost of feed, cost of medicine, vaccination and veterinary fee. The overall

gross income from the broiler farms was Rs. 1,53,422/- while the net income was Rs. 41,024/-. The overall benefit-cost ratio was 1.34.

Borah and Halim (2017) conducted profitability analysis of broiler farms in Sonitpur district of Assam state. The study revealed that the average meat production per bird was 2.18 kilograms with an average cost of production per bird at Rs. 134.66/-. The total fixed cost and total variable cost per bird was found to be Rs. 9.11/- and Rs. 125.55/-, respectively. On an average, the gross returns and net returns per farm per cycle were Rs. 3,74,518/- and Rs. 68,702/-, respectively for the sample as a whole. On the basis of NPV, BCR and IRR, the investment in broiler farming was found to be most profitable in large-sized farms. The sensitivity analysis revealed that small-sized farms were more sensitive to increase in costs and decrease in returns.

Patil *et al*. (2017) examined the economic performance of contract broiler farming in Shimoga district of Karnataka state. The study reported that capital investment of Rs. 4.11 lakhs, Rs. 6.44 lakhs and Rs. 10.91 lakhs was required to start small, medium and large-sized poultry units, respectively. The total cost incurred by the contract companies and the farmers for rearing of broilers was Rs. 4.29 lakhs, Rs. 6.19 lakhs and Rs. 11.43 lakhs in the case of small, medium and large units, respectively. The contract companies bore 92 per cent of the total cost while the rest (8 %) was borne by farmers. The study also reported that the contract companies garnered greater share of the profits than that of the poultry farmers. The medium-sized unit was found to be the optimum size to be followed in contract farming.

Raut *et al.* (2017) assessed the financial viability of investment in broiler poultry units in Raigad district of Maharashtra state for the year 2012-13. They reported that the per farm total cost of production was the highest on large poultry farms (Rs. 52,32,209/-) followed by medium farms (Rs. 26,36,044/-) and small farms (Rs. 13,95,372/-). The cost of production per kg of live bird weight had inverse relation with the size of broiler farms. The per farm gross returns obtained from small, medium and large groups were Rs.15,90,276/-, Rs. 31,80,338/- and Rs. 65,79,208/-, respectively. The study further revealed that the per farm Benefit-Cost Ratios were 1.14, 1.21 and 1.26 for small, medium

and large farms, respectively. The financial viability analysis revealed positive net present value, benefit-cost ratio of greater than one and internal rate of return more than the prevailing rate of interest, in all the three categories of broiler farms indicating that broiler poultry farming was a profitable business in Raigad district.

2.4 Constraints in broiler production and marketing

Rajendran and Mohanty (2003) identified the constraints in deep litter and cage systems of poultry rearing that affect poultry production in India. The major constraints identified in egg production were high cost of feed followed by high cost of medicine and vaccine; supply of poor quality feed and feed ingredients; non-remunerative price for eggs; lack of disease control facilities; and higher rate of electricity tariff.

Rani and Subhadra (2009) conducted a study in Thrissur taluk of Kerala to understand the problems perceived by farm women engaged in poultry farming. The study revealed that the problems perceived as most serious by the farm women were inadequate knowledge about low-cost scientific cage construction, low hatchability of eggs in summer, problems of predators, losses due to bacterial and viral diseases, and financial difficulties.

Swain *et al.* (2009) analysed the constraints in commercial poultry farming in North and South Goa for the year 2005-06. The study revealed that the major problems encountered by the farmers were high feed cost followed by competition from outside farmers, high labour cost, high cost of electricity, high cost of chicks and non-availability of health services.

Ahmad and Hakim (2010) analysed the economics of broiler marketing in Allahabad district of Uttar Pradesh state. They reported that majority (87.50 %) of the broiler farmers viewed price fluctuations and insufficient export facilities as major marketing constraints while for about 21 per cent of them, it was lack of storage facilities.

Gangwar *et al.* (2010) conducted a study on broiler supply value chain in Ghazipur poultry market of New Delhi in the year 2010. They found that the major constraints in marketing of broilers / chicken meat in NCR Delhi were erratic power supply followed by

long power cuts, lack of refrigerated transportation facility, poor monitoring of food safety and quality norms in manual processing, and rampant corruption in transportation of live chickens.

Deka *et al.* (2013) studied the status and constraints of backyard poultry farming amongst tribal community of Jorhat district in Assam state. The study revealed that high incidence of poultry disease, lack of suitable germplasm, non-availability of day old chicks round the year, lack of feed supply and limited scavenging area, lack of technical know-how, attack by predators, poor economic condition of the farmers and weak market linkage were the most serious constraints faced by the farmers. The authors suggested that introduction of hybrid variety suitable for backyard farming, skill upgradation on feeding, housing and disease prevention management, credit linkage, and establishment of market linkages could bring about significant improvement in sustainable poultry production of the downtrodden tribal communities in Assam.

Ghasura *et al.* (2013) studied constraints faced by poultry farm entrepreneurs in Banaskantha district of Gujarat state. Low egg prices during summer, high costs of feed and medicine, lack of adequate credit facilities, fluctuating prices for poultry products, increased risks and uncertainty of poultry enterprise, high mortality of chicks and non-availability of veterinary aids were the constraints as perceived by poultry entrepreneurs. The authors opined that establishment of poultry co-operative societies, mobile lab diagnostics (available in 24 hours), provision of loans to needy poultry farmers at reasonable interest rates and awareness programmes on various scientific poultry farm management practices would lessen the prevailing constraints, improve poultry production and create better livelihood economic opportunities in rural areas.

Malarvizhi and Geetha (2015) examined the profitability of layer poultry farming for the year 2013-14 in Namakkal district of Tamil Nadu state. It was found that majority of the poultry farmers adopted this business as a primary source of their income. The size of the layer farms ranged from one lakh to four lakh birds. Some of the layer farmers were forced to rely on institutional and non-institutional sources of credit due to the limited credit facility extended by the financial institutions. Majority of the poultry egg farmers

identified high cost of production, especially, the cost of feed ingredients as their major constraint.

Derbie and Kavitha (2016) examined the problems and prospects of poultry production in Amhara region of Ethiopia. The study revealed that the major constraints were flock mortality due to newcastle diseases, predator like buetorufofusces, supplementary feed shortage, inability to get access to credit and training service, and inability to use improved breed. The author suggested that important prospects of poultry production included market access, training service and ease of management. Improved management practice, quality poultry breeds and educating farmers were the viable options to improve the livelihood of poultry households.

Bhimraj *et al.* (2018) examined the constraints that prevailed in contract and backyard broiler farming in three districts, namely, Pune, Satara and Ahmednagar of Maharashtra state. The study found that the liveability of birds was significantly higher in non-contract broiler farming. The foremost constraints faced by the contract broiler farmers were untimely supply of quality inputs, non-remunerative price, poor quality inputs, exploitation by partnership organisation, difficulty in availing credit and low productivity while the major constraints of non-contract broiler farmers were inadequate finance, high rate of interest, repayment problems and difficulty in availing credit.

III METHODOLOGY

The overall description of the study area, sampling framework, conceptual framework and analytical tools / techniques used for achieving the objectives of the present study are elaborated in this chapter under the following headings.

3.1 Description of the study area

3.2 Sampling framework

3.3 Nature and sources of data

3.4 Analytical tools / techniques

3.1 Study Area

Chikkaballapur district of Karnataka state was selected for the study as a good number of farmers were found practising contract broiler farming enterprise as an important source of income apart from agricultural crop production. Chintamani taluk of Chikkaballapur district was purposively selected for the study as poultry farming assumes special significance in Chintamani taluk due to increasing industrialisation, increasing population, urbanisation and proximity to Bengaluru city. The increasing per capita income and changing consumer tastes and preferences are also contributing towards rising demand for poultry products.

Chikkaballapur district is situated between North Latitude of 13˚ 13’ 04” to 13˚ 58’29” and East Longitude of 77˚ 21’ 52” to 78˚ 12’ 31”. It is located in the southern maidan region of Karnataka state and situated on the eastern side of the State. It has an area of 4,244 sq. km. and its greatest length from north to south is 82.16 km. and from east to west it is 92.26 km. It is bounded on the south and south-west by Bengaluru rural district, on the west by Tumakuru, on the east by Kolar and on the north and north-east by the districts of Andhra Pradesh.

Chikkaballapur district is a newly created district in the state of Karnataka. It was carved out of the erstwhile Kolar district in 2007 by separating six taluks, namely,

Bagepalli, Chikkaballapur, Chintamani, Gauribidanur, Gudibande and Shidlaghatta to form a new district - Chikkaballapur (Fig. 1).

The total geographical area of Chikkaballapur district is 4,04,501 ha (Table 3.1). As per 2011 Census, the area under forest cover was about 49,704 hectares. The cultivable barren land was 6,143 hectares while the non-agricultural land was 31,933 hectares. It had a population of 12,54,377 with a density of 298 persons per sq. km. The literacy rate of the district was 70.08 per cent.

The district experiences tropical climate throughout the year. It falls in the eastern dry agro-climatic zone. It experiences a semi-arid climate, characterised by typical monsoon, tropical weather with hot summers and mild winters. The year is normally divided into four seasons. They are: a) dry season during the months of January and February, b) pre-monsoon season during the period from March to May, c) south-west monsoon season during the period from June to September, and d) post or north-east monsoon during the months of October and December. Normally, April and May are the hottest months with temperature as high as 40^0 C. The temperature is generally lowest during December, being as low as 10^0 C. With the advance of south-west monsoon to the district in early June, the temperature decreases and throughout the monsoon season, the weather is pleasant. The district is having red, clay loam and laterite soils with rich organic matter.

Chikkaballapur district is dominated by agricultural, horticultural and livestock farming activities. The major food crops cultivated in the district are maize and ragi while the horticultural crops grown are grapes, mango, banana, sapota, tomato, potato, chilly, onion, beans, coconut, cashew, betel-vine, ginger, coriander, tamarind, dry chillies, rose, marigold and chrysanthemum. Livestock rearing is an established economic activity in Chikkaballapur district. The district forms one of the popular regions for production of grapes, food grains, milk and silk. The major livestock reared are cattle, buffalo, sheep, goat, poultry, pigs and rabbits.

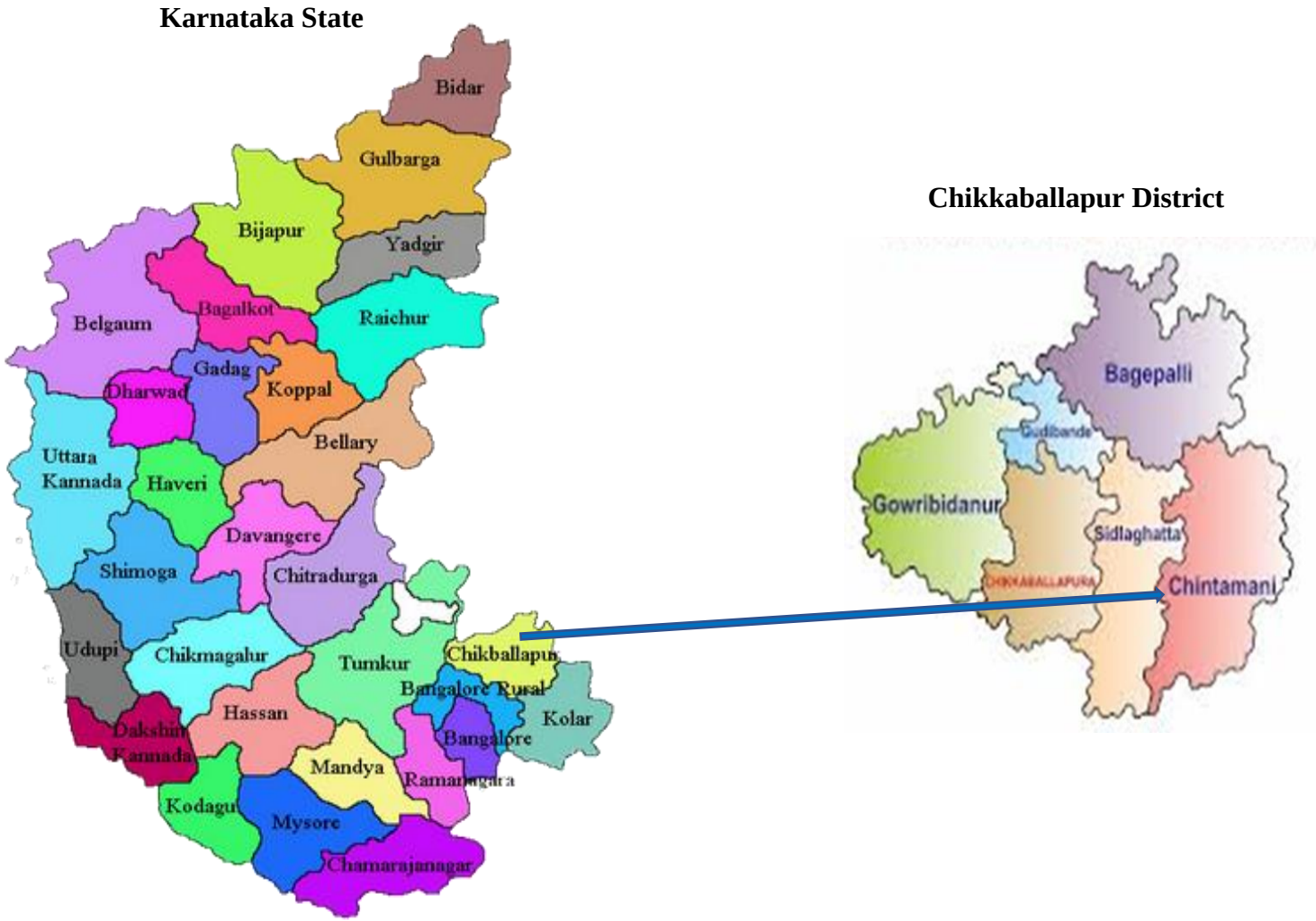

Fig. 1: Map of the study area

Table 3.1: Geographical and demographic profile of Chikkaballapur district

Sl. No.	Particulars		Number
1.	Geographical area (ha)		4,04,501
2.	Forest cover (ha)		49,704
3.	Cultivable barren land (ha)		6,143
4.	Non-agricultural land (ha)		31,933
5.	Livestock	Cows	2,46,339
		Buffaloes	47,140
		Sheep	4,32,691
		Goats	1,37,050
		Pigs	4,738
6.	Taluk		6
7.	Panchayat		254
8.	Gram panchayat		151
9.	Villages		1,514
10.	Population	Male	6,37,504
		Female	6,16,873
		Total	12,54,377
11.	Density of population (per sq. km.)		298
12.	Literacy rate (per cent)		70.08
13.	Annual rainfall (mm)		750.3
14.	Temperature	Maximum	32^0 C
		Minimum	21^0 C

Source: District Statistical Office, Chikkaballapur

3.2 Sampling Procedure

The present study was confined to the analysis of management practices in broiler farming; backward and forward linkages in broiler farming; financial viability of broiler farming; and production and marketing constraints in broiler farming.

3.2.1 Selection of study area

As mentioned earlier, Chikkaballapur district was purposively selected for the study as a good number of farmers were practising broiler farming. Further, Chintamani taluk was purposively selected for the study as a large number of contract broiler farms were operating in the taluk.

3.2.2 Selection of sample farmers

For the present study, a total sample size of 30 contract broiler farmers were randomly selected from the villages of Chintamani taluk. The sample broiler farms considered for the study were located in 13 villages, namely, Badagavarahalli, Beechagondanahalli, Channakeshavapura, Gollahalli, Guttur, Kencharlahalli, Kurutahalli, Masthenahalli, Mugalamari, Nayanahalli, Rachapura, Santhekallahalli and Yendahalli,.

3.3 Nature and sources of data

The primary data for the study were obtained from the sample farmers through personal interview method with the help of a pre-tested structured schedule.

The collected data pertained to the agricultural year 2018-19. As most of the respondents did not maintain the records of expenditure and receipts of broiler enterprise, the data collected were based on the recall / memory of the respondents.

The data elicited related to (a) general characteristics such as name of the respondent, age, type of family, size of family, educational qualification, occupation, land holding, etc.; (b) management practices in broiler farming (c) backward and forward linkages in broiler farming; (d) financial viability of broiler farming; and (e) production and marketing constraints in broiler farming.

Plate 1: Data Collection

3.4 Analytical techniques / tools

The methods of analysis followed in the study are presented under the following sub-headings.

3.4.1 Descriptive statistics

3.4.2 Discounted cash flow analysis

3.4.3 Garrett's ranking technique

3.4.1 Descriptive statistics

For the study, descriptive statistics such as mean and percentages were used for analysing the data pertaining to the management practices followed by farmers.

3.4.2 Discounted cash flow analysis

An appraisal of investments was made by using discounted cash flow techniques. The financial viability of investments were determined by using discounted cash flow techniques based on the facts that a rupee invested today has more worth than a rupee in future years. It is a process of finding the present worth of an amount received or paid in the future.

Discounted cash flow is a valuation method used to estimate the attractiveness of an investment opportunity. It discounts future cash flows using a required annual rate, to arrive at present value estimates.

3.4.2.1 Net Present Worth (NPW)

The discounted value of net cash flows to the project represents the net present worth. A discount rate of 12 per cent was used in the present study to discount the net cash flows representing the opportunity cost of capital. It may be represented by

$$\text{NPW} = \sum_{t=0}^{n} (B_t - C_t)/(1+i)^t$$

where,

B_t = Gross returns in year 't'

C_t = Cost in year 't'

n = Economic life of investment

i = Discount rate

3.4.2.2 Benefit-Cost Ratio (BCR)

By discounting the net returns, the benefit-cost ratio was worked out with the help of expected life of investment at a discount rate of 12 per cent. If a project has a BCR greater than one, it indicates that the NPW of the benefits outweigh the NPW of the costs. Therefore, the project should be considered if the value is significantly greater than one.

$$\text{BCR} = \frac{\text{Discounted benefits}}{\text{Discounted costs}}$$

$$= \frac{\sum_{t=0}^{n} \frac{\boldsymbol{B_t}}{(\boldsymbol{1+i})^{t}}}{\sum_{t=0}^{n} \frac{\boldsymbol{Ct}}{(\boldsymbol{1+i})^{t}}}$$

where,

B_t = Gross returns in year 't'

C_t = Cost in year 't'

n = Economic life of investment

i = Discount rate

3.4.2.3 Internal Rate of Return (IRR)

Internal Rate of Return (IRR) refers to the discount rate at which the NPW of cash flows is equal to zero. It represents the average earning power of money used in the project over its economic life. This is the other way of using discounted cash flow for measuring the worth of a project. It is a trial and error method which involves calculating one discount rate with positive networth and another discount rate with negative networth by

interpolation method. Interpolation is a simple method of determining the intermediate value between two discount rates and the method of interpolation followed is as follows.

$$\text{IRR} = \text{Lower discount rate} + \text{Difference between the two discount rates} \left(\frac{\text{Present worth of cash flows at lower discount rate}}{\text{Absolute difference between present worth of cash flows at two discount rates}} \right)$$

3.4.3 Garrett's ranking technique

In this study, Garrett's ranking technique was used to rank the production and marketing constraints faced by farmers practising broiler farming in the study area. The order of the merit given by the respondents was converted into per cent position using the formula.

$$\text{Per cent position} = 100 * (R_{ij} - 0.50) / N_j$$

where,

R_{ij} = Rank given for i^{th} item by j^{th} individual

N_j = Number of items ranked by j^{th} individual

The per cent position of each rank was converted to scores by referring to the table given by Garrett and Woodworth (1969). Then, for each factor, the scores of individual respondents were summed up and divided by the total number of respondents for whom scores were gathered. The mean score for all the factors / constraints were ranked, following the decision criteria that higher the value, the more important is the order of preference by respondents.

IV RESULTS AND DISCUSSION

The results of the present research which was undertaken to study the integration of broiler industry in Chikkaballapur district are presented and discussed in this chapter under the following headings in consonance with the objectives of the study.

4.1. Socio-economic characteristics of broiler farmers

4.2. Land holding pattern of broiler farmers

4.3. Livestock possession of broiler farmers

4.4. Management practices followed by broiler farmers

4.5. Backward and forward linkages of broiler farming

4.6. Financial viability of broiler farming

4.7. Constraints in broiler farming

4.1 Socio-economic characteristics of broiler farmers

The socio-economic characteristics of sample broiler farmers in Chintamani taluk of Chikkaballapur district are presented in Table 4.1. It was observed that majority (83.34 %) of the broiler farmers belonged to the age group of >30 to upto 50 years followed by age groups of above 50 years (13.33 %) and upto 30 years (3.33 %). This indicated that most of the respondent farmers had adequate experience in poultry farming activities.

With regard to the education level of broiler farmers, it was found that majority (36.67 %) of the farmers had education upto PUC level followed by high school level (30 %), degree level (23.33 %) and primary school level (10 %). There were no illiterates among the sample broiler farmers which augurs well for the farm economy. Moreover, being literate is a desirable proposition as all the sample broiler farmers were into contract broiler farming.

Majority (76.67 %) of the families of broiler farmers were nuclear in nature while the rest (23.33 %) were joint families. The phenomenon of nuclear family which is the order of the present day modern world, especially in urban areas is also catching up in rural

areas as endorsed by the findings of the present study. The average size of the family was eight consisting of three adult males, two adult females and three children.

Table 4.1: Socio-economic characteristics of broiler farmers in Chikkaballapur district

(n= 30)

Sl. No.	Particulars	Farmers	
		Number	Per cent (%)
1.	**Age (years)**		
	a. Upto 30	1	3.33
	b. >30 to upto 50	25	83.34
	c. Above 50	4	13.33
	Total	**30**	**100.00**
2.	**Education level**		
	a. Primary school	3	10.00
	b. High school	9	30.00
	c. PUC	11	36.67
	d. Degree	7	23.33
	Total	**30**	**100.00**
3.	**Family type**		
	a. Nuclear family	23	76.67
	b. Joint family	7	23.33
	Total	**30**	**100.00**
4.	**Family composition (Nos.)**		
	a. Adult male	3*	37.50
	b. Adult female	2*	25.00
	c. Children	3*	37.50
	Total	**8***	**100.00**

Note: * rounded-off averages

Broiler farming was the main occupation for all the sample farmers.

All the sample farmers were found practising broiler farming as their main occupation in the study area. In Chintamani taluk, animal husbandry is an important allied activity along with crop husbandry among the farming community. Amongst livestock, broiler farming is one of the major livelihood based activities of farmers in the study area. Hence, broiler farming was the main occupation practised by all the sample farmers.

4.2 Land holding pattern of broiler farmers

The land holding pattern of sample broiler farmers in Chikkaballapur district is presented in Table 4.2. The average size of land holding of broiler farmers was 9.63 acres comprising of 64.50 per cent dryland and 35.50 per cent irrigated land. The district receives an average annual rainfall of 785 mm. In the study area, the main source of water for agriculture is rainfall and hence, most of the land was under dryland agriculture. The only source of irrigation for agriculture is ground water from borewells. Due to acute shortage of water for crop production in the study area, majority of the sample farmers cultivated only a part of their farm, mainly for growing subsistence crops and left the remaining land fallow and took up broiler farming.

Table 4.2: Land holding pattern of broiler farmers in Chikkaballapur district

(n=30)

Sl. No.	Particulars	Acreage (in acres)	Per cent (%)
1.	Dryland	5.18	64.50
2.	Irrigated land	4.45	35.50
	Total	**9.63**	**100.00**

4.3 Livestock possession by broiler farmers

The livestock possession by sample broiler farmers is presented in Table 4.3. As mentioned earlier, poultry farming, i.e., broiler farming was the main occupation among sample farmers. Hence, poultry was the major livestock reared by the sample farmers. The average number of birds was 12,383 per broiler farm. In addition to poultry, the other livestock reared by the farmers were cattle, buffalo and sheep with a herd size of two each.

The sample farmers took up broiler farming for commercial purpose while rearing of other livestock, i.e., cattle (crossbred cows), buffalo and sheep was mainly for subsistence purpose. None of the sample farmers were rearing goats and pigs.

Table 4.3: Livestock possession of broiler farmers in Chikkaballapur district

(n=30)

Sl. No.	Particulars	Number
1.	Poultry (broiler)	12,383*
2.	Cattle	2*
3.	Buffalo	2*
4.	Sheep	2*

Note: * rounded-off averages

None of the sample broiler farmers were rearing goats and pigs.

4.4 Management practices followed by broiler farmers in Chikkaballapur district

India is the home for many breeds of native chicken like Aseel, Kadaknath, Tellicherry, Haringhata Black, Nicobari, Danki, etc., which are still popular among the rural and tribal areas for backyard / free range farming (Chatterjee and Haunshi, 2014). The private sector has developed and supplied high yielding crosses in the case of both broilers and layers for commercial farming. The broiler crosses developed are Cobb, Ross, Hubbard, Marshall, Lohman, Anak 2000, Avian-34, Starbra, Sam rat, etc., while the layers are Babcock, BV-300, Bowans, Hyline, H & N nick, Dekalb Lohman, etc. The crosses developed by the public sector includes Krishilayer, Krishibro (multi-coloured broiler birds) are popular in certain areas. The sample broiler farmers reared Cobb, Ross and Hubbard hybrids as the integrators supplied these hybrids to contract farmers in the study area. The integrators operating in the study area were Suguna Feeds Pvt. Ltd., Venkateshwara Hatcheries Pvt. Ltd., Sneha Farms Pvt. Ltd., Shreya Feeds Pvt. Ltd., Premium Chick Feeds Pvt. Ltd., SKM Animal Feeds and Foods Pvt. Ltd. and CP Feeds Pvt. Ltd.

The management practices followed by sample broiler farmers in Chikkaballapur district is presented in Table 4.4. All the sample contract broiler farms followed all-in all-out system of rearing of birds and deep litter system of housing. The all-in all-out system is more hygienic as it involves lesser sub-clinical infections and horizontal spreading of diseases; thereby resulting in lesser mortality rate, better growth rate and improved feed efficiency when compared to multiple batch system. The deep litter system of rearing avoids problems like breast blisters and leg weakness when compared to cage system of rearing. Moreover, deep litter system involves relatively lesser initial investment. Hence, the null hypothesis that "all the broiler farms follow deep litter system of rearing has been accepted". The average flock size reared per batch by the broiler farms was 12,383 birds and the average number of batches reared per year was five. Most of the sample broiler farmers were willing to rear six batches of birds in a year. However, the integrators provided birds to sample broiler farmers for rearing five batches in a year, keeping in mind the quality considerations. The mortality of birds was found to be 8.30 per cent which was higher than the standard norm of five per cent. The higher mortality of birds was mainly due to relatively higher temperature in the study area. The broiler birds are highly susceptible to various diseases, especially, avian influenza. In addition, defective housing construction and management coupled with improper disinfection by the sample broiler farmers also contributed to disease outbreaks affecting productivity and production of the broiler farms. Moreover, untimely culling of infected birds due to inadequate knowledge among sample broiler farmers also inflicted losses.

The average age of the bird at the time of marketing was 39.50 days which is within the normal range of 35-40 days. The live weight per bird was found to be 2.26 kg with a Feed Conversion Ratio (FCR) of 1.74 implying that by consuming 1.74 kg of feed, the bird will attain a weight of one kg. It was found that the chicks were fed twice while the matured birds were fed once in a day. The feed used by the broiler farmers for rearing the birds was readymade feed supplied by the integrators.

Table 4.4: Management practices followed by contract broiler farmers in Chikkaballapur district

(n=30)

Sl. No.	Particulars	Number
1.	**Rearing system**	
	a) All-in all-out	30
	b) Multiple batch	Nil
2.	**Housing system**	
	a) Deep litter	30
	b) Cage system	Nil
3.	Average flock size	12,383*
4.	Mortality rate (%)	8.3
5.	Number of batches reared annually	5
6.	Average age at marketing (days)	39.5
7.	Live bird weight (kg)	2.26
8.	Feed Conversion Ratio (FCR)	1.74
9.	**Number of times birds fed in a day**	
	a) Chicks	2
	b) Matured birds	1
10.	**Source of poultry feed**	
	a) Own preparation	Nil
	b) Readymade feed	30

Note: * rounded-off averages

Plate 2: Deep litter system of Broiler farming

4.5 Backward and forward linkages in broiler farming

More than 80 per cent of India's poultry (broiler) output is produced by organised commercial farms. Major poultry companies have vertically integrated operations which account for 60-70 per cent of the total chicken production. Major companies / integrators, own hatcheries, feed mills and primary processing facilities; and often provide credit, extension services and veterinary medicine to the contract farmers. Integrators enter into contract with multiple small farmers who rear the chicks to slaughter weight. The live birds are then either purchased by the integrators for slaughter and further processing or by a wholesaler who distributes them via live markets. The contract broiler production is mainly concentrated in the states of Tamil Nadu, Andhra Pradesh, Maharashtra, Uttar Pradesh, Telangana and Karnataka.

In agriculture, backward linkages refer to channels through which inputs, services, information and money flow between a farm and its suppliers; while forward linkages refer to channels through which outputs, services, information and money flow between a farm and its customers / consumers. Thus, both backward and forward linkages create networks of economic interdependence.

The backward and forward linkages in broiler farming are presented in the form of a flow chart (Fig. 2). In the case of backward linkages, the integrator provided major essential inputs, namely, chicks, feed and veterinary care required for broiler production while the rest of the inputs, namely, credit, water, labour, electricity, charcoal and bedding material were managed by the farmer himself. In the case of forward linkages, the integrator bought the birds at a pre-agreed price, while manure and feed bags were sold by the farmer to local crop growers and local shops, respectively.

4.5.1 Backward linkages in broiler farming

Credit: Majority of the sample broiler farmers used their own money for investment in broiler enterprise while some of them borrowed credit from Canara Bank which was the Lead Bank in Chintamani taluk.

Chicks: The sample broiler farmers were provided with day-old chicks by the integrators and these were converted into nutritious and top quality chicken meat after rearing by the broiler farmers. They provided adequate day-to-day care for the birds including better rearing environment in terms of feed, water, veterinary care, cleaning of litter, etc.

Feed: The integrators provided feed in lumpsum at the beginning, depending on the batch size to the sample broiler farmers. The broilers gain around two kg or more in about 39 days. The broiler birds need appropriately balanced feed not only for their requirement of energy and protein but also need balanced amino acid level and micro nutrients for their healthy growth. The birds require different types of feed based on their age. Accordingly, the integrators supplied Nutri Chick, Pre-broiler Starter, Broiler Starter, Broiler Finisher and Broiler Concentrates. Different broiler breeds require different nutrition and accordingly, the ingredients required to manage fast growth and complete nutrition are namely, maize, bajra, soybean cake, groundnut cake, meat and bone meal, di-calcium phosphate, mustard cake, rice polish, oil (sunflower / groundnut), phytase, choline chloride, threonine, sodium butyrate, sodium chloride and sodium bicarbonate.

Labour: In broiler farming, human labour is required for feeding, cleaning, maintenance, and watch and ward of birds. The family members met the labour requirements of broiler farming and hired labour was employed as the flock size increased. The wage rate for hired labour that prevailed in the study area was Rs. 2/- per bird per batch.

Veterinary care: The veterinary care requirements of broiler farmers in the study area were borne by the integrators. The major veterinary medicines given to birds are liver tonic, immuno vet forte, emulsifier, enzymes, lysine, methionine, toxin binder, acidifiers, marble powder, etc.

Water: Ground water formed the main source of water for rearing birds in the study area**.** All the sample farmers had invested on digging borewells to ensure water for broiler farming.

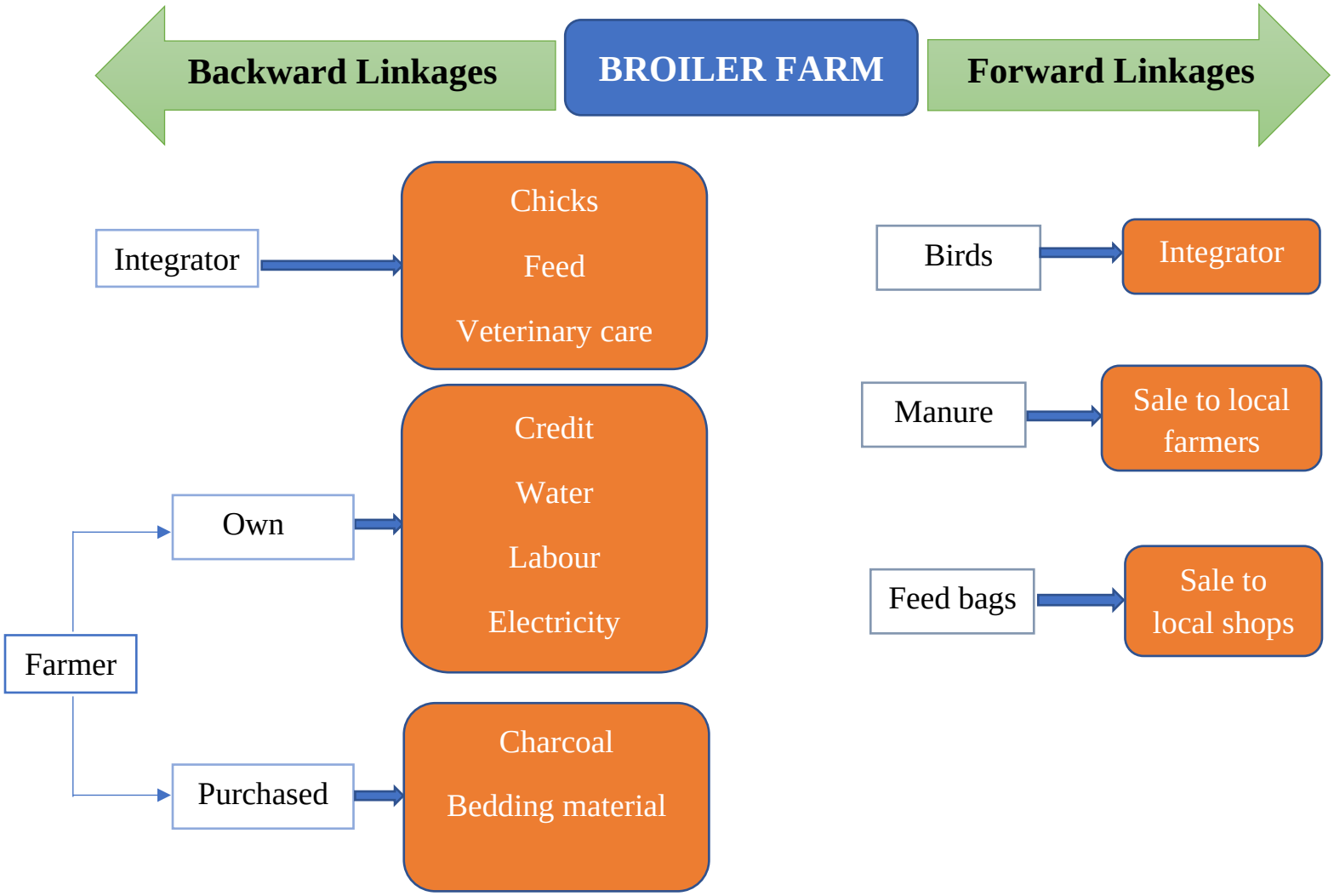

Fig. 2: Backward and Forward Linkages in Broiler Farming

Charcoal: Charcoal is required during winter for brooding purpose. It was sourced by the farmer himself by purchasing from fellow farmers in the village.

Bedding material: In the study area, paddy husk was used as bedding material for litter purpose. This was also sourced by the farmer himself by purchasing from fellow farmers in the village.

Electricity: In broiler farming, electricity is required for brooding purpose during winter and running fans during summer. The expenses of the same were borne by the farmer himself.

4.5.2 Forward linkages in broiler farming

In the case of forward linkages, the output consisted of one main product and one by-product, *viz.*, live bird being the main product and manure as the by-product. The integrator bought the birds from the contract farmers at a pre-agreed price of Rs.56/- per kg of live bird weight. The poultry manure was sold by the broiler farmers to fellow farmers for crop production. Besides, empty feed bags were also sold by the broiler farmers to nearby local retail shops in the village.

Hence, the null hypothesis that "the number of backward linkages are more than that of forward linkages in broiler production" has been accepted.

4.6 Financial viability of broiler farming

4.6.1 Cost of broiler farming

The cost and returns structure of broiler farming is presented in Table 4.5. As mentioned earlier, the average flock size of broiler farms was 12,383 birds and accordingly, the cost and returns have been worked out. The total cost incurred per batch for rearing a flock size of 12,383 birds was estimated to be Rs. 1,32,627/-, out of which fixed costs and variable costs accounted for about 58 per cent (Rs. 77,547/-) and around 42 per cent (Rs. 55,080/-).

Table 4.5: Cost and returns of broiler farming

(per batch)

Sl. No.	Particulars	Amount (Rs.)	Per cent (%)
1.	**Variable costs**		
	a. Water	9,650.00	17.51
	b. Labour	22,476.67	40.80
	c. Electricity	4,350.00	7.89
	d. Charcoal	11,966.67	21.72
	e. Bedding material	3,033.33	5.54
	f. Interest on working capital @ 7 %	3,603.37	6.54
	Sub-total (Cost A)	**55,080.04**	**100.00**
2.	**Fixed costs**		
	a. Amortized cost*	67,284.34	86.76
	b. Depreciation on equipments	9,204.42	11.86
	c. Interest on fixed capital @ 12 %	3,335.78	4.38
	Sub-total (Cost B)	**77,547.24**	**100.00**
	Total Cost (A+B)	**1,32,627.28**	
3.	**Returns**		
	a. Rearing charges	1,01,145.00	66.95
	b. Sale of manure	44,736.67	29.60
	c. Sale of feed bags	5,220.00	3.45
	Gross returns	**1,51,101.67**	**100.00**
	Net returns	**18,474.37**	

Note: Average flock size of 12,383 birds per batch

*Items considered were poultry shed and borewell

Among the variable costs, labour was the major cost accounting for 40.80 per cent of the total variable cost followed by charcoal (21.72 %), water (17.51 %), electricity (7.89 %), interest on working capital (6.54 %) and bedding material (5.54 %). Broiler farming involves providing feed and water, cleaning, watch and ward, veterinary care, collecting manure, etc., which calls for substantial amount of human labour. In the case of sample broiler farmers, this requirement of labour was predominately met by family labour supplemented by hired labour. Based on the prevailing wage rate (Rs. 2/- per bird per batch), the family labour was imputed and the cost of labour was worked out which amounted to Rs. 22,477/- for rearing a batch with flock size of 12,383 birds. The broiler farmers used charcoal during winter for brooding purpose and the cost of the same amounted to Rs. 11,967/- per batch.

As mentioned earlier, ground water formed the main source of water for rearing birds in the study area and all the sample farmers had invested on digging borewells to ensure water for broiler farming. Accordingly, the cost incurred towards lifting ground water amounted to Rs. 9,650/- per batch. In broiler farming, electricity is required for brooding purpose during winter and running fans during summer. The expenses of the same were borne by the farmer himself which amounted to Rs. 4,350/- per batch. In the study area, paddy husk was used as bedding material for litter purpose which amounted to Rs. 3,033/- per batch.

Among the fixed costs, amortized cost (poultry shed and borewell) was the major cost accounting for 86.76 per cent of the total fixed cost followed by depreciation on equipments (11.86 %) and interest on fixed capital (4.38 %).

4.6.2 Returns from broiler farming

The returns realised from broiler farming included returns from rearing of broilers, sale of manure and sale of feed bags, which accounted for 67 per cent, 30 per cent and three per cent of the gross returns, respectively (Table 4.5). In the study area, the average rearing charges paid by integrators to the contract broiler farmers was Rs. 9/- per bird, which amounted to Rs. 1,01,145/- per batch for rearing a flock size of 12,383 birds (mortality rate - 8.30 %). The broiler farmers sold poultry manure to fellow farmers in the village who

used it for crop production activities. The price of poultry manure ranged from Rs. 6,000-6,500 per tonne in the study area. Accordingly, the broiler farmers realised Rs. 44,737/- per batch from the sale of manure. The sale of feed bags by the broiler farmers to local shops in the village fetched returns of Rs. 5,220/- per batch. The average gross returns realised from rearing a flock size of 12,383 birds amounted to Rs. 1,51,102/- resulting in an average net returns of Rs. 18,474/-

4.7 Financial viability of broiler farming

The financial viability of broiler farming is presented in Table 4.6. As mentioned earlier, the average cost and returns of broiler farming per batch for a flock size of 12,383 birds was Rs. 1,32,627/- and Rs. 1,51,102/-, respectively. In the study area, the contract broiler farmers reared five batches in a year. Accordingly, the cash outflows and inflows were computed on an annual basis for discounted cashflow analysis involving estimation of net present worth, benefit cost ratio and internal rate of return. The cash flows were discounted at 12 per cent rate of interest since it represented the opportunity cost of capital in the study area. The discounted values represent the present values of future sums, which are more realistic than nominal values. The financial viability of investment in broiler farming was evaluated by taking 15 years as the economic life of a broiler farm unit.

Table 4.6: Financial viability of broiler farming

Sl. No.	Particulars	Value
1.	Net Present Worth @ 12%	30,64,889/-
2.	Benefit Cost Ratio (Rs.)	1.54
3.	Internal Rate of Return (%)	39.95

Note: Discount rate -12 per cent

4.7.1 Net Present Worth

Net Present Worth (NPW) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. The NPW of broiler farming for a flock size of 12,383 birds was estimated to be Rs. 30,64,889/- at 12 per cent

discount rate, thereby indicating that the investment in broiler farming was financially viable.

4.7.2 Benefit Cost Ratio

Benefit Cost Ratio (BCR) is the ratio of discounted benefits of an investment relative to its discounted costs. The BCR of broiler farming was 1.54, which implied that the investment in broiler farming was financially viable. In other words, for every rupee of investment in broiler farming, the benefits realised were Rs. 1.54.

4.7.3 Internal Rate of Return

Internal Rate of Return (IRR) is the rate of return, which equates discounted benefits with discounted costs. In other words, IRR is that rate at which the NPW is zero. The IRR was found to be 39.95 per cent, which was greater than the opportunity cost of capital, i.e., 12 per cent. This indicated that broiler farming enterprise was financially viable in the study area.

Hence, the null hypothesis that "investment in broiler farming is financially viable" has been accepted.

4.8 Production constraints in broiler farming

The production constraints faced by the broiler farmers in the study area are presented in Table 4.7. Among the production constraints, high mortality rate of birds was the major constraint faced by broiler farmers. As mentioned earlier, the mortality rate of birds among sample broiler farmers was 8.30 per cent which was higher than the standard norm of five per cent. The higher mortality of birds was mainly due to relatively higher temperatures in the study area. The second major constraint was disease outbreak. As mentioned earlier, the broiler birds are highly susceptible to various diseases, especially, avian influenza. In addition, defective housing construction and management coupled with improper disinfection by the sample broiler farmers also contributed to disease outbreaks affecting productivity and production of the broiler farms.

Table 4.7: Production constraints in broiler farming

Sl. No.	Constraints	Mean Garrett's Score	Rank
1.	High mortality rate	65.97	I
2.	Disease outbreak	62.27	II
3.	Inadequate availability of labour	58.27	III
4.	Inadequate availability of water	54.07	IV
5.	Untimely veterinary services	47.17	V
6.	Non-availability of credit on time	30.87	VI
7.	Inadequate number of batches per year	28.83	VII

Moreover, untimely culling of infected birds due to inadequate knowledge among sample broiler farmers also inflicted losses. The third production constraint was inadequate availability of labour. The availability of adequate labour for farm operations is an issue across the State and the situation was no different in the study area. Inadequate availability of water was the fourth constraint. As mentioned earlier, in the study area, the main source of water for agriculture is rainfall and hence, most of the land was under dryland agriculture. The only source of irrigation for agriculture is ground water from borewells. In some cases, the veterinary services provided by the integrators was not on time and hence, it was ranked as the fifth constraint. Some of the sample broiler farmers experienced delay in getting credit due to deferred sanction by banks and therefore, it was ranked as sixth constraint. Inadequate number of batches per year was another production constraint. As mentioned earlier, the integrators provided birds to sample broiler farmers for five batches in a year, keeping in mind the quality considerations. However, most of the sample broiler farmers were willing to rear six batches of birds in a year.

4.9 Marketing constraints in broiler farming

The marketing constraints faced by sample broiler farmers in the study area is presented in Table 4.8. Price fluctuation was the major constraint faced by broiler farmers. This was because the price of broiler birds keep fluctuating depending on the demand,

season, outbreak of bird flu, etc., which in turn influenced the contract price offered by the integrators. The second major constraint was delayed procurement of birds as in some cases, the birds were not procured on time by the integrators. There were also delayed payments by the integrators in some cases and hence, was ranked as the third constraint. Some of the integrators also breached contracts by paying less than the pre-agreed price to the sample broiler farmers and therefore, was considered as another constraint.

Hence, the null hypothesis that "high mortality rate is the major production constraint while price fluctuation is the major marketing constraint" has been accepted.

Table 4.8: Marketing constraints in broiler farming

Sl. No.	Constraints	Mean Garrett's score	Rank
1.	Price fluctuation	64.30	I
2.	Delayed procurement	48.43	II
3.	Delayed payments	42.73	III
4.	Breach of contract by integrators	42.53	IV

V SUMMARY AND IMPLICATIONS

Livestock is an integral component of farming system in Indian agriculture. It contributes manifold to the growth and development of agricultural sector. On one hand, it helps to improve food and nutritional security by providing nutrient-rich food products while on the other, it generates employment and income, and provides cushioning effect against crop failure. It also provides draft power and manure for crop production activities; and contributes to the Government revenue through forex earnings from exports.

Livestock products play an important role in the socio-economic life of India. It is a rich source of high quality products such as milk, meat and eggs. As per Livestock Census 2012, the country's livestock population comprised of 190 million cattle, 110 million buffaloes, 133 million goats, 63 million sheep and 730 million poultry. India has the largest population of milch animals in the world and has emerged as the largest producer of milk with 20.17 per cent share in world's milk production of 826.75 million tonnes in 2017. India also accounts for about 5.65 per cent of the global egg production and also livestock provides livelihood to two-thirds of rural community. It also provides employment to about 8.80 per cent of the country's population. The livestock sector contributed 4.11 per cent to the country's GDP and 25.60 per cent to the country's agriculture GDP.

Poultry farming in a broader sense includes rearing of domesticated birds such as chickens, ducks, turkeys and geese for the purpose of meat, eggs and feather production. Basically, broilers are raised for meat purpose whereas layers for egg production. The poultry sector in India has undergone a paradigm shift in structure and operation, involving transformation from a mere backyard activity into a major commercial agro-based industry. Poultry is one of the fastest growing segments of agricultural sector in India with around eight per cent growth rate per annum. Poultry meat is the fastest growing component of global meat demand, and India, the world's second largest developing country, is experiencing rapid growth in its poultry sector. The potential in this sector is due to a combination of factors - growth in per capita income, growing urban population and falling real prices of poultry products. Today, India is the third largest egg producer in the world

after China and the USA; and the fourth largest chicken producer in the world after China, Brazil and the USA.

There is a growing trend for integration in broiler farming. Contract farming in broiler production was first introduced in and around Coimbatore by Suguna Foods in the early 1990s and by 1995, it spread to the entire state of Tamil Nadu. Later, between 1995 and 2000, it spread to Karnataka and gathered momentum and spread its wings to Maharashtra, Andhra Pradesh in the years 2001 and 2002, respectively and after that it gained inroads in West Bengal and Gujarat states. The spread was due to in-built strengths in integration system. The integrators take care of all aspects of production, right from raising of grandparent and parent flocks, production of day-old chicks for rearing, manufacturing and supply of concentrate feed, providing veterinary services and wholesale marketing of birds. In integration, all the previous profit centres of broiler industry, *viz.*, chick selling, feed selling, hatching, medicine supply and transportation have become cost centres for the integrators who work as a single entity and distribute the benefits among the farmers, consumers and the integration of company by themselves.

Karnataka state has very congenial atmosphere for growth of poultry industry. The factors favourable for growth include better climate, presence of natural wealth, availability of skilled and unskilled labour, technical expertise, access to modern technology, etc., to increase the efficiency of farms. The State ranks fifth in both egg and meat production in the country. The districts leading in broiler production are Bangalore rural, Tumakuru, Kolar and Chikkaballapur while the districts popular in chicken egg production include Ballari, Chitradurga, Davanagere, Raichur and Koppal.

The present study is an attempt to analyse integration in broiler industry in Chintamani taluk of Chikkaballapur district.

The specific objectives of the study are

1. To study the management practices in broiler production
2. To analyse the backward and forward linkages in broiler production
3. To assess the financial viability of broiler production

4. To examine the constraints in broiler production and marketing

Methodology

Chikkaballapur district was purposively selected for the study as a good number of farmers practiced poultry farming and the literature with respect to the performance of poultry farming in this district was found to be limited. Further, Chintamani taluk was purposively selected for the study as a large number of contract broiler poultry farms were found concentrated here. Within the Chintamani taluk, 13 villages, namely, Badagavarahalli, Beechagondanahalli, Channakeshavapura, Gollahalli, Guttur, Kencharlahalli, Kurutahalli, Masthenahalli, Mugalamari, Nayanahalli, Rachapura, Santhekallahalli and Yendahalli villages were purposively selected for the study.

A total sample size of 30 contract broiler poultry farmers were randomly selected from the selected villages of the taluk. Contract poultry farming provided ample livelihood income to the farmers as agricultural crops yielded less returns owing to inadequate water availability in the study area.

The primary data for the study were obtained from the sample farmers through personal interview method with the help of a pre-tested structured schedule.

The collected data pertained to the agricultural year 2019-20. As most of the respondents did not maintain the records of expenditure and receipts of poultry enterprise, the data collected were based on the recall / memory of the respondents.

The data elicited related to (a) general characteristics such as name of the respondent, age, type of family, size of family, educational qualification, occupation, land holding, etc.; (b) management practices of poultry farming (c) backward and forward linkages in poultry farming; (d) financial viability of poultry farming; and (e) production and marketing constraints in poultry farming.

3.4 Analytical techniques

To analyse the objectives of the study, descriptive statistics such as averages, percentages, etc., discounted cash flow analysis and Garrett's ranking technique were used.

Major findings of the study

1. Majority (83.34 %) of the broiler farmers belonged to the age group of >30 to upto 50 years followed by age groups of above 50 years (13.33 %) and upto 30 years (3.33 %).

2. With regard to the education level of broiler farmers, it was found that majority (36.67 %) of the farmers had education upto PUC level followed by high school level (30 %), degree level (23.33 %) and primary school level (10 %). There were no illiterates found among the sample broiler farmers.

3. Majority (76.67 %) of the families of broiler farmers were nuclear in nature while the rest (23.33 %) were joint families.

4. All the sample farmers were found practising broiler farming as their main occupation in the study area.

5. The average size of land holding of broiler farmers was 9.63 acres and comprising of 64.50 per cent dryland and 35.50 per cent irrigated land. The district receives an average annual rainfall of 785 mm.

6. The average number of birds was 12,383 per broiler farm. In addition to poultry, the other livestock reared by the farmers were cattle, buffalo and sheep with a herd size of two each.

7. All the sample contract broiler farms followed all-in all-out system of rearing of birds and deep litter system of housing.

8. The average flock size maintained by the broiler farms was 12,383 birds and the average number of batches reared per year was five. The mortality of birds was found to be 8.30 per cent.

9. The average age of the bird at the time of marketing was 39.50 days which is within the normal range of 35-40 days. The live weight per bird was found to be 2.26 kg with a FCR of 1.74.

10. It was found that the chicks were fed twice while the matured birds were fed once in a day. The feed used by the broiler farmers for rearing the birds was readymade feed supplied by the integrators.

11. In the case of backward linkages, the integrator provided major essential inputs, namely, chicks, feed and veterinary care required for broiler production while the rest of the inputs, namely, credit, water, labour, electricity, charcoal and bedding material were managed by the farmer himself.

12. In the case of forward linkages, the integrator bought the birds at a pre-agreed price, while manure and feed bags were sold by the farmer to local crop growers and local shops, respectively.

13. The total cost incurred per batch for rearing a flock size of 12,383 birds was estimated to be Rs. 1,32,627/-.

14. Among the fixed costs, amortized cost was the major cost accounting for 86.76 per cent of the total fixed cost followed by depreciation on equipments (11.86 %) and interest on fixed capital (4.38 %).

15. Among the variable costs, labour was the major cost accounting for 40.80 per cent of the total variable cost followed by charcoal (21.72 %), water (17.51 %), electricity (7.89 %), interest on working capital (6.54 %) and bedding material (5.54 %), etc.

16. The average gross returns realised per batch was Rs. 1,51,102/-; resulting in an average net returns of Rs. 18,474/-.

17. The discounted cash flow analysis (at 12 % discount rate) revealed NPW of Rs. 30,64,889/-; BCR of 1.54; and IRR of 39.95 per cent.

18. In the case of production constraints, high mortality rate of birds was the major constraint faced by broiler farmers followed by disease outbreak, inadequate availability of labour, inadequate availability of water, untimely supply of veterinary care, delay in getting credit and inadequate number of batches per year.

19. In the case of marketing constraints, price fluctuation was the major constraint faced by broiler farmers followed by delayed procurement of birds, delayed payments and breach of contract.

Study Implications

1. Most of the farmers were not following the recommended management practices pertaining to feeding, cleaning of litter, maintenance of optimum temperature, cleaning of equipments, etc., which in turn resulted in relatively higher mortality among broiler birds. Therefore, the integrators need to sensitise the broiler farmers about the importance of the recommended management practices, as this would bring down the mortality rate thereby benefitting both the integrators and farmers

2. The integrators need to procure the birds on time; make payments on time to the farmers; and also avoid breach of contracts; as this would enhance the credibility about the contract system among the farmers, which in turn would also benefit the integrators.

VI REFERENCES

AHMAD HAKIM SHABIR AND IQBAL A. HAKIM, 2010, Economics of Broiler Marketing in Allahabad district, Uttar Pradesh. *Agriculture Update,* **5** (3&4): 375-379.

BALAMURUGAN, P., EZHIL VALAVAN, S., ASHA RAJINI, R., SUDEEPKUMAR, N.K., SERMA, A., SARAVANA PANDIAN AND SUNDARESAN, A., 2015, Adoption of Management Practices in Intensive Native Chicken Rearing. *Indian Journal of Poultry Science,* **2** (50): 213-217.

BALAMURUGAN, V. AND MANOHARAN, M., 2013, Cost and Benefit of Investment in Integrated Broiler Farming - A Case Study. *International Journal of Current Research and Academic Review,* **2** (4): 114-123.

BHIMRAJ ABHALE MANOJ, DUKARE SAGAR POPAT, SERMA SARAVANA PANDIAN, A., AND DINANI, O.P., 2018, Economics Evaluation and Constraints of Contract and Backyard Broiler Farming. *Bulletin of Environment, Pharmacology and Life Sciences,* **7** (4): 96-100.

BIRTHAL PRATAP, S., AWADHESH K. JHA AND HARVINDER SINGH, 2007, Linking Farmers to Markets for High-value Agricultural Commodities. *Agricultural Economics Research Review,* **20** (1): 425-439.

BORAH MONISHA AND HALIM, R.A., 2017, Profitability Analysis of Broiler Farms: A Case Study of Sonitpur district of Assam. *Economic Affairs,* **62** (1): 23-32.

CHATTERJEE, R.N., AND HANUSHI, 2014, Growth, Body Conformation and Immune Responsiveness in two Indian Native Chicken Breeds. *Livestock Research for Rural Development*. **19** (1): 151-159.

DEKA PANKAJ, RUPAM BORGOHAIN AND BINAPANI DEKA., 2013, Status and Constraints of Backyard Poultry Farming amongst Tribal Community of Jorhat district in Assam. *The Asian Journal of Animal Science,* **2** (8): 86-91.

DERBIE AND KAVITHA, 2016, Problems and Prospects of Poultry Production in Amhara region, Ethiopia: A Case Analysis. *Radix International Journal of Research in Social Science,* **5** (5): 2250 – 3994.

DWIVEDI SUDHAKAR, MORUP DOLMA AND PAWAN KUMAR SHARMA, 2014, Management Practices in Broiler Farming: A Study of Farms around Jammu city of Jammu & Kashmir state. *Agro Economist - An International Journal,* **2** (1): 35-40.

DWIVEDI SUDHAKAR, MORUP DOLMA AND PAWAN KUMAR SHARMA, 2016, Economics of Small Broiler Units in Jammu district of Jammu and Kashmir state. *Journal of Animal Research,* **6** (1): 57-165.

GANGWAR, L.S., SANDEEP SARAN AND SARVESH KUMAR, 2010, Broiler Supply Value Chain in the National Capital Region Delhi: A Case Study of Ghazipur Poultry Market. *Agricultural Economics Research Review,* **23** (1): 461-468.

GARRETT, H.E. AND WOODWORTH, R.S., 1969, Statistics in Psychology and Education. Vakils, Feffer & Simons Pvt. Ltd., Bombay.

GHASURA, R.S., SHEIKH, A.S., ASWAR, B.K., RAJPURA, R.M. AND CHARAN ROHIT, 2013, Constraints faced by Poultry Farm Entrepreneurs in Banaskantha district, Gujarat. *International Journal of Rural Studies,* **20** (2): 1-5.

KALAMKAR, S.S., 2012, Inputs and Services Delivery System under Contract Farming: A Case of Broiler Farming. *Agricultural Economics Research Review,* **25** (1): 515-521.

KINGORI, A.M., WACHIRA, A.M. AND TUITOEK, J.K., 2010, Indigenous Chicken Production in Kenya: A Review. *International Journal of Poultry Science,* **9** (4): 309-316.

MALARVIZHI, V. AND GEETHA, K.T., 2015, Economic Cost and Profit Assessment of Poultry Farming in Namakkal district. *Journal of Management and Science,* **5** (2): 2249-1260.

MASUKU, 2011, Analysis of the Broiler Supply Chain in Swaziland: A Case Study of the Manzini Region. *Asian Journal of Agricultural Sciences*, **3** (6): 492-499.

MATHIALAGAN, P., 2015, Marketing Technological Needs of the Layer Poultry Farmers. *International Journal of Science, Environment and Technology,* **4** (3): 1013-1018.

MOREKI JOHN CASSIUS AND TETO KEAIKITSE, 2013, Poultry Waste Management Practices in selected Poultry Operations around Gaborone, Botswana. *International Journal of Current Microbiology and Applied Sciences*, **2** (7): 240-248.

MURTHY, M.R.K. AND BINDU MADHURI, S., 2013, A Case Study on Suguna Poultry Production through Contract Farming in Andhra Pradesh. *Asia Pacific Journal of Marketing & Management Review*, **2** (5): 58-68.

PATIL KIRAN KUMAR, R., CHINNAPPA, B., GANESH PRASAD, VISHWAJITH, K.P. AND MANJUNATHA, G.R., 2017, Economic Performance of Contract Broiler Farming. *Indian Journal of Poultry Science,* **52** (2): 217-221.

PAWARIYA VIKASH AND JHEEBA, S.S., 2015, Economic Analysis of Costs-Return, Income and Employment in Poultry Enterprise in Jaipur district of Rajasthan state. *International Journal of Agricultural Science and Research*, **5** (1): 73-80.

RAHMAN, S., 2015, Management of Broiler Farms in Aizawl district of Mizoram, India. *Livestock Research for Rural Development*, **27** (4): 1-4.

RAJENDRAN, K. AND SAMARENDU MOHANTY, 2003, Comparative Economic Analysis and Constraints in Egg Production under Cage vs. Deep Litter Systems of Rearing in India. *International Journal of Poultry Science,* **2** (2): 153-158.

RAM DAYA, SINGH, M.K, AND LAISHRAM, J.M., 2017, Training Needs Assessment of Poultry Farmers in Imphal West and Imphal East of Manipur, India. *International Journal of Current Microbiology and Applied Sciences*, **6** (9): 2218-2227.

RANI DURGGA, V. AND SUBHADRA, M.R., 2009, Problems related to Farm Operations in Poultry Farming as perceived by Farm Women. *Veterinary World*, **2** (5): 191-192.

RAUT, S.D., MALAVE, D.B. AND GORE, S.T., 2017, Financial Feasibility of Investment in Broiler Poultry Units in Raigad district of Maharashtra. *International Research Journal of Agricultural Economics and Statistics*, **8** (1): 170-175.

KUMAR SANJIV, 2014**,** Marketing Efficiency Analysis: A Case of Broiler Marketing in Anand district of Gujarat. *International Journal of Commerce and Business Management*, **7** (1): 186-190.

SHAIKH, A.S. AND ZALA, Y.C., 2011, Production Performance and Economic Appraisal of Broiler Farms in Anand district of Gujarat. *Agricultural Economics Research Review*, **24** (2): 317-323.

SINGH VARINDER PAL, SHARMA, V.K., SIDHU, M.S. AND KINGRA, H.S., 2010, Broiler Production in Punjab - An Economic Analysis. *Agricultural Economics Research Review*, **23** (2): 315-324.

SWAIN, B.K., ASHOK KUMAR, J., PARESH PARITI AND KORIKANTHIMATH, V.S, 2009, Constraint Analysis of Commercial Poultry Farming in Goa. *Indian Journal of Poultry Science*, **44** (1): 137-138.

WAINAINA PRISCILLA, W., JULIUS, J. OKELLO AND JONATHAN NZUMA, 2012, Impact of Contract Farming on Smallholder Poultry Farmers' Income in Kenya (https://www.researchgate.net/publication/254387514_Impact_of_Contract_Farming_on_Smallholder_Poultry_Farmers'_Income_in_Kenya).

(http://apeda.gov.in)

(http://dahd.nic.in).