



**T.R.**

**KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY  
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE**

**DETERMINATION OF FACTORS INFLUENCE ON  
THE COST AND PROFIT OF CHICKEN BROILER  
PRODUCTION IN NORTHERN REGION OF IRAQ**

**BESTOON NAJMALDIN BAKR BAKR**

**MASTER THESIS**

**DEPARTMENT OF BIOENGINEERING AND SCIENCES**

**KAHRAMANMARAŞ – TURKEY 2017**

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**This thesis submitted in candidature for the degree of  
MASTER OF SCIENCE  
at the Department of Bioengineering and Sciences**

**KAHRAMANMARAŞ – TURKEY 2017**

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## **DECLARATION**

I hereby declare that all information in the thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

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Note: The original and other sources used in this thesis, the declaration, tables, figures and photographs showing the use of resources, subject to the provisions of Law No. 5846 on Intellectual and Artistic Works.

**KUZEY IRAK BÖLGESİNDE ETLİK PİLİÇ ÜRETİMİNİN MALİYET VE KARI  
ÜZERİNE ETKİLİ OLAN FAKTÖRLERİN BELİRLENMESİ  
(YÜKSEK LİSANS TEZİ)**

**BESTOON NAJMALDİN BAKR BAKR**

**ÖZET**

Bu çalışmada Kuzey Irak bölgesinde tavuk eti üretimi maliyetleri ve karı üzerine etkili olan faktörler analiz edilmiştir. Araştırmanın ana materyali 2013-2014 üretim döneminde Kuzey Irak Hayvansal Üretim Departmanı ile birlikte işbirliği yapılarak toplam 860 üretici ile yüz yüze yapılan anketlerden elde edilen verilerden oluşmaktadır. Çalışmanın popülasyonunu çalışma bölgesindeki tüm broyler üretim çiftlikleri oluşturmaktadır. Elde edilen veriler Cobb-Douglas üretim fonksiyonu ile analiz edilmiştir. Modelde üreticilerin geliri bağımlı değişken, üreticilerin sosyo demografik özellikleri ve üretim maliyetleri bağımsız değişken olarak belirlenmiştir. Açıklayıcı değişkenlerden yem masrafı, tavuk masrafı ve satılan tavukların yaşının pozitif ve önemli olduğu tespit edilmiştir ( $p \leq 0.01$ ) bununla birlikte çalışan ücretleri ve ısıtma sistemi masrafı da pozitif ve önemli bulunmuştur ( $p \leq 0.05$ ). Ayrıca soğutma sistemi pedi pozitif ve önemli bulunmuştur ( $p \leq 0.01$ ). Buna karşın yem fiyatı, tavuk fiyatı ve ölüm oranı negatif ve önemlidir ( $p \leq 0.01$ ). Broyler üretiminde firmaların daha iyi yönetim anlayışı ve broyler üretiminin pazar talepleri doğrultusunda üretim yapılması için daha doğru besleme yapılması desteklenmelidir. Ayrıca, broyler üreticilerinin üretim kapasitelerini artırılmasını destekleyen politikalar uygulanmalıdır.

**Anahtar kelimeler:** Tavuk eti, Üretim maliyeti, Gelir, Cobb-Douglas, Kuzey Irak

Kahramanmaraş Sütçü İmam Üniversitesi

Fen Bilimleri Enstitüsü

Biyomühendislik Ana Bilim Dalı, Ocak/ 2017

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Sayfa sayısı: 75

**DETERMINATION OF FACTORS INFLUENCE ON THE COST AND PROFIT  
OF CHICKEN BROILER PRODUCTION IN NORTHERN REGION OF IRAQ  
(M.Sc. THESIS)**

**BESTOON NAJMALDIN BAKR BAKR**

**ABSTRACT**

This study was carried out to determine factors influence on the cost and profit of chicken meat production in Northern Region of Iraq. The primary data were collected from 860 farm owners with interview during 2013-2014 production seasons, in collaboration with the directorate of animal department in Northern Region through personal interview methods and using questionnaire that was specially designed to achieve the objectives of the study. The population of the study was the whole broiler farms in the study area. On the other hand, the data was analyzed by Cobb-Douglas production function. In the model, farmer's income was chosen as a dependent variable and the socio demographics characteristics of farmers and the costs are independent variables. The explanatory variables were feed cost, chick cost and age of chicken sold were found to be positive and statistically significant ( $p \leq 0.01$ ). Labour cost and hitter for heating system were found to be positive and statistically significant ( $p \leq 0.05$ ) and also pad for cooling system were found to be positive and statistically significant ( $p \leq 0.1$ ). On the other hand, explanatory variables including feed price, chicks price and mortality rate were found to be negative and statistically significant ( $p \leq 0.01$ ). Moreover, broiler farms should be encouraged to adopt better feed management practices and also feed broilers with nutritious feed for the right market weight to be gained by week eighth to reduce expenditure on feed. Policies that will encourage broiler producers to increase production capacity should also be encouraged.

**Key words:** Chicken meat, Cost of production, Income, Poultry Farm, Cobb-Douglas and Northern Region of Iraq.

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Page Numbers: 75

## **ACKNOWLEDGEMENTS**

I would like to thank everyone who has given me support and encouragement over the year in completing this dissertation. First of all, thanks to my supervisor, Prof. Dr. Cuma AKBAY, whose knowledge and technical expertise has made this study an amazing learning opportunity, for his guidance and encouragement through the various stages of the M.Sc.

I am very grateful and thankful to my mother, my wife, my daughter, my brothers and my sister, for their support and impeccable understanding allowing me to accomplish this thesis during my study.

I would like to express my deepest appreciation to my friends and all those who provided me with assistance to complete this research.

BESTOON NAJMALDIN BAKR BAKR

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## LIST OF SYMBOLS AND ABBREVIATIONS

\$	: United State Dollars
%	: Percentage
°C	: Celsius
°F	: Fahrenheit
ABFL	: Aftab Bhumukhi Farm Limited
BC	: Before Christ
BRAC	: Bangladesh Agricultural Research Council
CD	: Cobb-Douglas
CSO	: Central Statistical Organization-Iraq
DOC	: Day-old Chick
et al.	: Et Alia
FCR	: Feed Conversion Ratio
FLW	: Final Live Weight
GH	: Ghanaian Cedi (Currency)
GP	: Gross Profit
GR	: Gross Revenue
ID	: Iraqi Dinar
JD	: Jordan Dinar
Kg	: Kilogram
KRSO	: Northern Region Statistics Office
m	: Miter
M.Sc.	: Master of Science
m <sup>2</sup>	: Miter Square
MFC	: Marginal Factor Cost
MVP	: Marginal Value Product
NWFP	: North-West Frontier Province

Rs : India Rupee

TK : Taka

VC : Variable Cost

X<sup>2</sup> : Chi-Square



## 1. INTRODUCTION

Chickens originated from Jungle hen in South Japanese Asia around 3200 BC and have been domesticated and spread out to China, India, Africa, Pacific Island, and Europe (Farran et al., 2009). They have been usually raised for human meals. Furthermore, their feathers had been used for making cushions; litter as fertilizers and, in some societies. Chickens had also been utilized in cock combating sources of amusements.

In Northern Region of Iraq, there are approximately 1179 broiler farms and 860 of them are operational farms (KRSO, 2015). According to broilers, the cost of production and net profits in those farms are the most essential factors in figuring out the destiny of broiler productiveness. Each factor is motivated by numerous factors such as marketing age, mortality rate, flock length and hygienic conditions of the farm. Both better marketing age and smaller flock length might narrow the margin of total gross profits and also net earnings of a broiler (Farooq et al., 2001).

Broiler manufacturing is one of the most crucial agricultural businesses amongst farm animals and chicken meat gives protein in phrases of excellent and amount that narrow down the animal protein supply hole in minimum viable time in comparison to different assets of animal source protein (Al-Masad, 2010).

Due to the human population increases, the chicken enterprise maintains to develop and to fulfill the call for poultry products in world markets. The significance of chicken farms lies in the excellent of products which consequently provides human needs. Broiler farms offer meat that nourishes the human body with high fine proteins. Layer farms provide eggs that are wealthy in proteins and nutrients, mainly fats and soluble vitamins (A, D, E, and K). Chicken farms are rapid-paced operations that may satisfy the call for meat and eggs, and may be accelerated effortlessly to meet the ever-growing demand (Farran et al., 2009).

In popular, the significance of the poultry industry is focusing to offer employment not best to those engaged in manufacturing without delay. However, for the hatchery operations, feed dealers, manufactures of incubators, constructing materials, processors of egg and rooster products and all sellers engaged in the advertising of eggs and rooster from the time they leave the manufacturer until they're in palms of purchasers (Morly, 1982).

The farm length and broiler farming can be either the primary supply of family income or offer subsidiary profits and gainful employment to farmers during the year. Additionally, it's far a quick-time period business enterprise, and consequently the range of batches may be raised within a year. Alternatively, there are several strains of broilers exist in various areas of the country; they possess a genetic ability to obtain 2.0 kg live weight at the age of 42 days (Bhende, 2006).

It's far usually accepted that feed charges constitute about 70% of the price of poultry manufacturing and this makes a bird's capacity to apply feed efficaciously very critical. Over the last many years feed efficiency has been improved via changes in a number of aspects of meat chicken production (Willems et al., 2013). Feed conversion ratio (FCR) can be defined as the quantity of feed that fed on according to unit of weight advantage, and is a composite trait of beginning and finishing frame weight and feed consumption (Skinner-Noble and Teeter, 2003).

Chickens are fast developing animals. In the past, it has been approximately taken four months to only produce a kilogram chicken. But, nowadays a kilogram chicken may be produced in forty two days (Farran et al., 2009). Because of this reality, a higher knowledge of husbandry practices, and the use of recent technologies, poultry farms can be worthwhile enterprises.

Holsheimer and Veerkamp (1992) recommended better standard performance of broilers that are marketed on the age of six<sup>th</sup> weeks than on the age of fif<sup>th</sup> and seven<sup>th</sup> through nin<sup>th</sup> week.

Farm profitability relies upon on internal and external factors. The primary internal elements are financial system of scale; farmer's age; time devoted to farm activities; use of equipment; land productiveness; utility of control technologies (Duffy and Nanhou 2003); distance to purchaser markets, processing plants, service companies; environmental situations, including soil, comfort, climate; opportunity of putting the product within the marketplace (downstream connection); opportunity of using city labor, and retirement pensions (Sousa-Filho and Batalha, 2005).

Jiang et al. (1998) used a deterministic financial version to assess the profitability of broiler breeder production. The authors implemented a model based on income equations with a set of quantity of broiler meat output. They discovered both linear and nonlinear relationships between financial values and production situations. They were also

concluded that financial values are generally sensitive to manufacturing stages and products and feed costs.

The financial assessment of broiler breeder manufacturing is very complicated for primary cause due to the several elements that affect its profitability, which makes statistical evaluation difficult (Groen et al., 1998; Faridi et al., 2011 and Yassin et al., 2012).

The mortality rate performs a crucial role in figuring out the overall profitability of broiler flock. An increase in mortality rate from 2.5 to 10% will result in decreasing the net earnings per broiler (Kitsopanidis et al., 1996).

Iraq is currently importing a big portions from its chicken meat because of wide production is not able to satisfy highly demand for this essential commodities, notwithstanding the availability of the fundamental ingredients to boom and expand manufacturing, and that requires interest to the issue of agricultural funding and the provision of goods to support farmers and to protect country from wide product for the advancement of agricultural reality productive down to self-sufficiency. Broilers production performs an essential role in imparting food and net profits for villagers. The net profits in turn helps to make contributions to poverty remedy, therefore, the most important troubles dealing with broiler producers had been low market costs, excessive price of feed, veterinary offerings, transportation, loss of getting admission to credit and extension services.

Main objective of this study is;

► To determine the factors affecting poultry production in the area of study.

The other objectives of the study are;

► To determine the costs, returns and profitability of broiler enterprise.

► To compare cost of production between different cities in northern region of Iraq including Erbil, Sulaymaniyah, Duhok and Garmian.

► To study factors effect on cost of production and net profit per one kg chicken meat in northern Iraq.

► To make some suggestions for policy guidelines and recommendations for development of broiler production.

## 2. LITERATURE RIVIEW

Review of literature is an attempt for reviewing findings which give a proper instruction in designing the future research problem and validating the new findings. It also helps to conduct the research work successfully by providing various knowledge and information related to the proposed study. With this end in view, a literature review was carried out in line with the present study. In the present section, the most common and relevant studies which were conducted in the past at home and abroad are highlighted.

Bader (1968) pointed out that there are many factors that affect consumer demand of poultry meat. Meanwhile, there are also factors affecting the production of poultry meat. The study used Cobb Douglas production function to estimate the production function. While using marginal productivity of physical, it appeared that producers do not continue in production until the point where the marginal value equal to the yield with the marginal cost of the resource.

Molla et al. (1974) studied poultry marketing in Mymensingh town with special emphasis on consumer, who found that no grading and weighing were followed at the rural market and also found that poultry had rather a shorter trade channel consisting of Beparics and retailers who were engaged in its marketing in Mymensingh town. Moreover, observed that the growers' share of the consumer price and the net margins of the traders were reasonable.

Khairy (1980) conducted a study on poultry projects. The results showed that fixed costs, ranging from about 2.3%-12.5% with an average of about 9.5% of the total costs. The interest on capital used to buy the land ranges between 0.4%-5.2% of the total costs, with an average of about 0.9% for each farm. The cost of the usage and maintenance of the buildings ranges between 1.1%-7% with an overall average of about 3.9% of the total costs, while usage and maintenance of machinery and tools ranging from 0.8%-4.3% of the total costs, with an overall average of about 1.9% for each sample farms. The costs of Permanent workers range were between 1.4%- 4.1% of the total costs, with an overall average of about 2.8%. From above calculations, it appears that the highest fixed costs are due to usage and maintenance of the building followed by permanent employment and wages. Then the cost for usage and maintenance of machinery and equipment, and lower costs are the interest rates on capital investment in the purchase of land.

Sikder (1981) conducted a study on poultry farm at village Daribhabakhali two miles away from the Bangladesh Agricultural University Campus. The study showed that the share of poultry in the total income of sample families was only 4.22% and 83.00% respectively, they reflected their opinion that they were willing to raise poultry production. Results of the study were also showed that poultry diseases were one of the major obstacles to the development of poultry in the study.

Karim and Mainuddin (1983) conducted a study on the backyard poultry farming in Bangladesh. They found that the financial hardship, inadequate supply of vaccines, wild animal, for example for snakes, etc. attack on improved cock. Difficulties in getting loan from bank and inadequate supply of improved birds were basic problems of backyard poultry farming in tins country.

Haque (1985) studied commercial poultry farming in Bangladesh, who suggested numerous measurements for boosting up the commercial poultry farming in Bangladesh such as supply of high quality commercial broiler and layer chicks, good quality feed, constant supply of medicine and vaccine, vitamins and mineral premixes feed additive disease investigation facility, withdrawn import duty from day-old chick, lower rate of interest on bank loans and insurance system in commercial poultry farm.

Kashem and Sarker (1988) determined the extent of problems faced by the owners of poultry farms in Tanundia Union of Mymensingh district. Among the various problems, namely, breeding, feeding, housing, prevention and control diseases were the most acute problems in poultry rising.

Miah (1990) studied small-scale poultry farms in Savar area. The purpose of the study was to identify the profitability of small-scale poultry farming, who found that the average number of birds in small and medium farms were 589 and 3,139 respectively. The average annual costs per small and medium farms were 136,788 and 567,304 Tk respectively. The average gross income of small and medium farms stood at 308,739 and 1480,302 Tk respectively. The researcher found that the profitability of poultry farming depends on the sizes of individual farms.

Abdul-Rahim (1991) studied the production and marketing of poultry in Sohaj Governorate in Egypt, turned out that the most important problems facing the broiler production in Sohaj province is the lack of adequate fodder availability at reasonable prices, who demonstrated, there are not biosecurity for the chicks contained and high

prices, and the epidemiological circumstances, as well as the inability to marketing in a timely manner. The study also showed that the most important marketing problems are reduced output price, abundant supplies in the provinces, the lack of mechanized slaughterhouses and refrigerators, the control of brokers on the market, and the lack of a sufficient number of chickens distribution within the province of Sohaj outlets, in addition to the decline in consumer demand.

Ukil and Paul (1992) conducted a study on problems and prospects of broiler industry in Chittagong region. They found that non-availability of chicks; prevention and control of diseases, predators, lack of balanced feed and fluctuation of market were the basic problems of broiler poultry farming. They also showed that 88% of profit was earned within a year by broiler farming.

Khalil (1992) studied the economic productivity of farms poultry broiler in the Fayoum governorate in Egypt. They obtained that the most important factors underlying the poultry industry are chicks, feed and veterinary care, and employment farm. Also it turns out that the government sector is best among other sectors in terms of its use of feed, and that the private sector is the best sectors in the use of the element of labor, while the traditional sector is the best productive sectors in achieving the maximum profit per ton of poultry. The study also showed that the variable costs in all productive sectors were accounted for about 90% of the total cost. Both value of feed and chick were represent about 80% of the total variable costs. Those study also determined that the most important problems which face poultry producers are soaring feed prices, a lack of quality, lower feed conversion rates of the chick, control of intermediaries and compete with imported poultry, the higher the veterinary drug prices, the lack of availability and lack of effectiveness.

Haque (1992) analyzed the cost and benefits of 500 broiler and 500 layer farms in Bangladesh. Results showed that the net profits of broiler and layer farms were 37,146 Tk and 105,876 Tk respectively.

Paul et al. (1992) conducted a study on the profitability of layer farms in Savar, Dhaka in Bangladesh. They observed that average number of birds in small, medium and large farms were 100, 200 and 300 respectively. The average annual costs per small, medium and large farms were 538,000, 1061,800 and 153,800 Tk respectively. The average net income of small, medium and large farms stood at 72,000, 144,000 and

216,200 Tk per year respectively. They also observed that the profitability of small-scale commercial poultry farming was positively correlated with sizes of individual farms.

Sulaiman (1993) studied on the economic factors that are specific to the production of poultry in Egypt and ways that have roles to overcome the problems they face. The study showed a positive relationship between the amount of output for meat and all of used amount of feed/bird, and the number of operating cycles per year at the level of all production capacities. Results also showed a negative relationship between the quantity of produced chicken meat and for the bird of the operating loan across all capacities, as the existence of a negative relationship between the amount of the resulting meat and the number of the chicks found mortality in the first amplitudes, second, third, and fifth, where the rate of the mortality rising, subsequently leads to production of chicken meat reduction. There is a positive relationship between them on farms in fourth amplitude, and this does not agree with economic logic, which may be due to uniform birth of the population density of birds on the unit area.

Ali (1993) undertook a study to examine the profitability of small scale layer farms in Dhaka in Bangladesh. In his study 30 layer farms were selected, of which 16 were small farms and 14 were medium farms. The average number of birds in small farms was 61; while it was 188 in the case of medium farms. The average annual egg production was 268 and 266 per hen in small and medium farms respectively and also found that gross margins in small and medium farms were estimated at 16.17 l and 60.822 Tk respectively.

Salim (1993) studied the returns analysis of the capacity in Egyptian poultry farms. Results showed that the average cost per farm per session for chicken fattening amounted to about 22.49, 39.47, 27.23 and 86.26 thousand pounds for all categories of the first to fourth, respectively. While, the ratio of variable costs accounted for about 94.5%, 93.5%, 92% and 89.5% of the total costs for the four categories respectively. Furthermore, the results also showed that the feed ratio represents about 67.5%, 65.6% and 64.5% of the total costs for the four categories respectively. Total revenue for the chicken farms has reached fattening about 4915.15 thousand pounds per cycle, the net return on average session amounted to about 10.5 thousand pounds.

Hoque and Ukil (1994) conducted a study on the poultry production in various selected villages of Bangladesh, namely Dhaka, Sylhet, Khulna, Dinajpur and Chittagong districts were selected for the survey. They observed that highest number of birds was available at the farm household during April-June and the lowest during July-September,

Highest number 41.69 Eggs of eggs per bird was found during January-March while the lowest 25.83 Eggs was during July-September. They also found that the average annual net income from poultry and poultry products per farm was 2.397 Tk.

Ahmed et al. (1995) conducted an economic study on the performance of broilers round the year in Bangladesh. In this study, identical care and management were assigned to the birds all the year to examine the performance and profitability. Feed intake 4.25 kg bird and live weight gain 1.36 kg/bird were in the highest value in the rainy season and the lowest value 3.20 kg per bird and 1.14 kg per bird in the summer season. Profit per kg of broiler was recorded the highest value 14.12 Tk in summer and the lowest value 4.22 Tk in rainy season. Feed cost was counted to be the highest in rainy season and the lowest in summer season.

Said-Ahmed (1995) conducted a study on the economics of production and marketing of poultry in the Republic of Egypt. The study showed that production costs per ton of broiler farms of the public sector were estimated at about 3115.8 pounds, while it was around 3054.0 pounds in the farms of private sector.

Islam (1995) conducted a study on economic analysis of poultry farms of different sizes in different areas of Dhaka city, and examined the relative profitability of small, medium and large poultry farms. The study revealed that total costs per poultry bird per year were 406.17, 373.86 and 347.54 Tk for small, medium and large firms respectively. On the other hand, the average gross returns per poultry bird per year stood at 614.15 Tk for a small farm, 599.69 Tk for a medium farm and 351.69 Tk for a large firm. The gross returns for egg production per poultry bird per year stood at 597.50, 585.01 and 545.00 Tk for small, medium and large poultry farms, respectively.

Das (1995) conducted a study on production and marketing of poultry and poultry products in Sylhet Sadar Thana in Bangladesh and found that a number of market intermediaries were involved in selling native poultry and its product. The intermediaries were Paiker, Aratdar, Renanes and retailers. Price of birds was determined by the relative bargaining power, who also estimated the net return per annum from investment of 100 was 1396 Tk for eggs, which was higher than the live broiler 7.88 Tk.

Rahman and Wahid (1995) studied the influence of seasonal variations on the economic trails of layers and broilers under Bangladesh conditions. Two experiments were separately conducted at the Bangladesh Agricultural University, poultry farm, with fifty

broiler chicks and thirty pullets. This study investigated to find out the overall performances in winter season (November to February) under Bangladesh conditions. They found that the production performances of broilers in winter season were not better in comparison to standard performances of present broiler production in the world, but the performance was better when compared to production under average Bangladesh condition. On the other hand, the average per hen egg production, livability and other performances of layers were only recorded in winter season and the production characteristics were found better in comparison to rainy season under average Bangladesh condition.

Shanmugam and Kumar (1995) analyzed the supply response of egg and poultry meat in Salem district of India. They showed that layer farm was found to be more profitable from broiler farm. Egg and broiler meat supplies were found to be price elastic and so it was suggested that efforts to tin remunerative price would encourage the development of the poultry sector.

In a study by Abu-Alazam (1996), they found the impact of the economic liberalization policy on the real prices of eggs and the value of poultry meat. This study showed that the net profit of 16.21%, achieved in relation to the total annual operating costs. This shows the decrease in this ratio target rates ranging between 30% and 35%, due to the multiplicity of the problems facing the fattening poultry projects, topped by the problem of rising feed prices.

Kitsopanidis et al. (1996) studied the effects of the most important factors including mortality and age of final live weight (FLW) of broilers on the profitability of the poultry farming in Greece. These factors are very valuable for poultry meat production because they affect the total consumed feed and the total FLW of achieved broiler. Analysis of these factors showed that an increase of mortality from 2.5% to 10.0 % and the age of FLW of broilers from 53 to 62 days led to a decrease in the profitability by 96.7% and 77.1% respectively.

Shalaby and Zachary (1996) showed statistical estimate of the estimated production functions and the total sample, of three positions in city of Sharqia in Egypt. The study found that most influential factor on the amount of output meats are the number of chicks used for fattening, the amounts of feed consumed, human labor, and also veterinary care. The study found when an estimation cost function used for the total sample there are a positive relationship between the total cost and the size of the actual production of chicken

meat reaching the selection coefficient of about 97%. It has also shown that from the estimation factor there was optimal production reached around 21000 birds, and that maximized the size production profits into around 59000 birds.

Abu-Arab (1996) in a study on the economics of poultry production projects in Qaliubiya in Egypt. They found that the average total fixed costs in all capacities production has reached about 3.3% of the average of total costs. This study also showed that the average variable cost in all capacities productivity has been reached 96.7% of the average of total costs during 1990. Results also showed that the average cost of producing a ton of live chicken broiler farms in Qaliubiya province was reached about 2387.6 pounds on the third level of the productive capacities.

Ahmed and Begum (1997) studied the performance of 1-757 and Isa-vedette broilers in different seasons of the year. The study was also undertaken to recommend which type of broilers would be economically viable under the condition of Bangladesh. Moreover, about 12,500 broilers reared in 22 batches; 8 in rainy 4700, 7 in winters 4200 and 7 in summer season 3600 broilers. All the broilers were procured from Aftab Bahumukhi Farms Ltd., Kishoreganj. The study revealed that the total cost of production per bird was the highest 77.86 Tk in rainy season for Isa-vedette while it was the lowest 61.831 Tk in summer for the 1-757. Labour cost was found to be 11.11% for 1-757 compared to 10.10% for Isa-vedette broilers. They also revealed that profit margin of 1-757 broilers was the highest 21.52 Tk per bird in winter season and the lowest 7.78 Tk per bird in summer season. The study also showed that mortality of 1-757 broilers was comparatively lower 2.67% in rainy season but higher 7.17% in summer season. The study recommended that both 1-757 and Isa-vedette broilers were found profitable in Bangladesh.

Hasan (1997) examined the relative profitability of poultry rearing of four different categories of farms under the supervision of Bangladesh Rural Advancement Committee (BRAC) in the Mirpur upazila of Kushtia district. The study revealed that on an average, the total cost per poultry farm per year was 1367.65, 6259.13, 24558.76 and 76703.75 Tk for Key rearer, Model rearer, Chick rearer and Mini Hatcheries, respectively. Moreover, the gross returns and net returns per poultry farm per year were 6533.25 and 5165.00 Tk; 17150.40 and 10899.27 Tk; 42996.50 and 18437.74 Tk; 92611.20 and 45907.45 Tk, for Key rearer, Model rearer, Chick rearer and Mini Hatcheries respectively.

Zebunnesa (1998) conducted a study on the performance of selected rural development programs that was organized by BRAC in a selected area of Mymensingh district and analyzed three BRAC programs namely poultry, dairy and sericulture. On poultry programs of the BRAC, who found that the average annual income per household was 23,388 Tk and poultry rearing constituted the major source of income representing 36.47 percent of total income. The gross margin of the poultry enterprise was estimated at Tk. 8,529.

Bhuiyan (1999) studied the socio-economic characteristics of poultry farm owners and assessed the relative profitability of broiler and layer poultry farms, who totally worked on 60 poultry farms taking 30 broiler farms and 30 layer farms from the Sadar Upazila of Mymensingh district. The study demonstrated that on an average, the total costs per poultry farm per year were 299,482 and 1,314,620 Tk for broiler and layer farm, respectively. Additionally, the gross returns per year were 355,772 and 43,747 Tk for broiler and layer farm, respectively. Also found that the net returns per year were 56,290 Tk for broiler and 122,862 Tk for layer poultry farms. Results from this study showed that most of the selected input variables had some statistically significant impacts on the production of the broiler and layer poultry farms.

Uddin (1999) conducted a study comparing broiler and layer production in particular selected areas of Sadar Upazila in Mymensingh district and observed that none of the layer and broiler farm owners were illiterate, who also found that the average annual income per family amounted to 133,679 and 83,022 Tk for the owners of layer and broiler farms respectively. The result of the analysis shows that the total costs per day per bird were 1.65 and 1.24 Tk for small and large layer farms and 1.95 and 1.82 Tk for small and large broiler farms respectively. In addition, the gross returns and net returns per bird per day stood at 2.33 and 0.68 Tk for small layer farms, 2.15 and 0.86 Tk for large layer farms, 2.14 and 0.19 Tk for small broiler farms and 2.18 and 0.36 Tk for large broiler farms respectively and implied that layer poultry farms were more profitable than broiler poultry farms.

Karim (2000) studied the performance of broiler farms at Bajitpur Upazila of Kishoregonj district in terms of profitability and sustainability under contract system in areas of Bangladesh. This study showed that total costs per bird per batch were estimated at 78.43, 78.51, 78.32 and 78.31 Tk for small, medium, large and all farms respectively. It was found that the variable costs accounted for the major part of the total costs. The

variable costs per bird per batch for small medium, large and all broiler farms stood at 71.33, 71.81, 71.98 and 71.75 Tk respectively, which accounted for 10.95%, 91.47%, 91.90% and 91.62% of their respectively total costs. On the return side, the average gross returns per bird per batch stood at 89.21, 89.40, 90.71 and 89.87 Tk for small, medium, large and all farms respectively. Gross margins per bird were 17.88, 17.56, 18.83 and 18.12 Tk for small, medium, large and all broiler farms respectively. The net returns per bird for small, medium, large and all farms were 10.80, 10.85, 12.40 and 11.75 Tk respectively. Findings of the study clearly indicate that all the broiler farms made good profit. However the large farms earned a little higher profit.

Talukder et al. (2000) conducted a study to analyze the relative profitability of BRAC and PROSHIKA supervised layer farms and farmers' own farms. The study revealed that the cash expenses per farm per year for BRAC and PROSHIKA supervised farms and farmers' own farms stood at 33,354, 24,441 and 28,065 Tk respectively, which accounted for 84.90%, 81.33% and 80.70% of their respective total costs. Additionally, annual average income earned from selling eggs stood at 16,323, 22,940 and 48,520 Tk for BRAC and PROSHIKA supervised farms and farmers' own farms respectively. Moreover, average annual return per Taka invested on cash and full costs basis were estimated at 0.55 and 0.33 Tk for BRAC supervised farms, 0.94 and 0.60 Tk for PROSHIKA supervised farms and 0.77, and 0.46 Tk for farmers' own farms. In general, all respective farms were earned considerable profits. However the PROSHIKA supervised layer farms earned higher profits than other respective farms.

Farooq et al. (2001) investigates different effective factors on the cost of production and net profit. Data were collected from 61 broiler farms (each one comprising 6 flocks) located in Mardan Division, NWFP in Pakistan during the year 1997-1998. Results showed that average costs of production and net profit per broiler were  $51.38 \pm 1.08$  and  $7.92 \pm 0.85$  Rs respectively. The mortality rate had a negative effect on net profit per broiler but did not affect cost of production who found that market age and flock size were negatively and positively associated ( $b = -1.06 \pm 0.536$ ; and  $b = 0.734 \pm 0.127$ , respectively) with net profit. In addition, net profit was shown lower value when the flock size was less than 1500 birds. Cost of production was reduced in optimally utilised sheds on concrete type floors and for broilers maintained under average hygienic conditions. Data from this study showed that net profit per broiler was higher on concrete floors, and in optimally utilised sheds and also from broilers maintained under good hygienic conditions.

Ahmed (2001) conducted a study on Comparative economic analysis of broiler production under Proshika supervision and Private management in some selected areas of Tangail district. The study revealed that total costs per farm per year stood at 153849.40 and 146325.55 Tk under Proshika supervision and Private management. The total costs per bird on an average were estimated at 72.53 and 70.38 Tk under Proshika supervised and Private managed farms. The variable cost per farm per year under Proshika supervision and Private management stood at 133363.70 and 133119.88 Tk respectively, which accounted for 86.69 and 90.97 per cent of their respective total. The total fixed cost per farm per year amounted to 20485.70 Tk for Proshika supervision and 15177.80 Tk for Private management. It is evident from the study that the gross returns per farm per year stood at 205623.39 Tk for farms under Proshika and Private management respectively, who was also revealed from the study that broiler raising under Proshika supervision and Private management, were profitable, but broiler production under Private management was more profitable.

Abdulmumin and Atwa (2003) found that the quantity of the chicken meat produced in the Beni Suef city, insufficient to the number of populations in the same city. As the study found lack of moral influence of farm management type used, whether rented or dependent on the amount of production. The study also found higher feed efficiency from those manufactured within the farm than the feed that is purchased ready. The study also found the importance of the effect of amount of used feeds, the number of days of operating cycles, and the number of work on the quantity of live chicken meats produced. They collectively found that there is a proven moral influence they also showed that there are a positive relationship between the amount of feeds used in this study and the amount of the resulting meat. Meanwhile, from their results, there were an inverse relationship between the number of days operating cycle and the number of working days with the amount of the resulting meat. By using estimation indicator for the sampled farmer costs, they found the optimum production that maximizes profit size is 17.5 tons of live chicken meat in the production cycle, to be given a profit 10,950.2 pounds capacity and about 87.5 tons of live chicken meat a year to give a profit of 54.8 thousand pounds a year.

Bhuiyan (2003) conducted a study comparing economic analysis of poultry production under supervision of ABFL and farmers own management in various selected areas of Kishoregonj district in Bangladesh. The study revealed that in case of broiler farm total cost per year stood at 833860.00 and 653952.00 Tk under ABFL supervision and

farmers own management. The respective figures of layer farm per 18 months were 3281098.00 and 709712.00 Tk. Additionally, the cash expenses of broiler farm per year stood at 771413.00 and 607177.00 Tk for ABFL supervised farm and farmers own management farm respectively, which accounted for 92.51 and 92.84 per cent of their respective total costs. The cash expenses of layer farm per 18 months were estimated at 2937367.00 and 6380011.00 Tk. On the other hand, the gross returns of broiler farm per year stood at 1101786.00 and 884482.00 Tk under ABFL supervision and farmers own management respectively. The average gross returns at layer farm per 18 month stood at 6266456.00 and 1008381.00 Tk. Thereafter, the net returns over full cost of broiler farm per year stood at 267926 and 230530 Tk under ABFL supervision and farmers own management respectively.

Sambidi, (2003) studied factors affecting plant location decisions of U.S. broiler executives, a national survey of broiler industry executives was conducted to analyze site-specific factors related to the broiler-complex location problem. Conjoint analysis was used to measure the relative importance of each attribute in the location decision. Three different conjoint models were constructed based on factors related to broiler growing, feed mill, and broiler processing enterprise. A bridged experimental design was used to link the three models. Result showed that distances between feed mill and growers, cost of feed ingredients, and community attitude toward the broiler industry were found to be the most important factors influence the location decision of broiler growing, feed mill, and broiler processing respectively. Results from bridging design indicated that cost of feed ingredients was the most important attribute affecting the location of a broiler complex. Cost of feed ingredients was found to be the most critical factor in the location decision of their broiler complex. This study concluded that Louisiana should analyze the factors that might lower the costs of importing feed and/or analyze other important factors affecting the broiler complex location decision such as grower concentrations, community attitude toward the broiler industry, and labor costs.

Alam (2004) studied backward and forward linkages of poultry farming in some selected areas of Saver Upazila under Dhaka District. This study was mainly conducted to understand the dynamics of poultry farm and to determine the cost and returns of poultry farming and explore the backward and forward linkages of the study. Backward and forward linkage effects created great potentials of capital investment by private entrepreneurs.

Bairagi (2004) Examined contract farming in a form of production which establishes relationship between agribusiness firms and the farmers. Aftab Bhumukhi Farm Limited (ABFL) in one of the commercial integrated farms that has introduced contract growing of broiler and layer production in 1994 and integrated it with a supply chain to serve the urban consumers. The efforts of the organization need to be studied in term of its effectiveness in raising the income and profitability of the contract growers. The study was undertaken to study the economics of broiler farming with special reference to an understanding of the supply chain management. This study identified problems and constraints associated with supply chain management in broiler farming under the contract system. It established the contract broiler farming linked with the supply chain management and suggested that ABFL should the experiences and brings about efficiency at the contract grower's level.

Tohura (2004) conducted a study on economics of small-scale commercial broiler farming in Sadar upazila of Rangpur District. The study revealed that on an average, the total cost per farm per year was 786615 Tk. It was found that the variable cost per farm per year stood at 774,689 Tk which accounted from 98.48 per cent of total cost. The total fixed cost per farm per year amounted to 11926 Tk which shared 1.52 percent of total cost. It is evident from the study that the gross return per farm per year stood at 1176643 Tk. The net return over total cost per farm per year was calculated at 390028 Tk. Collectively, based on the findings of the study, some recommendations were made for the development of broiler farming in Bangladesh.

Begum (2005) carried out a study to estimate the relative profitability of small, medium and large categories of broiler and layer farms and to determine the contributions of key variables to poultry income, who found that total costs per broiler per farm per year stood at 238,051 Tk, 525,095 Tk, 663,943 Tk and 1,420,630 Tk for small, medium, large and all farms respectively. For layer farms total costs per farm per year stood at 215,255 Tk, 432,179 Tk, 535,129 Tk and 1,192,688 Tk for small, medium, large and all farms respectively.

Ahmed (2006) studied the economics of poultry production in Khartoum State of Sudan. The data collected by questioners with 30 broiler producers. The cost of feed was the main cost constituting about 63.2% of the total cost, followed by the cost of one day-old chicks representing about 18.6%. The results showed that the farm size, feed cost, egg price and poultry diseases were the major factors that influenced production of broilers.

The study also showed that the main broiler production problems were poultry diseases, electricity, water shortage and the high cost of feed.

Bandara and Dassanayake (2006) discovered the profit function regression model as a decision support tool in small scale commercial broiler production. The study was carried out in major broiler production areas in Sri Lanka. Data were collected from 120 broiler rearing farmers. They found in the field, the most important factors affecting profit in this study were the feed conversion ratio and the price of feed. It was also found that excepted cost of labor and all the other factors were statistically significant in the model and thus were the determinants of the profitability.

Rajendran et al. (2008) analyzed economic aspects of broiler farming in commercial broiler farms located in and around Palladam area of Coimbatore district in Tamil Nadu. The data were collected by personal interview method using a standard pre-tested questionnaire. A total of 483,900 broilers reared in 56 broiler farms representing three farm sizes. The cost of production per broiler recorded in the present study was 60.97, 58.69 and 55.97 Rs in small, medium and large farms, respectively. They indicated that the production cost decreased with the increase in farm sizes.

Akhter and Rashid (2008) assessed a comparative efficiency of Aftab Bahumukhi Farm Limited supervised broiler farms and farmers' own managed broiler farms. Data were randomly collected from selected 90 broiler farmers of which 45 were ABFL supervised farmers and 45 were own managed farmers. Cobb-Douglas stochastic production function and cost frontier function were applied to determine the technical, allocative and economic efficiency of broiler farming. Technical and economic inefficiency effect models were also estimated. The estimated mean of technical efficiency of all farms was 94.06 percent. The estimated mean of allocative efficiency was 96.76 percent for all farmers. The mean of economic efficiency was estimated at about 91.00 percent for all farmers.

AL-Masad (2010) studied factors effecting on profits of broiler production in Amman, Jordan. A total of 120 broiler farms were randomly selected for the purposes of this study. A profit function regression model was used as a decision support tool in commercial broiler production. The most important factors affecting profit in this study were the price of feed and the feed conversion Rate, the correlation matrix of the variables in the regression model shows stronger negative relation between the dependent variable

(profit) and these two factors compared to the other variables. The correlation coefficients were 0.301 and 0.357 for price of feed and FCR, respectively.

Hamra (2010) studied profitability of broilers production. A farm and its facilities were rented to grow and finish the flock for market delivery in South Lebanon, in the Marjayoun Valley during 2009. Production (input) costs and sales (output) prices were used to determine the feasibility of growing broilers in the region. A Sensitive analysis was used to test the robustness of this feasibility under several different pricing scenarios. This analysis showed that the operation is predicted to be profitable, or at least break even, at all the forecasted extremes of input and output prices including low meat prices coupled with high feed and chick costs.

Singh et al. (2010) conducted a study on the economic analysis for broiler production in Punjab, India. The cost and return analysis of different sizes of broiler farms was carried out based on the primary data collected from 140 broiler farmers. The data were analyzed by simple averages, percentages and standard procedures. Results showed that the total cost of meat production per bird was found at a highest level on small broiler farms, followed by medium and large farms. The net returns per bird over the variable costs were recorded at a highest level on large farms and economies of scale prevail on these farms. The small broiler farms were observed highly sensitive to increase in costs and decrease in net returns.

Hossain et al. (2010) analyzed the cost, return and profitability of broiler production in Mymensingh district, Bangladesh. This study was mainly based on primary data of 60 samples, selected purposively from nine villages under Trishal Upazila. For the analysis of data, tabular and production function technique were used. The findings revealed that broiler production was a profitable enterprise. Cobb-Douglas production function was also applied to explore the specific effect of the factors on broiler production. It was observed that most of the included variables had statistically significant impact on broiler production. Out of six variables included in the function, three variables were counted to have a positive impact on return.

Shaikh and Zala (2011) studied the production performance of different sizes of broiler farms by collecting data from 60 broiler producers in Anand District of Gujarat district during 2005. Though broiler production is capital-intensive, it has been found profitable. The average cost of production per kilogram live weight of broiler as 32 Indian Rupee. The major cost components were found as feed cost 58.6%, chick cost 21.5%. The

net profit per broiler as well as per kilogram body weight was found as 7.20 and 3.59 Rs, respectively for the sample as a whole. The benefit-cost ratio was worked to be 1.11 for the sample as a whole and it increased with the increase in farm-sizes.

Areerat-Todsadee et al. (2012) studied the efficiency score of broiler farms in northern Thailand. This study considered trans-log stochastic frontier model in which the effects of technical inefficiency were defined by the Battese and Coelli model, which imposed a common temporal pattern upon all broiler farms. Results showed that feed, bird stocks, operating costs, and other costs were important factors to broiler output in the Chiang Mai Province. They also showed that the socio-economic situation of farmers appears to have effects on technical efficiency at the farm level. They suggested that there is an opportunity to improve broiler production in the region by adopting appropriate management practices.

Mustafa and Ashfaq (2012) discovered the profitability of broiler in the Faisalabad using profit function regression model. In this study, price of purchase chicks, cost of feed, cost of labor, mortality rate, feed conversion rate (FCR) and cost of building and machinery depreciation, electricity, heating and cooling charges and rent on the profit of the broiler producer were investigated. Results of the study showed that each of those factors is associated with producer's profit. Amongst the independent variables entered in the model, only the statistical association of "labor costs (X3)" with the dependent variable was not found to be statistically significant at  $p < 0.05$ , and it was therefore dropped from the model. The rest were had a strong statistical association with profit per kg live weight ( $p < 0.05$ ). R2 value indicated 72 percent of the variation of the profit of the farmers due to effect of the independent variables.

Al-Khraisat (2013) carried out a study of economic analysis of chicken meat production in Amman district, Irbid zone in Jordan during 2009-2010. This study was based on primary data collected from 98 poultry farms. The production function was used to analyze the collected data. Majority of poultry farms 39.80% were small farms and the farmers were forced to rely on non-institutional source of credit. Seasonal and cyclical price fluctuations in input and output were found high. The estimated input/output ratio of poultry production was 1: 1.39 (in winter) and 1: 1.75 (in summer) without marketing costs as they were added to the live weight sold to the consumer per kilogram live weight, which was estimated to be 0.15 to 0.2 JD/kg.

Ikikat Tumer (2013) studied effects of factors on mortality rate within the broiler farms in Mersin province, Turkey. The chi-square test was implemented to the acquired information. Results showed that the fewer mortality rates of animals were observed whilst the price range for the production duration will be increased. The average death rate was found as 9.68. With the possibility 7%, the average production increased to 508 kg/period for each management.

Al-Tarawneh et al. (2013) examined the profitability of broiler production in Amman city, Jordan. The study was based on primary data collected from 149 broiler farmers during 2012. Factors affected the production of Broiler enterprise in the respective area included number of birds, quantity of consumed feed, mortality rate, costs of veterinary service and medicine. Marginal analysis of input showed that the farmers were inefficient in their production practices as indicated by the ratio of marginal value product (MVP) and marginal factor cost (MFC).

Dziwornu (2014) studied the analysis of factors affecting competitive advantage of broiler agribusinesses in Ghana, using multiple regression analysis. A multi-stage random sampling technique, structured questionnaire was used to collect farm level data from 441 small-scale commercial broiler agribusinesses in the Greater Accra, Ashanti and Brong Ahafo Regions of Ghana. The average variable cost of producing a broiler at an average market age of 57 days was 8.48 GH (5.93 \$). Of this cost, feed and one day-old chick costs together constitute about 72%. Thereafter, feed cost, one day-old chick cost and market age of broilers were positively and significantly affected costs of broiler agribusinesses while utilization of production capacity was negatively and significantly affected costs.

Carvalho et al. (2015) investigated factors affect the economic efficiency of broiler production using the analysis of stochastic profit frontier function. Data were collected in 48 broiler breeder farms contracted by a commercial company located in southwestern Paraná, Brazil. Results showed that the cost of electricity, as well as area of occupied land, production scale, and feed intake per hatching egg were significantly affected the economic efficiency of the broiler breeder farms in Southwestern Paraná, Brazil.

The present study is exploring a new dimension which is very important at present situation to know the economic analysis of cost for chicken meat production. Moreover, this study was conducted using latest data to get recent information regarding production and will help both the researchers and the farmers concerned with broiler farming.

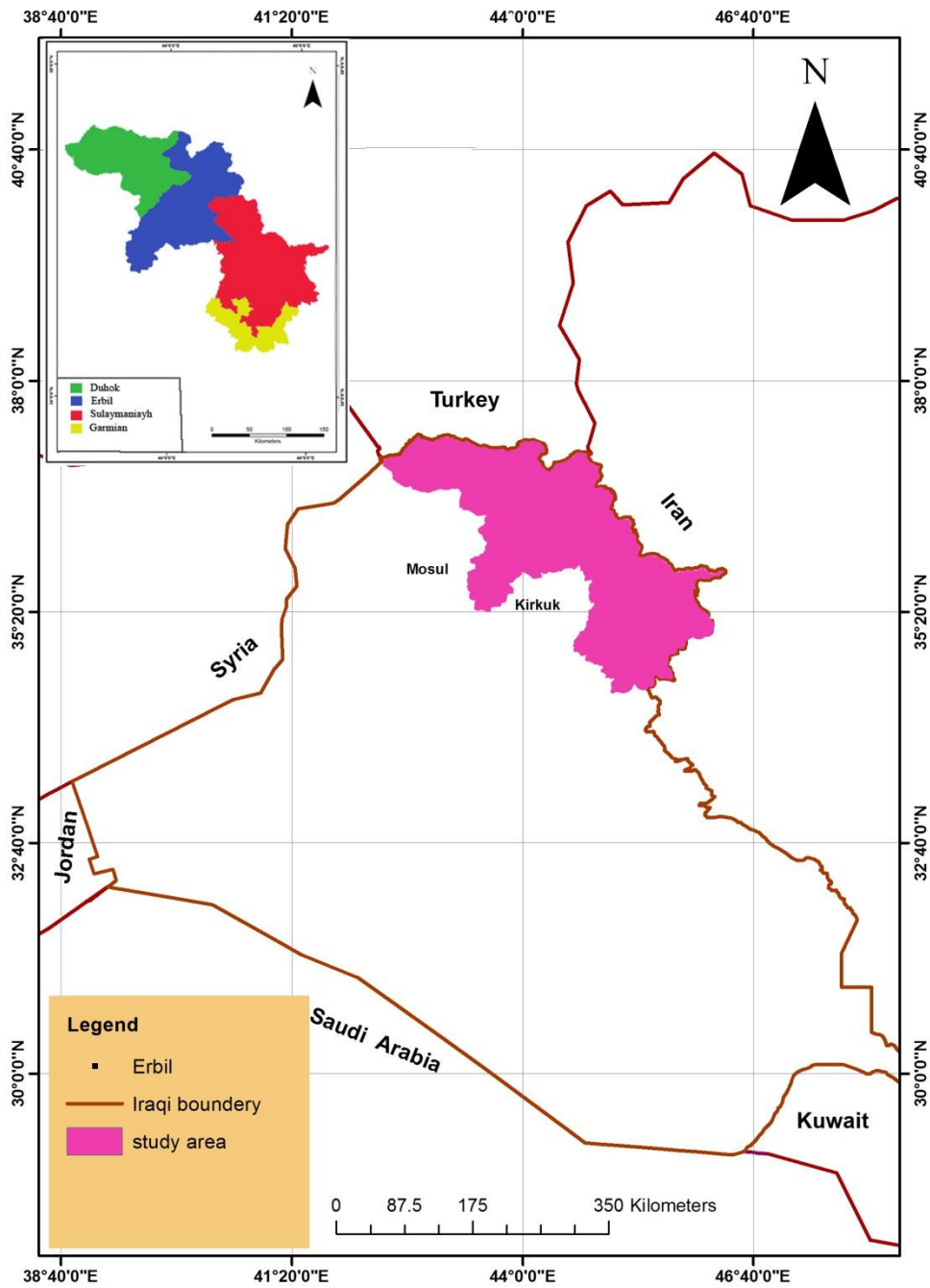
### **3. MATERIALS AND METHODS**

The present study was combined two methods; first, socio demographic characteristics of farmers were analyzed by using descriptive statistics that was taken from the independent variable. Secondly, through the use of popular version of Cobb-Douglas function of production in order to estimate the chicken meat production using SPSS statistical software. For this purpose, the effect of the independent variables of costs on the production of chicken meat is analyzed using cross sectional data of farmers for the towns Erbil, Sulaymaniyah, Duhok and Garmian in Northern Region of Iraq.

#### **3.1. Study Area**

The area of study was three governorates and an autonomous management (Erbil, Sulaymaniyah, Duhok and Garmian) in the northern region of Iraq. The capital of Northern Region of Iraq is Erbil. It was located at the border of Syria to the west, Turkey to the north and Iran to the east, and also along with the middle cities (Diyala, Salahaddin, Kerkuk and Nainawa) to the south of Iraq. The northern region is a greatly mountainous, according to the top point being a 3,611 m points, it is known locally as Chekha Der. These mountains are a part of the biggest Zagros mountain chain. There are several rivers running and flowing through mountains of the region making it characterized by its plentiful water, picturesque nature and fertile territories. The Small Zab and the Great Zab flow from the east to the west of the region. The Dijla River enters Iraq from the northern region after its streaming from Turkey (King et al., 2005).

The atmosphere of the northern region is semi-dry continental, very cold and wet in winter and hot and dry in summer. The most stunning season in the Northern region is spring and it is a time when Kurds celebrate Nawroz, the Kurdish New year, at the spring or Vernal Equinox. Imply excessive temperatures variety from 13-18 °C (55-64°F) in March to 27-32°C (80-89°F) in May. Also the summer season months from June to September are warm and dry. Within the July and August imply highs are 39-43°C (102-109°F), and regularly to attain 50°C (122°F) (King et al., 2005).



**Figure 3.1.** The study area (pink regions) and Iraqi boundaries (CSO, 2013)

The farm site from the study area has been picked at the north of Iraq, from the cities Erbil, Sulaymaniyah, Duhok and Garmian administration region. Indication from results shows that, 39% of the total number of farms in the region was found in Sulaymaniyah province, 37% in Erbil and 17% in Duhok province and 7% in Garmian. It

is found in the Table 3.1 below that most of farms are located in both cities of Erbil and Sulaymaniyah which they compromise around 76% of overall production farms.

**Table 3.1.** The sample of research distribution

City	Frequency	%
Erbil	315	36.60
Sulaymaniyah	337	39.20
Duhok	149	17.30
Garmian	59	6.90
Total	860	100.00

Agriculture is the main occupation in the study area. The study area is basically an intensive barley and wheat growing area. Barley and wheat are grown in one season simultaneously which is the spring season. This area is also grown with winter crops, such as potato, cauliflower, bean, chili, tomato, cucumber, aubergine, pulses, and many other vegetables.

### 3.2. Material

The primary data were collected from the farm owners in a face-to-face interview by the northern region statistically office (KRSO) team during time 2013-2014, in collaboration with the directorate of animal source of northern region, through personal interview method using questionnaire that is specially designed to achieve the objectives of the study. The population of the study was the whole broiler farms in northern region of Iraq.

### 3.3. Method

#### 3.3.1. Descriptive statistics

Descriptive statistics have been applied to analyse and gift the farm/farmer characteristics and rank the responses of the farmers with reference to positive questions. The descriptive statistics were included frequencies, percentages, and standard deviation. Furthermore, exploratory data analysis tool such as tables and figures were hired to make the important graphical instance of the data. Moreover, Chi-square ( $X^2$ -test) was also used to look at two groups and more than two groups.

### 3.3.2. Production function

In this study Cobb-Douglas was used to identify variables affecting on this poultry broiler production cost. In 1928, Cobb and Douglas introduced a famous two factor production function, nowadays is called Cobb-Douglas production function, in order to describe the distribution of the national income by help of production functions. Two factors Cobb-Douglas production function is given by;

$$Y = bL^kC, \dots\dots\dots (1)$$

Where  $L$  denotes the labor input,  $C$  is the capital input,  $b$  is the total factor productivity and  $Y$  is the total production. The Cobb-Douglas production function is especially notable for being the first time an aggregate or economy-wide production function was developed, estimated and then presented to the profession for analysis (Wang and Fu, 2013). Many attempts have been made to find algebraic forms that are theoretically appropriate and empirically useful to describe and estimate the functional relationships between inputs and outputs (Vilcu, 2011). Each alternative functional form has advantages, but each usually imposes certain limitations on the input-output relationships. Factor demand and output supply functions are formulated within the framework of the Cobb-Douglas profit function and they have been widely used to study technological and production behaviors of farm firms.

The Cobb-Douglas production function attempts to identify one or more variables that influence the partial production elasticity of one or more input. Such variables may represent different sizes, different levels of managerial ability, different types of capital, or different qualities of labor. The only restriction imposed by the function is that the variable should be quantifiable. Generally, the production function will not be homogeneous after the variable is introduced. For instance, if I have a continuous observable variable and it is believed to influence one or more of the partial production elasticity (Ulveling and Fletcher, 1970).

In microeconomics and macroeconomics, the production functions are positive non constant functions that specify the output of a firm, an industry or an entire economy for all combinations of inputs. Almost all economic theories presuppose a production function, either on the firm level or the aggregate level. Hence, the production function is one of the most key concepts of mainstream neoclassical theories. By assuming that the maximum output technologically possible from a given set of inputs is achieved, economists always

use a production function in analysis abstracting from the engineering and managerial problems that are inherently associated with a particular production process (Wang and Fu, 2013).

In case of a Cobb-Douglas production function, the feasible estimation of return to scale is restricted both by the type of output growth and by the type of collinearity which occur during the estimation process. In this context, it is defined that the indicator “Reference value of returns to scale” is used to surpass difficulties generated especially by harmful collinearity. Having in mind the above-mentioned indicator, it is proposed that an analysis methodology in order to emphasize the role of proper elasticity of an output related to production factors, on the one hand and the impact of type of collinearity in obtaining the estimated returns to scale, on the other hand. In many papers dealing with the problem of returns to scale, the Cobb-Douglas production function is frequently used, due to its qualities. The form of Cobb-Douglas production function in general case, with n production factors.

Finally, in this study, the statistical technique was used as a supplement to the tabular technique. In order to determine effects of the most important variables to the returns of poultry farms, Cobb-Douglas production function was chosen since it fits well. In fact, it is widely used by many researchers in their economic studies. An advantage of the model is its simple pattern to calculate and determine the elasticity of production that can directly be obtained from the co-efficient. The following model was used in this study;

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} e^{U_i} \dots\dots\dots (3)$$

The function was estimated by transforming into natural log form;

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + \sum_{i=3}^n b_i \ln X_i + U \dots\dots\dots (4)$$

Where,

Ln is the natural logarithm, Y is gross return (ID), a is constant or intercept value, i are essential parameters for associated variables, x are feed cost (ID), day-old chick cost (ID), fuel cost (ID), electricity cost (ID), veterinary cost (ID), labour cost (ID), feed price (Ton), day-old chick price (ID), mortality rate, age of chicken market (day), hiter (1; 0), feed type mad in the farm (1; 0), pad for cooling system (1; 0), U are error terms and b<sub>1</sub>, b<sub>2</sub>, b<sub>3</sub>...; are regressions co-efficient of respective variables.

### 3.3.3. Profitability

Farm budgeting model became constructed to decide the profitability of broiler production; it is the distinction between the gross revenue and total fee of production. Total cost of production is the total prices incurred for the duration of the production period. This model consists of variables and fixed costs and its miles are expressed as;

$$GP = GR - VC$$

Where

GP is gross profit, GR is gross revenue and VC is variable cost of production.



## **4. RESULTS AND DISCUSSION**

### **4.1. Socio Demographic Characteristics of Farmers**

This chapter contains the analysis of data concerned to socio economic characteristics of farmers, profit and cost of poultry production in northern region of Iraq. Average yields and prices at the time of survey were used in the analysis. There were certain characteristics of poultry producers that affect their access to the factors of production and accordingly the poultry production. These characteristics are experience and occupation. In spite of the positive responses to most of the questions, the respondents were conservative in answering questions regarding their incomes.

#### **4.1.1. Educational level of workers**

Education plays an important role for broiler farm workers and helps a worker to have up to date information about the existing modern techniques in line with changes in various management practices. It enables a man more capable to manage scarce resources and hence to earn maximum profit (Miah, 1990).

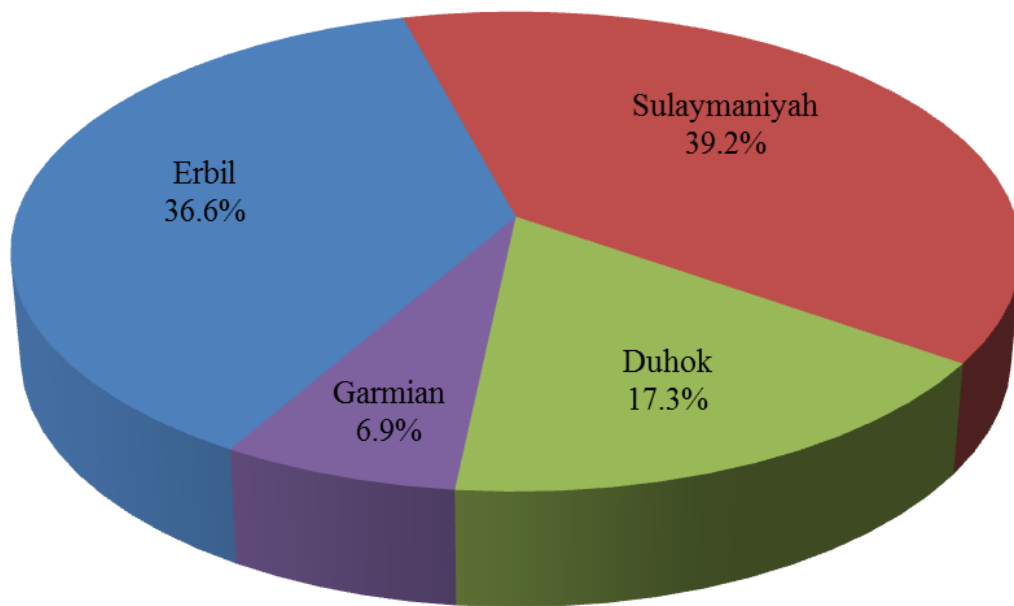
The educational level of the broiler farm workers were categorized into six categories; (i) illiterate, (ii) up to literate, (iii) up to primary school, (iv) up to secondary school, (v) up to high school and (vi) Institutes and above. The educational level of the broiler farm workers of the study area is shown in (Table 4.1). This table shows that the most of respective workers of the selected broiler farms were well educated. It can be seen from the table that only 18.44 % workers were illiterate, 46.46 % were literate, 24.31 % were at primary level, 5.61 % were at secondary level, 3.14 % high school level and about 2.04 % were educated up to graduate level.

**Table 4.1.** Educational level of workers

Education Level	Number of Workers	%
Illiterate	588	18.44
Literate	1481	46.46
Primary School	775	24.31
Secondary School	179	5.61
High School	100	3.14
Institutes and More	65	2.04
Total	3188	100.00

#### 4.1.2. Farm site

The farm site from the study area was picked at the north of Iraq, from the cities Erbil, Sulaymaniyah, Duhok and Garmian. Figure 4.1 shows that 39.2% of the total number of farms in the region was selected in Sulaymaniyah province, 36.6% in Erbil, 17.3 % in Duhok province and 6.9 % in Garmian. The table demonstrates that the most of the farms were located in both cities of Erbil and Sulaymaniyah which they compromise around 76% of overall production farms. This may be due to the high population rate within those cities In comparison to others. Also, the revolution in the poultry industry has started from these two cities in line with opening two big poultry farms which they has been supported by the local government. Then they have been given to the private sector.



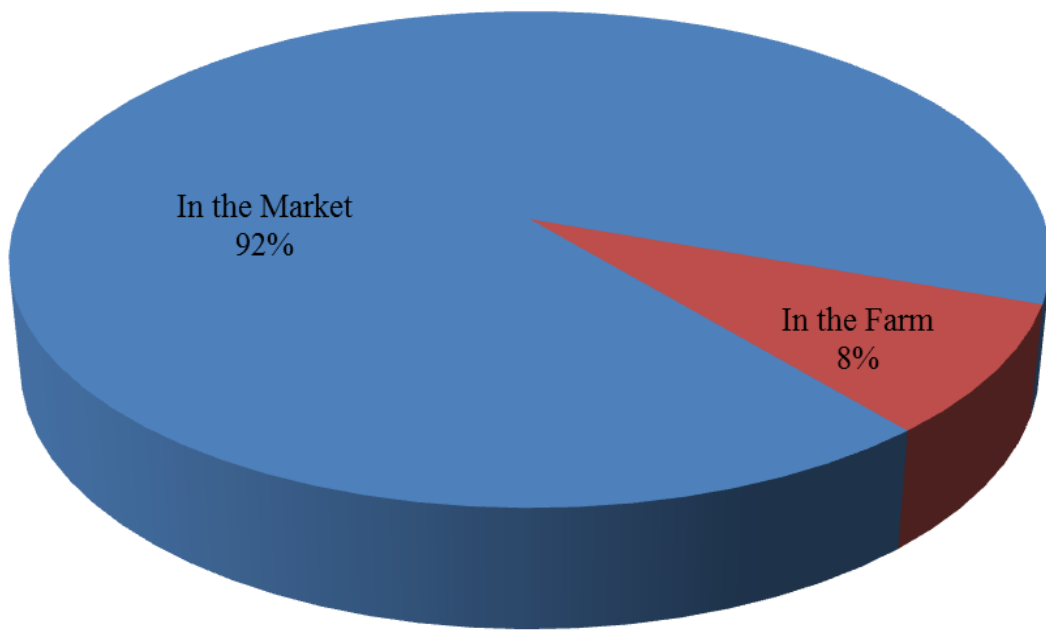
**Figure 4.1.** Distribution of farms according to regions

#### 4.1.3. Feed type

Poultry feed, which is the main part of this study and it is the most important measurement because it takes big costs for growing broiler chickens. Feeds can also be a mean for the transportation of diseases.

Extra nutritional nutrients are frequently excreted within the feces. Higher amounts of nitrogen and phosphorus in feces may additionally need to reason a chance to contamination the environment. For this reason, managing feed formulation for accuracy is a crucial step within the chicken farm management to guard the surroundings, and decrease running prices (Karcher, 2009).

Within the study area about 8% of poultry feed was produced onsite while about 92% are produced in the factories or bought from the warehouses. The results show that the most poultry feeds were bought in the warehouses which subsequently increase costs as well as risks of transmitting diseases to the field (Figure 4.2).



**Figure 4.2.** Type of feed

#### **4.1.4. Farm capacity**

Farm capacity is mainly important for as much the farm capacity are bigger the cost of production decreased. This is in relation with the world wide standards and systems for the breeding of suitable broiler chicken meats. The result shows that 36.2% of total number of farms was small sized, 43.1% were medium, 10.2% were large size and 10.5% were very large-sized farms. This may be due to the limited sources of capitals or practices of other activities with poultry production in the same farms and/or due to high cost of inputs especially day-old chicks and feed costs (Table 4.2).

The measurements of the breeding broiler chickens per meter square were made in two ways; firstly, by the number of birds for the farms that have average weight between 2–2.5 kg during the sell at markets and within this type (10-12/m<sup>2</sup>) bird per meter square. Secondly, it was be measured by the weight of the birds during selling process which was between (24-28 kg/m<sup>2</sup>).

If the numbers are less than the numbers mentioned above, the costs of production are increased while more than the number mentioned above, there are risks of spreading diseases and increase in the mortality rate.

**Table 4.2.** Capacity of farms

Farm Capacity	Frequency	%
Less than 10000 birds	311	36.20
10000-15000 birds	371	43.10
15001-20000 birds	88	10.20
More than 20000 birds	90	10.50
Total	860	100.00

**4.1.5. Experiences of farmers**

Table 4.3 indicates that about 48.6% of the sample units were reported to have less than 6 years of experiences in running poultry units, whereas 23.8% of the units reported to possess more than 6-10 years of experiences. However, 27.6% of the unit reported of having more than 10 years of experience. The proportion of experiences was varied across the size of poultry units.

**Table 4.3.** Experiences of farmers

Experiences (years)	Frequency	%
Less than 6	418	48.60
Between 6–10	205	23.80
More than 10	237	27.60
Total	860	100.00

**4.1.6. Distance of broiler farm with another broiler farm**

It is interesting note that about 18.6% of the poultry farm are distance between them less than 500 m, this violation of the laws establishing the poultry fields and must be at least 500 m this is important to control diseases which transmitted through the air. However, about 51.2% of the poultry units are distance between them 500-1000m and whereas about 30.2% of the poultry units are distance between them above 1000 m. (Table 4.4).

**Table 4.4.** Distance farm with another farm (m)

Distance farm group	Frequency	%
Less than 500	160	18.60
Between 500-1000	440	51.20
More than 1000	260	30.20
Total	860	100.00

**4.1.7. Income**

Results indicate that about 12.9% of the sample units reported to have less than 50 million Iraqi Dinars (ID) of income in running poultry units, whereas 36.4% of the units reported of having more than 50-75 million ID income, whereas 24.5% of the units reported of having more than 75-100 million ID income and whereas 26.2% of the unit reported of having more than 100 million ID (Table 4.5).

**Table 4.5.** Income groups

Income groups	Frequency	%
Less than 50 Million	111	12.90
50-75 Million	313	36.40
< 75-100 Million	211	24.50
More than 100 Million	225	26.20
Total	860	100.00

**4.1.8. Mortality rate**

This part investigated the factors at the death rate in poultry farms in Northern Region of Iraq. This study additionally investigated using pads on the effectiveness of broiler manufacturing and broiler location choice and its impact death rate in poultry broiler farms.

In the controlling of poultry fields, possibly one of the most troubles stages is the organization of the anew introduced herd. For the action to be gainful, a good disease avoiding program would be offered for the newly announced chicks to prevent from any

future damages. Diseases can be spread out via newly introduced chicks, humans, other birds, or polluted tools. Prevalent disease from the starting is important for the winning of the process (Mobley and Kahan, 2007).

Vaccination is an actual road to minimize the negative influence of diseases that may cause damages in a poultry procedure. Sickesses may be due to microorganism, viruses, fungi, mycoplasma protozoa and parasites. Viruses are the number one reason of poultry disease and are believed to be the largest threat to poultry fields. Viral diseases can be minimized by correct purification on the field, biosecurity measures, and vaccination of the chicks and chickens (Farran et al., 2009).

Viruses can produce numerous diseases; the chief ones contain Newcastle disease, Fowl Pox, Marek disease, Avian Encephalomyelitis Laryngotracheitis, Fowl Cholera and Infectious Bronchitis (Jacob et al., 1998). Vaccination is generally investigated to prohibit Marek's disease, which can infect laying hens and hence, a whole herd if the eggs are spoiled.

There are vaccinations of various ways. A few vaccines are handled through consuming water; some vaccines can be sprayed to enter drug into the nostrils and eyes at form of antibodies. Some others are injected with the aid of using an automatic syringe injects within the neck (Jacob et al., 1998). Chicks are generally vaccinated between two to six weeks of ages, depending on kinds of vaccines and diseases. Some vaccines are promoted as admixture to prevent numerous diseases.

Several ways of vaccinations have been recently advanced in the United States. For example in-ovo vaccination has made the route more labor effective. This way vaccinates the embryo in the egg at the hatchery; after that there isn't any necessity to vaccinate another time on the field (Williams, 2007).

Additionally, the satisfactory duration of broilers marketing is on the age of sixth weeks than at the age of fifth and seventh thru ninth weeks. The mortality rate performs an essential position in figuring out the general profitability of broiler flock. Increasing in mortalities rate from 2.5 to 10% will result in lowering the internet profit in keeping with broiler (Kitsopanidis et al., 1996; Bhende, 2006).

After hen farm removal from the chickens, it needs to be easily wiped and cleared. That the swages system unique relying on the ground type and shape of fowl halls. Masses of disinfectants could be used for smoothening and sanitization of the hen corridor.

Moreover, the disinfectant needs to be selected because of it need to be to keep away from issues with newly brought flocks of chicks (Smith, 1999).

According to results, proportion of the poultry farms who've death rate less than 8% were 15.1% of producers. Proportion of the farms that have death rate among 8%-15% death was 32% and more than 15% death rate was 52.9%, the average percentage of mortality rate was 18.5% (Table 4.6). According to Akbay and Azeez (2016) average percent of death rate was found as 15%. On the other hand, Ikikat Tumer (2013) studied the effects of factors on the death rate in the broiler farms in Mersin province of Turkey and the average percent of mortality rate was calculated as 6.8%.

**Table 4.6.** Mortality rate groups

Mortality Rate Groups	Frequency	%
Less than 8%	130	15.10
8%-15%	275	32.00
More than 15%	455	52.90
Total	860	100.00

#### **4.2. Broiler Production Cost**

In poultry raising various inputs are required like day-old chicks, feeds, labour, veterinary expenses (vaccine, medicine and veterinarian fee), electricity, transportation, tools and equipment, litter, housing, operating capital and land. The total costs per year per one kg were classified. On the return side, gross return, return per one kg/ID invested on the basis of cost were estimated and analyzed in this section of the study (Table 4.7 and 4.8).

The control of broiler breeders needs to clear up numerous contradictions of this activity, including animal welfare, productiveness, manufacturing, reproduction, rising sicknesses, customer market, and prices and income. The primary task confronted by manufacturers is to discover the balance between these factors and excellent-track all factors on the way to growth profitability (Mendes et al., 2014).

Feed expenses have a main effect at the profitability of chicken farm operations. The excessive price of feed is associated with the power and protein contents of the food regimen. In an unbalanced diet, with an excess protein, feed would cost greater, subsequently increasing production expenses. With low protein diets, chickens would take more time to develop, and will be at a greater chance of infecting diseases. Chickens have different nutrient (feed) necessities relying on their kind, age, and intercourse. Rations formulated to fulfill nutrient necessities produce quicker developing, more healthy chickens, and as a consequence better products and greater profits (Farran et al., 2009).

### **Feed Cost;**

Feed cost was the major cost item of broiler farms. Feed of poultry included, such as rice bran, wheat bran, bone meal, fishmeal, oil cake, salt, mineral, vitamin, oyster shell, etc. In this study the average feed cost per one kg was calculated 1769.28 ID and just represented about 65.08% of total costs. The data also reveals that the comparison for feed costs between cities Erbil, Sulaymanyah, Duhok and Garmian were 1789.30, 1821.73, 1631.80 and 1711.41 ID/kg respectively, high feed costs were recorded in Sulaymanyah and low feed costs were counted in Duhok (Table 4.7 and 4.8). This result is almost similar to the Begum (2005), Shaikh and Zala (2011) and Dziwornu (2014) that they demonstrated feed costs in their studies.

### **Labour cost;**

One of the biggest cost items for poultry farms is labour. In our study the cost of farm operation, the services of both hired and family labour were taken into consideration. The labour was mainly used for feeding, watering, cleaning of house, changing litter etc. In case of poultry broiler farms the costs of hired labour was 122.96 ID/kg, alone represents about 4.38% of total cost and for the compare between Erbil, Sulaymanyah, Duhok and Garmian were 145.27, 110.11, 114.19 and 99.37 ID/kg respectively. The results observed high labour cost per one kg was in Erbil and low labour cost per one kg was in Garmian. This result corroborates Akhter and Rashid (2008), Hossain et al. (2010) found labour cost to affect broiler production cost in their study (Table 4.7 and 4.8).

### **Day-old chick cost;**

Cost of day-old chick is one of the essential cost items for the broiler farms. Day-old chick costs according to one kg of chicken meat were estimated at 409.78 ID and alone

represented about 15.66% of total cost, which were 437.62, 391.58, 364.20 and 480.28 ID/kg for Erbil, Sulaymanyah, Duhok and Garmian respectively (Table 4.7 and 4.8). The data showed the high cost in Garmian and low cost in Duhok. This result is almost similar to results were found by Begum (2005), Shaikh and Zala (2011) and Dziwornu (2014) in their studies.

#### **Veterinary cost;**

Veterinary expense is another important cost item of broiler production. Veterinary services included cost of vaccine, medicine and fees of veterinarians. Total veterinary costs were 141.55 ID/kg, alone represents about 4.85% of total cost. Also the veterinary costs were 160.49, 153.63, 76.70 and 135ID/kg for Erbil, Sulaymanyah, Duhok and Garmian respectively. Our data showed the high cost in Erbil and low cost in Garmian (Table 4.7 and 4.8). This result is consistent with Bandara and Dassanayake (2006), AL-Masad (2010), Al-Tarawneh et al. (2013).

#### **Electric cost;**

Electricity is very important for poultry farms for maintaining optimum temperature inside the poultry house. In case of broiler farm, electricity cost per kg stood at 27.33 ID, alone represented about 0.85% of total cost, which were between the Erbil, Sulaymanyah, Duhok and Garmian were 34.69, 27.10, 17.94 and 13 ID/kg respectively. Data from the present study showed that the high costs were counted in Erbil and low cost in Garmian (Table 4.7 and 4.8). This result agrees with Areerat-Todsadee (2012), Sambidi (2003) and disagrees with Carvalho et al. (2015).

#### **Fuel Cost;**

Fuel is very important for poultry farms for maintaining temperature inside the poultry house and used to run generator because in the study area the electricity is very bad. In case of broiler farm fuel cost per kg stood at 170.00 ID, alone represented about 5.88% of total cost, which were between the Erbil, Sulaymanyah, Duhok and Garmian were 188.89, 175.51, 130.05 and 138.58 ID/kg respectively. Recorded data showed the high cost in Erbil and low cost in Duhok (Table 4.7 and 4.8).

**Cost of repairmen;**

Repair costs are required for more necessary needs to rectify disabled machines and to maintain all other required tools. Repair costs per kg in case of broiler farm stood at 66.89 ID, alone represent about 2.02% of total cost, were 85.72, 66.10, 47.55 and 19.79 ID/kg respectively when results discovered high other cost per one kg in Erbil and low in Garmian (Table 4.7 and 4.8).

**Other costs;**

Other costs were required for transportation, buying water at necessary time for chicks, Sawdust, bonus to be given to labour for more output, imposed tax by the government and any other unforeseen cost constitute 33.57 ID/kg, constitute about 1.08% of total cost, were 38.19, 36.10, 24.48 and 17.51 ID/kg respectively when results observed high other cost per one kg in Erbil and low in Garmian (Table 4.7 and 4.8).

**Total cost;**

The total costs were worked out for broiler farms separately. On average, total costs per one kg live chicken meat was 2747.29 ID/kg. The study also reveals that the comparison for total costs between cities Erbil, Sulaymanyah, Duhok and Garmian were 2886.50, 2787.75, 2412.53 and 2618.33 ID/kg respectively. These results showed high total costs in Erbil and low total costs in Duhok (Table 4.7 and 4.8).

**Table 4.7.** Broiler production cost by provinces (ID/kg)

Provinces	Chick cost	Feed cost	Fuel cost	Electric cost	Veterinary cost	Worker cost	Water cost	Repairs cost	Other cost	Total cost
Erbil	437.62	1789.03	188.89	34.69	160.49	145.27	6.60	85.72	38.19	2886.50
Sulaymaniyah	391.58	1821.73	175.51	27.10	153.63	110.11	5.91	66.10	36.10	2787.75
Duhok	364.20	1631.80	130.05	17.94	76.70	114.19	5.62	47.55	24.48	2412.53
Garmian	480.28	1711.41	138.58	13.01	135.25	99.37	3.17	19.79	17.51	2618.33
Average	409.78	1769.28	170.00	27.33	141.55	122.96	5.93	66.89	33.57	2747.29
F-table (P-value)	40.75 (0.000)	10.34 (0.000)	14.80 (0.000)	17.97 (0.000)	53.93 (0.000)	40.46 (0.000)	0.57 (0.634)	60.04 (0.000)	27.05 (0.000)	26.13 (0.000)

**Table 4.8.** Broiler production cost by provinces (%)

Provinces	Chick cost	Feed cost	Fuel cost	Electric cost	Veterinary cost	Workers cost	Water cost	Repairs cost	Other cost	Total cost
Erbil	15.17	61.98	6.54	1.20	5.56	5.03	0.23	2.97	1.32	100.00
Sulaymaniyah	14.05	65.35	6.30	0.97	5.51	3.95	0.21	2.37	1.29	100.00
Duhok	15.11	67.64	5.39	0.74	3.18	4.73	0.23	1.97	1.01	100.00
Garmian	18.33	65.36	5.29	0.50	5.17	3.80	0.12	0.76	0.67	100.00
Average	15.66	65.08	5.88	0.85	4.85	4.38	0.20	2.02	1.08	100.00

### 4.3. Chicken Meat Production Profit

The main aim of the commercial broiler farms, like all other business is to earn profit by selling broiler birds. The subsidiary aim of these farms is to meet the demand for home consumption of meat. In this part of the current study, gross return, net return and benefit cost ratio were calculated.

#### Gross return;

Gross return was determined by adding income earned from sale of live broiler. The data of study represented that on an average, price per kg live broiler received was 2918 ID (KRSO, 2015). The gross returns for one kg were 2904.25 ID (Table 4.9).

#### Net return;

Net return on total cost was arrived by deducting all the costs from the gross return. Table 4.9 shows that net return per one kg stood at 156.96 ID.

**Table 4.9.** Net return of broiler production (ID/kg)

Provinces	Gross return	Cost	Net return
Erbil	2894.00	2886.50	7.50
Sulaymaniyah	2991.00	2787.75	203.25
Duhok	2748.00	2412.53	335.47
Garmian	2984.00	2618.33	365.67
Average	2904.25	2747.29	156.96

### 4.4. Factors Effecting on Poultry Broiler Production

#### 4.4.1. Descriptive statistics of variables used on production functions

The results showed that the descriptive statistics to analyses and gift the farm/farmer characteristics, and to rank the responses of the farmers with reference to positive questions were used the growing income dependent variable. Mean and standard deviation were calculated as a part of descriptive statistics. Further, exploratory data

analysis tool such as tables were hired to make the important graphical instance of the data (Table 4.10).

**Table 4.10.** Main characters of poultry broiler production

	Variables	Definitions	Mean	Std. Deviation
Y	Ln Gross Income	Gross income (ID)	18.17	0.43
X <sub>1</sub>	Ln Feed Cost	Feed cost (ID)	17.65	0.39
X <sub>2</sub>	Ln Chick Cost	Chick cost (ID)	16.19	0.39
X <sub>3</sub>	Ln Fuel Cost	Fuel cost (ID)	15.17	0.62
X <sub>4</sub>	Ln Electric Cost	Electric cost (ID)	13.14	0.87
X <sub>5</sub>	Ln Veterinary Cost	Veterinary cost (ID)	14.98	0.63
X <sub>6</sub>	Ln Labour Cost	Labour cost (ID)	14.93	0.41
X <sub>7</sub>	Ln Feed Price	Feed cost (ID)	13.59	0.06
X <sub>8</sub>	Ln Chick Price	Chick price (ID)	6.88	0.12
X <sub>9</sub>	Ln Mortality Rate	Mortality rate (%)	7.45	0.74
X <sub>10</sub>	Ln Age of Chicken sold	Age of chicken sold (Day)	3.98	0.11
X <sub>11</sub>	Hitter for Heating system	Hitter; 1; 0 other wise	0.17	0.38
X <sub>12</sub>	Feed type made in the farm	Feed type; 1; 0 other wise	0.08	0.28
X <sub>13</sub>	Pad for Cooling system	Pad; 1; 0 other wise	0.94	0.23

The focus of this chapter is to relate main factors affecting returns of broiler production operation in the framework of functional analysis. Cobb-Douglas production function was applied to determine the effects of resources used on gross returns of broiler production.

Production function refers to the relationship between the inputs of factor services and the output of rearing broiler. Rearing of broiler was considered to be explained by a number of input factors namely, feed, day-old chicks, fuel, electricity, veterinary expenses, hired labour, price, mortality rate, period of breeding, heating system, feed type and cooling system.

#### 4.4.2. Empirical results

To explore effects of variable inputs both linear and Cobb-Douglas production function models were initially estimated. The results of Cobb-Douglas models appeared to be superior on theoretical and econometric grounds. So this model was accepted.

Cobb-Douglas production function analysis was made by taking 860 broiler farms. The function was linearised by transforming it into the log linear model.

The estimated coefficient and related statistics of the Cobb-Douglas production function for broiler production are presented in Table 4.11. Major characteristics of the models are noted below;

- For testing the significance level of individual coefficient 1 and 5 percent probabilities were used.
- Total variation of output was measured by multiple co-efficient of determination of R<sup>2</sup>.
- Goodness of fit for different types of inputs was measured by F-values.

The coefficient of determination R<sup>2</sup> means that about 87.6% of variability in per unit variable cost was accounted by the explanatory variables in the model. Indeed, the explanatory factors in the cost function model explain competitive advantage of broiler producers. Thus, the cost function regression model was adequate. According to Gujarati (2004) in determining model adequacy, broad features of results, such as the value of coefficient of determination R<sup>2</sup> and F-value should be looked at. The F-value of chicken meat production (433.01) was highly statistically significant at 1% level implying that all the included explanatory variables were important for explaining the variation of income of broiler production.

#### **Feed cost;**

It can be seen in results that the regression coefficient of feed cost was positive and statistically significant at 1% level. This indicates that there is an opportunity to increase the gross return per farm by spending additional amount of money. An increase of 1 percent in money spent on feed keeping other factors remaining constant would result in an increase of return by 0.29% (Table 4.11). This result is consistent with Begum (2005), Singh et al. (2010), Shaikh and Zala (2011), Dziwornu (2014) and Carvalho et al. (2015) who found feed costs to be the one of main factors affecting the cost of broiler production in their studies.

#### **Day-old chicken cost;**

The regression co-efficient of expenditure on day-old chicks cost was positive. The coefficient was statistically significant at 1% level for broiler farms. Results of the analysis indicated that 1% increase in day-old chicks cost, keeping other factors constant, would

result in increased of gross return by 0.94% for broiler farms (Table 4.11). This finding corroborates with Begum (2005), Singh et al. (2010), Shaikh and Zala (2011), Dziwornu (2014) and Carvalho et al. (2015) who found one day-old chick costs to be the one of main factors affecting the cost of broiler production in their studies.

#### **Fuel cost;**

The results showed that the regression coefficient of fuel cost were negative and not statistically significant for broiler farms. The regression coefficient indicate that 1% increase in the fuel cost, remaining other factors constant, would result in 0,011% decrease in the gross returns for broiler farms(Table 4.11).

#### **Electric cost**

The regression coefficient of expenditure on electric cost was positive. The coefficient was non-statistically significant at for broiler farms. Results of the analysis indicated that 1% increase in electric cost, keeping other factors constant, would result in increased of gross return by 0.007% for broiler farms (Table 4.11). This result agrees with Areerat-Todsadee (2012), Sambidi (2003), disagrees with Carvalho et al. (2015).

#### **Veterinary cost**

The regression coefficient of veterinary expenses was negative and non-statistically significant. The regression coefficient of veterinary expenses implies that 1% increase in veterinary expenses, keeping other costs constant, would result in a decrease of gross return by 0.003% (Table 4.11). This result is consistent with Bandara and Dassanayake (2006), AL-Masad (2010), Al-Tarawneh et al. (2013).

#### **Labour cost**

The results showed that the regression coefficient of human labour were positive and statistically significant at 5% level for broiler farms. Also, the regression coefficient indicate that 1.00% increase in the labour cost, remaining other factors constant, would result in 0.028% increase in the gross returns for broiler farms (Table 4.11). This result corroborates Akhter and Rashid (2008) and Hossain et al. (2010) their found labour cost to affect broiler production cost in their studies.

**Price of feed;**

It can be seen from results that the regression coefficient of feed price was negative and statistically significant at 1% level. This indicates that there is an opportunity to increase the gross return per farm by feed source alternative. An increase of 1 percent in money spent on feed keeping other factors remaining constant would result in a decrease of return by 0.47% percent (Table 4.11).

**Price of day-old chicks;**

The regression coefficient of expenditure on day-old chicks cost was negative and the coefficient was statistically significant at 1% level for broiler farms. Results of the analysis indicated that 1% increase in day-old chick price, keeping other factors constant, would result in decreased of gross return by 0.90% for broiler farms (Table 4.11).

**Mortality rate;**

The result showed that the coefficient of mortality rate were negative and statistically significant at level 1%. It showed that, poultry deaths has a negative effect on gross returns, this is logical result. On the other hand the results of the analysis indicated that 1% increase in mortality rate would result in decreased of gross return by 0.244% for broiler farms (Table 4.11). This result is consistent with Ikikat Tumer (2013), Mustafa and Ashfaq (2012) and Akbay and Azeez (2016).

**Age of chicken sold;**

The result of the parameter estimate for marketing age variable in the model was also found to be positive and statistically significant at 1% level (Table 4.11). This indicates that more broiler producers deviate from the standard 42 to 56 days required for birds to be ready for market, more cost incurred. This in turn, reduces the competitive advantage of the broiler sector, as broilers are kept for longer days to gain the right market weight, the quantity of utilized feed might increase. This consequently increases the value of feed conversion ratio. Broiler producers therefore incur extra cost when they keep their birds for extra days beyond the required number of days. There is the need for broiler producers to feed broilers with high quality feed for the right market weight to be gained by week eight. This will improve the feed conversion ratio to reduce production cost and to make the sector gain competitive advantage. This result corroborates Rajendran et al. (2008) who found marketing age to affect broiler production cost.

**Table 4.11.** Cobb-Douglas production function analyses

Variables	Coefficients	Std. Error	t-test	Sig.
(Constant)	10.274	1.374	7.475	0.000
Ln Feed Cost	0.290***	0.034	8.424	0.000
Ln Chick Cost	0.944***	0.040	23.617	0.000
Ln Fuel Cost	-0.011	0.010	-1.057	0.291
Ln Electric Cost	0.007	0.006	1.139	0.255
Ln Veterinary Cost	-0.003	0.010	-0.331	0.741
Ln Labour Cost	0.028**	0.016	1.802	0.072
Ln feed price	-0.474***	0.108	-4.387	0.000
Ln chicks price	-0.902***	0.058	-15.451	0.000
Ln mortality Rate	-0.244***	0.009	-25.973	0.000
Ln Age of Chicken	0.412***	0.054	7.654	0.000
Hitter	0.025**	0.014	1.704	0.089
Feed made in the farm	0.009	0.019	0.481	0.631
Pad for Cooling system	0.032*	0.022	1.439	0.151
$R^2=0.878$ Adjusted $R^2=0.876$ F-test= 433.01, (P-value; 0.000)				

**Note:** \*\*\*, \*\* and \* indicate significance levels at 1%, 5% and 10% respectively.

## 5. CONCLUSION AND RECOMMENDATION

Iraq is an agrobased country in the Middle East region. Livestock is an important sub-sector of agriculture. Broiler is one of the most important segments of livestock sub-sector. At present a large number of broiler farms have been established on commercial basis throughout the country. Iraq is badly affected by the problems of unemployment and malnutrition. Poultry production can play an important role to solve great part these problems in the shortest possible time. The importance of broiler farming can be realized from two points such as economic point of view and nutritional point of view. It gives maximum return with minimum expense compared to other meat producing animals. In respect of nutrition, broiler meat is an excellent source of protein of high biological values as it contains the most nutritious components of human diet.

In recent years, broiler farming in Iraq has emerged as a profitable business and a number of people have undertaken broiler farming on commercial basis. So, investment are attracting broiler farming then others. The present study was designed to determine the factors affecting poultry production in the northern region of Iraq district with the following specific objectives;

- To determine the costs, returns and profitability of broiler enterprise.
- To compare cost of production between different cities in northern region of Iraq including Erbil, Sulaymaniyah, Duhok and Garmian.
- To study factors effect on cost of production and net profit per one kg chicken meat in northern Iraq.
- To make some suggestions for policy guidelines and recommendations for development of broiler production.

Keeping these objectives in view, the study was conducted in northern region of Iraq. The primary data were collected from the farm owners in interview during time 2013-2014. The present study was combined two methods; first, socio demographic characteristics information descriptive that was taken from the independent variable. Secondly, through the use of popular version of Cobb-Douglas production function in order was to estimate the chicken meat production using SPSS statistical software. For this purpose, the effect of the independent variables of costs on the broiler production is analyzed using cross sectional data of farmers for the towns Erbil, Sulaymaniyah, Duhok

and Garmian in northern region of Iraq. The findings suggested that most of the selected variables had statistically significant effects on growth return for broiler farming. Elevating of broiler became a profitable business within the take a look at region. However, there's a much wider scope for the development of broiler farming on this location.

In studying the socio-economic characteristics of broiler farmers and workers, the study shows that the most of respective workers of the selected broiler farms were well educated. It can be seen from the table that only 18.44 % workers were illiterate, 46.46 % were literate, 24.31 % were at primary level, 5.61 % were at secondary level, 3.14 % high school level and about 2.04 % were educated up to graduate level.

The results showed that the most of the farms were located in both cities of Erbil and Sulaymaniyah which they compromise around 76% of overall production farms. This may be due to the high population rate within those cities In comparison to others. Also, the revolution in the poultry industry has started from these two cities in line with opening two big poultry farms which they has been supported by the local government.

Poultry feed, which is the main part of this study and it is the most important measurement because it takes big costs for growing broiler chickens. Feeds can also be a mean for the transportation of diseases. Within the study area about 8% of poultry feed was produced onsite while about 92% are produced in the factories or bought from the warehouses. The results show that the most poultry feeds were bought in the warehouses which subsequently increase costs as well as risks of transmitting diseases to the field.

Farm capacity is mainly important for as much the farm capacity are bigger the cost of production decreased. This is in relation with the world wide standards and systems for the breeding of suitable broiler chicken meats. The result shows that 36.2% of total number of farms was small sized, 43.1% were medium, 10.2% were large size and 10.5% were very large-sized farms. This may be due to the limited sources of capitals or practices of other activities with poultry production in the same farms and/or due to high cost of inputs especially day-old chicks and feed costs.

The study indicates that about 48.6% of the sample units were reported to have less than 6 years of experiences in running poultry units, whereas 23.8% of the units reported to possess more than 6-10 years of experiences. However, 27.6% of the unit reported of having more than 10 years of experience, the proportion of experiences was varied across the size of poultry units.

It is interesting note that about 18.6% of the poultry farm are distance between them less than 500 m, this violation of the laws establishing the poultry fields and must be at least 500 m this is important to control diseases which transmitted through the air. However, about 51.2% of the poultry units are distance between them 500-1000m and whereas about 30.2% of the poultry units are distance between them above 1000 m.

Results indicate that about 12.9% of the sample units reported to have less than 50 million Iraqi Dinars (ID) of income in running poultry units, whereas 36.4% of the units reported of having more than 50-75 million ID income, whereas 24.5% of the units reported of having more than 75-100 million ID income and whereas 26.2% of the unit reported of having more than 100 million ID.

The results showed that the average percentage of mortality rate was 18.5% this is indicates to several reasons; quality of day-old chick, feed sources, weather, management and disease ...etc.

In this study the average feed cost per one kg was calculated 1769.28 ID and just represented about 65.08% of total costs. The data also reveals that the comparison for feed costs between cities Erbil, Sulaymanyah, Duhok and Garmian were 1789.03, 1821.73, 1631.80 and 1711.41 ID/kg respectively, high feed costs were recorded in Sulaymanyah and low feed costs were counted in Duhok. The study showed that the costs of labour was 122.96 ID/kg, alone represents about 4.38% of total cost and for the compare between Erbil, Sulaymanyah, Duhok and Garmian were 145.27, 110.11, 114.19 and 99.37 ID/kg respectively. The results observed high labour cost per one kg was in Erbil and low labour cost per one kg was in Garmian. Day-old chick costs according to one kg of chicken meat were estimated at 409.78 ID/kg and alone represented about 15.66% of total cost, which were 437.62, 392.58, 364.20 and 480.28 ID/kg for Erbil, Sulaymanyah, Duhok and Garmian respectively. The data showed the high cost in Garmian and low cost in Duhok. Total veterinary costs were 141.55 ID/kg, alone represents about 4.85% of total cost. Also the veterinary costs were 160.49, 153.63, 76.70 and 135.25 ID/kg for Erbil, Sulaymanyah, Duhok and Garmian respectively. Our data showed the high cost in Erbil and low cost in Garmian. In case of broiler farm fuel cost per kg stood at 170.00 ID, alone represented about 5.88% of total cost, which were between the Erbil, Sulaymanyah, Duhok and Garmian were 188.89, 175.51, 130.05 and 138.58 ID/kg respectively. Recorded data showed the high cost in Erbil and low cost in Duhok. The fuel is very important for poultry farms for maintaining temperature inside the poultry house and used to run generator

because in the study area the electricity is very bad. The total costs were worked out for broiler farms separately. On average, total costs per one kg live chicken meat were 22747.29 ID/kg. The study also reveals that the comparison for total costs between cities Erbil, Sulaymanyah, Duhok and Garmian were 2886.50, 2787.75, 2412.53 and 2618.33 ID/kg respectively. These results showed high total costs in Erbil and low total costs in Duhok (Table 4.7 and 4.8). The data of study represented that on an average, price per kg live broiler received was 2918 ID. The gross returns for one kg were 2904.25 ID, shows that net return per ID per one kg stood at 156.96 ID.

The financial benefits received from broiler farming indicates that the enterprise is helpful in employment generation and poverty alleviation that are now the main problem of making plan processes of the country. The study identified numerous problems and constraints that are associated with broiler production. The results obtained from this study revealed that feed and day-old chick costs constitute almost 80% of the average variable cost of broiler production. This indicates the relative importance of feed and day-old chick in broiler production. Reduction in the cost of these two inputs might increase profitability of broiler production. The study also obtained that feed cost, day-old chick cost, labour cost as well as market age of broilers and capacity utilization are the main factors that significantly affect competitive advantage of broiler agribusinesses in northern region of Iraq. Moreover, reduction in the cost of feed, day-old chick cost, labour cost and market age at which broilers are ready for sale will promote competitive advantage in broiler production. Similarly, an increase in capacity utilization will significantly reduce the production cost promoting competitive advantage of the broiler sector.

Recommended policy actions should therefore be directed at building the capacity and technical know-how of broiler producers to adopt proper farm management practices ensuring efficient utilizations of feed resources. This might follow by reductions of expenditure on feed and consequently production cost leading to ensure competitive advantage of broiler agribusinesses. In addition, measures that aim to encourage broiler producers to increase capacity utilization of farm structures is recommended as a policy option to reduce production cost and to promote competitive advantage of the sector. Given that marketing age significantly affects competitive advantage, broiler producers should be encouraged through appropriate policy options to raise their birds for the market by the eight week to reduce expenditure on feed. Producers should also feed birds with

high feed quality enabling birds to gain the right market weight by the eight week. Further recommendations are list below;

- ✓ The need of immediate formulation of feed standardization and act of poultry feed,
- ✓ Necessary steps need to be taken to reduce the high price of feed. Again government should give adequate financial support to establish more feed factories throughout the country,
- ✓ Price stabilization and/or floor price schemes should be chalked out to make sure that broiler producers receive the minimum level of profits.
- ✓ There is a need for monitoring production and the formation of a quality control system for local hatcheries by a government department to ensure the highest quality of old chick day,
- ✓ Important steps need to be taken in terms of reducing the immoderate day-old chick price. It is authority's responsibility to supply good and enough financial aid to set up more hatcheries throughout the country.

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## APPENDIX

### APP. 1. Poultry broiler production in Iraq during 1980-2012

Year	Production (Ton)	Imports (Ton)	Consumption (Ton)
1980	57783	72000	129783
1981	64621	141000	205621
1982	154682	104000	258682
1983	112582	78000	190582
1984	160046	42000	202046
1985	190454	22000	212454
1986	198482	38000	236482
1987	200770	81000	281770
1988	209850	9600	216750
1989	226628	---	226628
1990	192283	321	192514
1991	10971	14	10805
1992	24439	987	25426
1993	22344	19682	42026
1994	8260	321	8581
1995	2693	46	2739
1996	3750	3272	7022
1997	3847	1964	5811
1998	16814	6437	23251
1999	44156	15535	59691
2000	82590	13658	96248
2001	94302	8859	103161
2002	122461	32831	155292
2003	53191	---	53191
2004	46317	---	46317
2005	59639	217	59856
2006	55567	34	55601
2007	40258	---	40258
2008	36947	17	36964
2009	34087	177834	211921
2010	87500	190775	278275
2011	132000	45347	177347
2012	171000	78265	249265

CSO, 2013.

APP. 2. Quantities available for consumption and the average per capita in Iraq during 1980-2012.

Year	Population (Million)	Consumption (Ton)	Available per capita (kg/year)
1980	13.238	129783	9.804
1981	13.669	205621	15.043
1982	14.110	258682	18.333
1983	14.586	190582	13.066
1984	15.077	202046	13.401
1985	15.585	212454	13.632
1986	16.110	236482	14.679
1987	16.335	281770	17.429
1988	16.882	216750	12.839
1989	17.428	226628	13.004
1990	17.890	192514	10.761
1991	18.419	10805	0.587
1992	18.949	25426	1.342
1993	19.478	42026	2.158
1994	20.007	8581	0.429
1995	20.536	2739	0.133
1996	21.124	7022	0.332
1997	22.46	5811	0.264
1998	22.702	23521	1.024
1999	23.382	59691	2.553
2000	24.086	96248	3.996
2001	24.816	103161	4.158
2002	25.565	155292	6.074
2003	26.34	53191	2.019
2004	27.139	46317	1.707
2005	27.963	59856	2.141
2006	28.810	55601	1.930
2007	29.682	40258	1.356
2008	31.664	36964	1.159
2009	31.664	211921	6.693
2010	32.490	278275	8.565
2011	33.338	177347	5.320
2012	34.208	249265	7.287

CSO, 2013

## **CURRICULUM VITA**

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### **Qualifications:**

1. Primary school was in Gulan-Erbil-Iraq graduate at 1996-1997
2. High school was in Khabat-Erbil-Iraq graduate at 2001-2002
3. Bachelor of Agriculture-Department of Animal sources-College of Agriculture-Salahaddin University graduate at 2005-2006
4. Master Student of Agricultural Economics, University of Kahramanmarash Sutcu Imam-Turkey 2015-2017

### **Training Courses:**

1. Management, breeding, nutrition and diseases of poultry at 2013 in Antalya-Turkey.
2. English course in Language center of Salahaddin University, Erbil-Iraq.
3. Management cores in ISO 9001.
4. Course of management in ISO 9001 at 2014 in Erbil-Iraq.

### **Languages:**

1. Kurdish language is a Native Language
2. Arabic language (good)
3. English language (good)
4. Turkish language (medium)

**Membership:**

1. Head of Agricultural Engineers Syndicate Branch of Erbil during 2011-2015.
2. Member of the Agricultural Engineers Syndicate 2007.

**Scientific Research Published;**

1. Research on title Influence of Addition Different Levels of Organic Acids to the Diets on the Performance of Broiler Chicken. Karkuk Agricultural Sciences Journal, 2015 Vole 6: 37-45.
2. Effect of Dried Betony and Peppermint Uses in Broiler Diets on Performance, Hematological and Immunity Response. Diyala Agricultural Sciences Journal, 2013, 5(2): 1-9.

**Previous work and experience;**

1. Worked on the production manager for private company of poultry production period 9 year in Erbil-Iraq.
2. Teaching chemistry to secondary school students in 2006.

**Experience in using some computer programs such as;**

1. Word (special program for writing)
2. Excel (special program for designing tables and calculations)
3. Power Point (special program for detail data show)
4. SPSS (special program for statistical analysis)
5. Experience in the use of the Internet and programs in use such as Front page and Outlook.