An Assessment of the Potential Profitability of Poultry Farms: A Broiler Farm Feasibility Case Study

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Abstract

Poultry farms, mainly chicken farms producing meat or eggs, can be highly specialized operations. To maximize profits and plan future enterprise activities, a feasibility analysis prior to investment and proper management during the operation are required. Proper management ensures efficient production and good quality products (meat or eggs). This is accomplished by controlling diseases, maintaining feed efficiency, proper handling of wastes, and proper sanitizing of the poultry house. Due to short turnover rates of poultry flocks and strong market demand, the poultry business could potentially be a profitable enterprise.

This study details a profitability analysis on a flock of broilers raised for the purpose of meat production. A farm and its facilities were rented to grow and finish the flock for market delivery. The farm was located in South Lebanon, in the Marjoyoun Valley and was rented on a lump sum basis.

Production (input) costs and sales (output) prices were used to determine the feasibility of growing broilers in the region. The flock was introduced into the poultry house on November 11th, 2009 and was managed until it reached the slaughtering phase, as per market requirements, on December 20th, 2009. The total production cost was $10,479 (including rental cost, labor salaries, electric cost, and other miscellaneous costs). Because the farm used in this study was rented, depreciation expenses on the buildings and equipment were not considered in the feasibility analysis. The flock produced 4,428 kg of meat at a market selling price of $3.10/kg of meat. Thus, total sales were $13,726.80 (USD), resulting in a net profit of $3,247.80 (USD). Depending on the location of the poultry farm and the owner's experience and facilities, profitability may vary.

Market prices of chicks, meat, and feed vary and these variations can affect enterprise profitability. Examining input and output price trends from 2007 through 2009 revealed the following insights. When the price per kg of meat goes down, feed costs tend to decrease (compensating for the low meat price). When the price per chick increases, the price per kg of meat also tends to increase, thus compensating for the increased cost per chick. Since price variations are critical factors in determining future profitability, statistical forecasting techniques were used to set a range of price expectations for the year 2010 so that sensitivity analysis could be performed.

Sensitivity analysis was used to test the robustness of this feasibility study 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.

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Introduction

Poultry farms are farms that raise chickens, ducks, turkeys, and other birds for meat or egg production. In the past, poultry farming involved raising chickens in the back yard for daily egg production and family consumption. However, poultry farming today is a huge business that is split into several operations including hatcheries, pullet farms for meat production, or farms for egg production. This paper will focus on poultry farms raising chicken.

Chickens originated from Jungle Fowl in South Eastern Asia around 3200 BC (Dr. M. Farran, personal communication, 2009). Chickens were domesticated and spread to China, India, Africa, Pacific Island, and Europe. The main use of chickens has never changed. They were primarily raised for human food. In addition, their feathers were used for making cushions, litter for fertilizers and, in some societies, chickens were used in cock fighting as a source of entertainment.

As the human population increases, the poultry industry continues to grow to meet the demand for poultry products in world markets. The importance of poultry farms lies in the quality of products that are provided to humans. Broiler farms provide meat that supplies the human body with high quality proteins. Layer farms provide eggs rich in proteins and vitamins, especially the fat soluble vitamins (A, D, E, and K). Poultry farms are fast-paced operations that can fulfill the demand for meat and eggs, and can be expanded easily to meet the ever-growing demand (Dr. M. Farran, personal communication, 2009).

Chickens are fast growing animals. In the past, it took about 4 months to produce a two-kilogram chicken. However, today a two-kilogram chicken can be produced in 42 days (Dr. M. Farran, personal communication, 2009). Due to this fact, a better understanding of husbandry practices, and use of new technologies, poultry farms can be profitable enterprises.

Each operation in the poultry business has become a huge business by itself. Some farms specialize in producing eggs for market consumption, or for hatching chicks for the purpose of meat production. Many large farms specialize in raising broilers for meat production. Other businesses are focused on feed preparation or on using the wastes of poultry farms for compost production and fertilizing farmlands. If managed and marketed well, all segments of the poultry business can be profitable.

Objectives

This study will examine the feasibility of broiler producing farms in Lebanon.

A rental farm will be used as a representative case study for other poultry producers.

Sensitivity analysis will be used to determine potential profitability when input costs and point of sale values are varied.

Literature Review

Poultry farms can be classified into two main types: farms for egg production and farms for meat production.

Egg Production

In egg-producing farms, day-old chicks are purchased from specialized hatcheries that produce egg-producing pullets. These pullets are either raised by the egg producer or a pullet grower until they are ready to start laying eggs, which is usually at 19 weeks of age (Beutler, 2007).

The egg production cycle lasts for about one year. The pullets and laying hens are raised mainly in environmentally controlled poultry houses in cage systems. To make the maintenance process easier, automated feeding, watering, and egg collection systems were developed. Feed and water are moved on rotating belts which pass by the cages. Another rotating belt collects the eggs and sends them to the sorting chamber to be tested for fertility, graded, and sorted according to size, making them ready for delivery to the market (Dr. M. Farran, personal communication, 2009).

Laying hens in egg producing farms are usually of small body frame and body weight compared to broilers. They can be classified into two groups: dual purpose chickens or egg producing chickens. Egg producing chicken breeds have been bred and raised for maximum egg production (up to 300 eggs per year) rather than high meat yield (Beutler, 2007). Dual purpose chickens are smaller in size than commercial meat breeds. They are used for meat as well as egg production, and can produce around 200 to 250 eggs per year (Dr. M. Farran, personal communication, 2009).

There have been several developments to increase the marketing value of eggs. These developments include omega-3 eggs, folate and lutein enriched eggs, as well as free run and organic eggs. These specialty eggs increase the value of eggs, and have caused a noticeable change in the market (Dr. M. Farran, personal communication, 2009).

Meat Production

In poultry farms focused on meat production, broiler breeders are raised mainly in environmentally controlled poultry houses. Fertile eggs are collected and transported to the hatchery, where they are placed in hatcheries for 18 days and then transferred to incubators in the last 3 days (Beutler, 2007). After hatching, broiler chicks are distributed to producers who grow out the birds, and send them for slaughtering and processing after 42 days. These broilers are chickens that are raised for the purpose of meat production and have a larger body frame and weight than layers (Beutler, 2007).

Approvals and Construction of Poultry Farms

Prior to the construction of a poultry farm, initial approvals from the appropriate planning department must be obtained. These approvals usually take into consideration the environmental aspects of poultry farming including avoiding or minimizing visual views, noise, odor, and wastes. When constructing a poultry farm, future plans should be taken into consideration. For example, after the operation starts, waste material will be generated. Construction planning should include plans for an isolated area to dispose the waste material without causing any health or environmental risks, including risks to water resources, until some specialized company for compost production collects the wastes (Wood et al., 1998).

Due to the type of business and growth potential, poultry farms should be constructed in a manner that allows for future expansion. This should include plans for expansion of feed storage areas, drainage, and effluent (Wood et al., 1998).

Facilities on a Poultry farm

Facilities on poultry farms are related to the purpose of the farm**.** In general, all poultry farms share common facilities and equipment such as feeders and drinkers. However, depending on the purpose of the farm, some facilities vary. For instance, some meat production farms include slaughter house facilities. The purpose of having these slaughtering facilities on a broiler farm is to minimize cost and increase profits through vertical integration. Egg production farms are equipped with nest boxes if the breeders are raised on the floor, or, if raised in cages, automated belt systems are installed for collection of eggs. Hatcheries are equipped with incubators that maintain the eggs for 18 days and hatchers that keep the eggs for 3 days, both maintained at the right temperature and humidity required for hatching (Wood et al., 1998).

Waste Handling

Wastes are produced in all types of poultry operations. After poultry houses are cleaned and sanitized, the wastes should be confined in one area for later removal by specialized companies for composting or proper disposal to avoid contaminating the environment. This confinement area can be used for all types of wastes including litter from most poultry farms and un-hatched eggs from hatcheries (Wood et al., 1998).

Poultry litter can also be considered to be a by-product with economic potential. At the end of a production cycle in a broiler or egg-production operation, litter is removed mechanically from the poultry house, and can be used as fertilizers for crop production. Litter can also be

removed and sold to commercial processors for composting operations or nursery preparations. It can also be composted on the farm in a confined area, and then applied to farm lands.

Management of Poultry Farms

Feeding

Feed costs have a major impact on the profitability of poultry farm operations. The high cost of feed is related to the energy and protein contents of the diet. In an unbalanced diet, with an excess protein, feed would cost more, thus increasing production costs. With low protein diets, chickens would take more time to grow, and could be at a higher risk of catching diseases. Chickens have different nutrient (feed) requirements depending on their type, age, and sex. Rations formulated to meet nutrient requirements produce faster growing, and healthier chickens, and thus better products and more profits (Dr. M. Farran, personal communication, 2009).

Excess dietary nutrients are often excreted in the feces. The excess nitrogen and phosphorus in feces could cause a threat to the environment. For this reason, managing feed formulas for accuracy is an important step in the poultry farm management to safeguard the environment, and reduce operating costs (Karcher, 2009).

Disease Management

In the management of poultry farms, probably one of the most difficult phases is the management of the newly introduced flock. For the operation to be profitable, a good disease prevention program should be available for the newly introduced chicks to avoid any future losses. Diseases can be transmitted via humans, other birds, newly introduced chicks, or contaminated equipment. Controlling diseases from the beginning is important for the success of the operation (Mobley and Kahan, 2007).

Vaccination

Vaccination is an effective way to reduce the negative effects of diseases that can cause losses in a poultry operation. Diseases can be caused by viruses, mycoplasma, bacteria, fungi, protozoa, and parasites. Viruses are the number one cause of poultry disease and are considered to be the largest threat to poultry farms. Viral diseases can be reduced by proper sanitation on the farm, biosecurity measures, and vaccination of the chicks and chickens (Dr. M. Farran, personal communication, 2009).

Viruses can cause several diseases; the major ones include: Marek's disease, Newcastle disease, infectious bronchitis, laryngotracheitis, fowl pox, fowl cholera, and avian encephalomyelitis (Jacob et al., 1998). Vaccination is mainly done to prevent Marek's disease, which can infect laying hens and hence, a whole flock if the eggs are infected.

There are several vaccination methods. Some vaccines are administered via drinking water. Others can be sprayed, whereby the spray enters the nostril or the eye to form antibodies. Another way is by injection using an automatic syringe in the neck (Jacob et al., 1998). Chicks are usually vaccinated between 2 to 16 weeks of age, depending on the type of vaccine and disease. Some vaccines are marketed as mixtures to prevent more than one disease.

More vaccination methods have been developed in the United States. For example in-ovo vaccination has made the process more labor efficient. This method vaccinates the embryo in the egg at the hatchery; after that there isn't any need to vaccinate again on the farm (Williams, 2007).

Slaughtering and Processing

In the final phase of the poultry operation, in both egg laying farms and meat production farms, slaughtering has to occur. In egg production farms, older hens must be culled when egg

production is reduced. The hen is either sold to another farm or, more commonly slaughtered. At the slaughtering facility, all poultry must be brought to a holding area where a good shelter with sufficient time for rest and water are provided before slaughtering (Wholesome meat and fish Act, 2005). Prior to slaughtering, all poultry are stunned using the correct voltage depending on size and weight of the birds. Slaughtering should be as humane as possible, allowing blood to drain for about 90 sec. after killing. Hot water at 82°C should be available to ease the removal of feathers. After the feathers are removed, the bird is eviscerated, washed, and the carcass is cut into pieces. The knives should be sanitized frequently to avoid disease transmission. After cutting and chilling of the chicken carcass, packaging takes place at an area close to the slaughter house. Packaged chicken meat is then stored in refrigerators before going to the market (Wholesome Meat and Fish (Slaughter-houses) Act, 2005).

The U.S. poultry industry was faced with opposition in 2009 when animal rights activists questioned the slaughtering techniques used at some plants. Advanced slaughter machines are slaughtering at a rate of 6,000 broilers an hour. Even with this high number, the world still needs more chicken for consumption. How will market demands be met? A balance between efficient slaughtering technique and animal welfare must be established.

Cleaning and Sanitizing

After poultry are removed from the poultry house, it must be cleaned and sanitized. The sanitation process differs depending on the floor type and type of poultry house. Several disinfectants can be used to clean and sanitize the poultry house. However, the disinfectant must be chosen carefully to avoid problems with newly introduced flocks (Smith, 1999).

Budget Considerations

Starting a poultry farm requires start-up capital and a budget for the operations. Usually farmers get loans from banks or other lenders for start-up costs (Rhodes et al., 2008). The start-up cost of a poultry farm varies with the size, and the facilities required for the farm to run. In 2008, the average cost for a poultry broiler house in Maryland was about $10 per square foot. This number varies depending on the design, location, equipment required, and doesn't include the cost of land (Rhodes et al., 2008).

The budget represents the income, fixed & variable costs, profits, and investment amounts for the poultry farm, depending on its size. Determining these values and using an enterprise budgeting sheet will give the broiler producer a clear view of the operation and whether or not it is feasible (Rhodes et al., 2008).

Start-up costs represent a substantial investment (Table 1). These costs include construction of poultry houses, equipment within the houses, tractors and other implements, wells and water systems, and site preparation (Rhodes et al., 2008). Usually the farmer gets a loan to cover these initial costs. Rhodes et al. (2008) prepared an example of an enterprise budget for a broiler farm (Table 2). The table includes the descriptions of the farm, and the total number of flocks/birds that can be produced per year. The broiler producer can use estimates of income and costs to estimate gross income, variable and fixed costs, leading to an estimate of the net income.

The gross income (table 2) represents the total amount of money received by the grower from the sales of broiler meat after slaughtering. Income can also come from the sales of litter or other by-products of the operation.

Table 1. An Example of Fixed Investment Costs for a Broiler Farm in Maryland, U.S.A (Rhodes et al.,2008)

FIXED INVESTMENT	UNIT	QUANTITY	PRICE	TOTAL	DOLLARS/SQFT
Tunnel House	House	2	$179,856.14	$359,712.28	$5.35
Generator, Wiring, & Alarm	House	2	$22,900.00	$45,800.00	$0.68
Equipment	House	2	$89,391.19	$178,782.37	$2.66
Site Preparation	House	2	$8,500.00	$17,000.00	$0.25
Tractor Loader Blade & Mower	Farm	1	$35,000.00	$35,000.00	$0.52
Manure Storage and Composting Shed	Farm	1	$5,300.00	$5,300.00	$0.08
Vegetative Shelterbelt**	Farm	1	$1,300.00	$1,300.00	$0.02
Well and Water System	House	2	$4,400.00	$8,800.00	$0.13
Stone	Farm	1	$27,000.00	$27,000.00	$0.40
Total Investment				$678,694.65	$10.10

*Average payment from Integrator

**Assumes cost share is obtained from NRCS

Table 2: An Example of a Farm Broiler Production Enterprise budget for a Farm with two 60' x 560' poultry houses in Maryland, U.S.A. (Rhodes et al., 2008)

SQUARE FEET OF HOUSE	**33600**	**FLOCKS/YEAR**		**5.5**	
BIRD DENSITY	**0.75**	**BIRDS/YEAR**		**492800**	
NUMBEROF BIRDS/FLOCK	**89600**	**NUMBER OF HOUSES**		**2**	
ITEM	**UNIT**	**QUANTITY**	**PRICE**	**TOTAL**	**DOLLARS/SQFT**
GROSS INCOME					
Grower Payments*	1000 Birds	492.8	$236.75	$116,670.4	$1.74
Litter	Tons	190	$20.00	$3,800.0	$0.06
Total Gross Income				$120,470.4	$1.79
VARIABLE COSTS					
Electricity	Flock	5.5	$2,530.00	$13,915.00	$0.21
Telephone/Alarm		1	$500.00	$500.00	$0.01
Supplies and Miscellaneous	House	2	$2,130.00	$4,260.00	$0.06
Building & Equipment Repairs	House	2	$3,024.00	$6,048.00	$0.09
Crust Out or Windrow	Flock	5.5	$568.00	$3,124.00	$0.05
House Cleanout	Flock/12	0.4583	$2,130.00	$976.25	$0.01
Interest on Operating Capital	Year	$28,823.25	6%	$1,622.12	$0.02
Total Variable Costs Listed Above				$30,445.37	$0.42
Net Income Over Variable Costs Listed Above				$90,025.03	$1.34
FIXED COSTS					
(DO NOT DUPLICATE COSTS LISTED ABOVE)					
Owner's Labor	Hours/Flock	75	$8.00	$3,300.00	$0.05
Building Depreciation	Total	$359,712.28	5.00%	$17,985.61	$0.27
Equipment Depreciation	Total	$264,882.37	6.67%	$17,667.65	$0.26
Interest on Investment	AVG. Invest	$312,303.33	9.00%	$28,107.30	$0.42
Property Taxes				$1,344.00	$0.02
Insurance				$3,360.00	$0.05
Land Charge	ACRE	6	$100.00	$600.00	$0.01
TOTAL FIXED COST LISTED ABOVE				$72,364.57	$1.08
TOTAL VARIABLE AND FIXED COST LISTED ABOVE				$102,809.94	$1.53
NET INCOME OVER VARIABLE & FIXED COSTS LISTED ABOVE				$17,660.46	$0.26

Producers can encounter both variable and fixed costs. Variable costs include the cost of electricity, equipments, house cleanout, building repairs, telephones and alarms (Table 2). Fixed costs include the cost of labor, insurance, taxes, and land charges. With good management practices, the grower can reduce costs, thus increasing profitability.

A cash flow statement of the poultry operation represents the total cash revenues, costs, and required investments that will be spent on the operation (Table 3). The aim of preparing a cash flow statement for a poultry farm is to estimate the available cash for loan payments and other farm requirements prior to the start of the project. The poultry producer would then have a clear idea of the revenues and costs, and can determine a payment schedule to pay back the loan (Rhodes et al., 2008,).

The cash flow statement can also be developed for established farms, and can help in following the cash in or out of the operation on a daily basis. The producer can monitor costs, and work on reducing them to end up with a high positive cash flow. Net cash flow is obtained by subtracting the total cash expenses from the total cash receipts. If the result is positive, then the firm is considered profitable, and with that profit, the poultry producer can pay back loans, buy poultry houses or equipment or use the cash for other farm or personal expenses.

Feasibility

To do a feasibility study for a poultry farm, the purpose of the farm should be clear because this affects equipment required, water requirements, and the type of waste management system that will be used. When estimating costs for establishing and running the business, the poultry producer should consider potential extremes in costs, in addition to current costs.

A feasibility study conducted by "The Center for Agricultural Development & Entrepreneurship" in Oneonta in NY (no date), compares several options that a poultry producer

Table 3. An example of a farm broiler production cash flow in Maryland, U.S.A. (Rhodes et al., 2008)

TWO HOUSES 60' X 560'			
SQUARE FEET OF HOUSE	**33600**	**FLOCKS/YEAR**	**5.5**
BIRD DENSITY	**0.75**	**BIRDS/YEAR**	**492800**
NUMBEROF BIRDS/FLOCK	**89600**	**NUMBER OF HOUSES**	**2**

ITEM	UNIT	QUANTITY	PRICE	TOTAL	DOLLARS /SQ FT
CASH RECEIPTS					
Grower Payments*	1000 Birds	492.8	$268.75	$132,440.00	$1.97
Litter	Tons	190	$20.00	$3,800.00	$0.06
Total Cash Receipts				$136,240.00	$2.03
CASH EXPENSES					
Electricity	FLOCK	5.5	$2,530.00	$13,915.00	$0.21
Telephone/Alarm		1	$500.00	$500.00	$0.01
Supplies and Miscellaneous	HOUSE	2	$2,688.00	$5,376.00	$0.08
Building & Equipment Repairs	HOUSE	2	$3,024.00	$6,048.00	$0.09
Crust Out or Windrow	FLOCK	5.5	$568.00	$3,124.00	$0.05
House Cleanout	FLOCK/12	0.4583	$2,130.00	$976.25	$0.01
Interest on Operating Capital	YEAR	$29,939.25	9%	$2,514.53	$0.04
Property Taxes	YEAR	1		$1,344.00	$0.02
Insurance	YEAR	1		$3,360.00	$0.05
TOTAL CASH EXPENSES				$37,157.78	$0.55
NET CASH FLOW				$99,082.22	$1.47
LOAN PAYMENTS					
Mortgage Payment	15 YEARS	ANNUAL TOTAL PAYMENT	8%	$74,071.00	$1.10
Equipment Payment - Tractor, Loader, Blade, Mower	6 YEARS	ANNUAL TOTAL PAYMENT	6%	$7,194.00	$0.11
TOTAL LOAN PAYMENTS				$81,265.00	$1.21

*Guaranteed payment from Integrator

might consider when starting a poultry investment. Table 4 summarizes the feasibility of an on-farm processing unit versus processing at the USDA facility in Delaware County. The total cost of processing at the USDA processing facility is less than processing on farm for poultry producers raising 5000 and 10,000 poultry units per year (Table 4). However, it would be feasible to process on farm for producers raising 20,000 or more poultry units per year, where the transportation cost to the USDA facility would outweigh the costs of constructing an on-farm facility (The Center for Agricultural Development & Entrepreneurship, nd).

Table 5 is a projected income statement for a feasibility study of a broiler farm done by the Small and Medium Enterprise Development Authority, of the Government of Pakistan (2002). The study was based on raising 7,500 birds at the farm, taking into consideration farm rental costs and all other fixed and variable costs.

The projected income for 10 years on a meat producing farm in Pakistan increases over time (Table 5). The profit (after taxes) for year one in the Pakistani currency, Rupee, is 183,047Rs or $2,178.6. As the farm grows, the projected net profit also increases. In general, larger farms have decreased cost on a per bird basis. All costs vary depending on management, and thus profits vary with management practices. The same generalization would also apply to egg producing farms.

With an ever increasing human population, the demand for poultry should continue to grow. Well managed poultry operations should be profitable in this environment.

Table 4. Financial comparison of on-farm versus centralized plant poultry processing, (The Center for Agricultural Development & Entrepreneurship, nd)

COST OF USDA PROCESSING IN DELAWARE COUNTY	Poultry Units Processed Per Year		
	5000	10000	20000
Shipping Labor	$ 450	$ 900	$ 1,800
Truck/Fuel	$ 730	$ 1,460	$ 2,920
Processing	$ 7,500	$ 15,000	$ 30,000
Total Cost	$ 8,680	$ 17,360	$ 34,720
Per Bird	$ 1.74	$ 1.74	$ 1.74
COST OF ON-FARM POULTRY PROCESSING			
Wages	$ 2,667	$ 5,333	$ 10,667
Benefits (12.5%)	$ 333	$ 667	$ 1,333
Utilities	$ 795	$ 1,329	$ 2,397
Insurance	$ 1,000	$ 1,000	$ 1,000
Office Expense	$ 1,200	$ 1,200	$ 1,200
Interest	$ 3,617	$ 3,617	$ 3,617
Depreciation	$ 5,002	$ 5,002	$ 5,002
Total Cost	$ 14,613	$ 18,148	$ 25,216
Per Bird	$ 2.92	$ 1.81	$ 1.26
Difference	$ 1.19	$ 0.08	$ (0.48)
FARM INCOME STATEMENT FOR POULTRY PROCESSING			
USDA Processing			
Revenue (3.5 Lbs./Unit at $1.85 per Pound)	$ 32,375	$ 64,750	$ 129,500
Expenses Variable Cost $3.45/Unit	$ 17,250	$ 34,500	$ 69,000
Overhead Cost (Amortized at 10 Years)	$ 1,383	$ 2,765	$ 5,531
Processing (USDA)	$ 8,680	$ 17,360	$ 34,720
Total	$ 27,313	$ 54,625	$ 109,251
Per Bird	$ 5.46	$ 5.46	$ 5.46
Net Income	$ 5,062	$ 10,125	$ 20,249
ON-FARM PROCESSING			
Revenue (3.5 Lbs./Unit at $1.85 per Pound)	$ 32,375	$ 64,750	$ 129,500
Expenses Variable Cost $3.45/Bird	$ 17,250	$ 34,500	$ 69,000
Overhead Cost (Amortized at 10 Years)	$ 5,531	$ 5,531	$ 5,531
Processing (On Farm)	$ 14,613	$ 18,148	$ 25,216
Total $ 37,394	$ 37,394	$ 58,179	$ 99,747
Per Bird	$ 7.48	$ 5.82	$ 4.99
Net Income	$ (5,019)	$ 6,571	$ 29,753
Percent Change	- 199%	- 35%	47%

Table 5. Projected income statement for a feasibility study of a broiler farm (Small and Medium Enterprise Development Authority, of the Government of Pakistan, 2002)

PROJECTED INCOME STATEMENT										in Rs.
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Sales*	2,745,924	2,883,220	3,027,381	3,178,750	3,337,688	3,504,572	3,679,801	3,863,791	4,056,980	4,259,829
Cost of goods sold										
DOC (Day Old Chicks)	540,000	567,000	595,350	625,118	656,373	689,192	723,652	759,834	797,826	837,717
Feed Cost	1,587,600	1,666,980	1,750,329	1,837,845	1,929,738	2,026,225	2,127,536	2,233,913	2,345,608	2,462,889
Vaccination Cost	90,000	94,500	99,225	104,186	109,396	114,865	120,609	126,639	132,971	139,620
Spray Cost	6,444	6,766	7,105	7,460	7,833	8,224	8,636	9,067	9,521	9,997
Litter Cost	9,924	10,420	10,941	11,488	12,063	12,666	13,299	13,964	14,662	15,395
Payroll (Production Staff)	72,000	75,600	79,380	83,349	87,516	91,892	96,487	101,311	106,377	111,696
Heat Expense for Brooding	12,000	13,200	14,520	15,972	17,569	19,326	21,259	23,385	25,723	28,295
Total	2,317,968	2,434,466	2,556,850	2,685,418	2,820,488	2,962,391	3,111,476	3,268,113	3,432,688	3,605,609
Gross Profit	427,956	448,754	470,531	493,332	517,200	542,182	568,324	595,678	624,292	654,221
Operating Expenses										
Fixed electricity	24,000	26,400	29,040	31,944	35,138	38,652	42,517	46,769	51,446	56,591
Administrative Overheads	13,730	14,416	15,137	15,894	16,688	17,523	18,399	19,319	20,285	21,299
Depreciation	6,404	6,404	6,404	6,404	6,404	6,404	6,404	6,404	6,404	6,404
Mortality Loss	71,190	74,750	78,487	82,411	86,532	90,858	95,401	100,171	105,180	110,439
Total	115,324	121,970	129,068	136,653	144,763	153,438	162,722	172,664	183,315	194,733
Operating Profit	312,632	326,784	341,464	356,679	372,437	388,744	405,603	423,014	440,977	459,488
Non-operating Expenses										
Financial Charges on Running Finance	32,586	14,341	-	-	-	-	-	-	-	-
Building Rent	84,564	93,020	102,322	112,555	123,810	136,191	149,810	164,791	181,270	199,397
Total	117,150	107,361	102,322	112,555	123,810	136,191	149,810	164,791	181,270	199,397
Profit Before Tax	195,482	219,423	239,141	244,124	248,627	252,553	255,792	258,223	259,707	260,090
Tax	12,435	15,428	17,893	18,516	19,078	19,569	19,974	20,278	20,463	20,511
Profit After Tax	183,047	203,995	221,249	225,609	229,549	232,984	235,818	237,945	239,243	239,579
Retained Earnings beginning of year	-	183,047	387,042	608,291	833,900	1,063,448	1,296,432	1,532,250	1,770,195	2,009,439
Retained Earnings end of year	183,047	387,042	608,291	833,900	1,063,448	1,296,432	1,532,250	1,770,195	2,009,439	2,249,018

Materials/Methods

To determine feasibility of poultry production, this study used a small rental farm located in South Lebanon in the Marjoyoun valley (Fig.1). On November 11th, 2009, 3,060 day-old chicks were introduced into a poultry house furnished with wood chips and supplied with heaters, feeders, and drinkers. The chicks were bought at a price of $0.55 each from a local supplier. The poultry house preparation cost was $270, which included the cost of wood chips and gas for heaters. The cost of the feeders and drinkers was included with the rental cost of $500 per flock. All cost figures used in this report are in United States dollars (USD).

Figure 1. Farm Location in Lebanon

Feeding:

Feed for broilers varies according to age. The percentage ingredients differ between the starter, grower, and finisher feeds. However, the ingredients in all feeds used were corn, soya, sish granule, mono di-calcium, broiler pre-mix, methionine, lysine, enzymes, coline, coxi, salt, stone granules, and soya oil.

Starter feed was used for chicks between the age of 1 and 10 days. For this study, a total of 1 ton of starter feed was used at a cost of $507/ton. Grower feed was used for chicks between the age of 11 and 28 days. The amount used was 7 tons at a cost of $475/ton. The finisher feed was used for chicks between the age of 29 and 50 days. The amount used was 6 tons at a cost of $435/ton. The variation in feed quantities was related to chick size and growth stage. The conversion of feed differs between the three levels of growth, with broilers in the growth phase consuming more of the grower feed as compared to the other feeds.

Vaccination

Four vaccines were used throughout the grow-out: B1, Gamboro, Gamboro Stress, and Clone. Vaccine B1 was applied to the chicks at 7 days of age; Gamboro was applied at the age of 12 days, and Gamboro Stress at the age of 22 days. Clone was applied at three stages, at the age of 18, 27, and 35 days. The cost of vaccine B1 was $6, Gamboro $9, Gamboro Stress $16, and Clone $23 (this is the per flock costs of vaccines).

Slaughtering

The flock was ready for slaughter at an age of 46 days on December 20th, 2009, as per market requirements. Broilers were moved in plastic cages into the holding area of the slaughter house at different times, depending on the speed of slaughtering. The slaughtering method was traditional, following accepted Islamic slaughtering practices.

The whole flock took four days to be slaughtered, and the total slaughtering cost was $550. This cost was primarily labor, since machines were not involved (except for the feather removal machine).

Packaging and Refrigerating

After slaughtering, the chickens were cleaned and moved into the cutting and packaging area. They were then placed in plastic bags, weighed, marked, and sent to the refrigerators. Packaging cost was mainly for the cost of the plastic bags which was $100/flock. The labor cost for packaging was included in the total labor cost for slaughtering.

Cleaning and Sanitizing the Poultry House

With the removal of the broilers from the poultry house, all that remained was the chicken litter and the wood chips that initially furnished the poultry house. The feeders and drinkers were moved outside the poultry house to be cleaned and sanitized. Excess feed was collected in bags and stored to be fed later to finishers in the next flock. The litter was removed with a skid-steer loader at a rental cost of $50/day.

The floor was washed and brushed to remove the excess litter and prepared for sanitization. Quat and Virex Sanitation material (Killcone Corp.) were sprayed in the poultry house, on the floor, walls, roof and atmosphere to kill germs that might infect future flocks. Quat sanitation material was sprayed first. After 10 days, Virex was sprayed in the closed poultry house to ensure complete sanitation. The cost for the sanitation materials was $30/flock.

Throughout the whole operation of the broiler production farm, one supervisor handled the process with a fixed lump sum salary of $500/flock.

Data Collection

Data on dead chicks, feed, and vaccines used, were collected on a daily basis to monitor the flock. Data on the price/kg of meat for the years 2007, 2008, 2009, were obtained from the local market, through checking the historical data of the market places in Marjoyoun area. Chick prices were obtained from the historical data of the chick supplier, and average feed prices were obtained from the owners of the rental farm who had data for the past 15 years.

Forecasting for 2010 for the three main factors contributing to overall profit of the business, cost/chick, cost/ton of feed, and price/kg of meat, followed different procedures depending on historical data for 2007 to 2009.

Cost/chick historical data showed seasonal changes in the prices, where prices rose to a peak in March and April, dropped, and then rose again in August and September. This seasonal rise in prices is just before the high seasons in the summer holiday and Christmas and New Year's holiday. With this clear seasonality, the classical decomposition model was used to forecast data for 2010. This technique isolates the trend, cyclical, and seasonal components, and forecasts them separately (Lawrence, and Pasternack, 2002).

Historical data for feed costs showed that a stationary model was appropriate for forecasting feed cost for 2010. Regression analysis was also tried, but a P-value ($P = 0.718985$) greater than the value of alpha (0.05) was obtained indicating that there was little evidence that a linear trend exists. Therefore, the weighted moving average technique was used to forecast feed costs for 2010, using the weights for four periods (0.1, 0.3, 0.1, & 0.5) following historical data.

The price/kg of meat historical data showed that a linear trend exists. To further prove this theory, Regression analysis was used, giving a P-value of 3.99×10^{-6}, which is much smaller that

the level of significance ($\alpha = 0.05$), proving that a Linear Regression forecasting model was appropriate for this data set.

Sensitivity analysis was conducted based on the peak market prices of each of the three profit contributors following simple calculations (Total Sales – Total Costs). Sensitivity analysis was calculated separately for each factor and for the worst-case scenario of all three factors.

All calculations and analysis were done using Microsoft Excel®.

Results & Discussion

Production Costs

This poultry farm feasibility study was conducted following traditional methods of production. Daily records were kept throughout the project; these records included the daily chick deaths, vaccination, and feed used for the flock (Table 6). The initial start-up costs for this operation included the cost of purchasing the chicks, and the cost of preparing the poultry house for the flock. The cost of one chick was $0.55. The capacity of the rented poultry house was 3060 birds, so the total cost was $1,683. The preparation cost was $270, which covered the cost of wood chips that furnished the floor and gas for heaters during cold nights. Each poultry house needs one laborer to manage the flock. In this study, the agreement with the laborer was for $500 per flock. One laborer can look after more than one poultry house, and needs a maximum of two hours a day to finish their work in each poultry house. Therefore, a laborer can earn triple the money if they agree to handle three flocks at a time.

Table 7 summarizes the main costs for this broiler farm operation. The cost per chick was $0.55, but it could vary between a minimum of $0.40 and maximum of $0.75, depending on the market. Four vaccines were used, with a total cost of $54. Although the cost of vaccines was not significant with respect to the profitability of the project, the use of vaccines can save the farm from major losses associated with disease.

Feeding costs represented the major cost in this poultry operation. Feed varied throughout the operation according to chick age. Each feed type consisted of different ratios of ingredients which affected the feed cost. The grower feed was used in the largest quantity, constituting the highest cost of feed (Table 7). Starter feed was the most expensive per ton due to its high protein content. The total cost of feed for the project was $6,442. This value may vary depending on the

Table 6. Daily record of poultry farm operations for a poultry farm in South Lebanon, 2009

Total in	3060	Date in		:	5/11/2009			
Age (days)	Deaths	Vaccine	Feed		Age (days)	Deaths	Vaccine	Feed
1	2		Starter		26	1		Grower
2	4		Starter		27	2	Clone	Grower
3	7		Starter		28	1		Grower
4	4		Starter		29	2		Finisher
5	4		Starter		30	2		Finisher
6	2		Starter		31	4		Finisher
7	1	B1	Starter		32	1		Finisher
8	1		Starter		33	0		Finisher
9	1		Starter		34	3		Finisher
10	1		Starter		35	0	Clone	Finisher
11	3		Grower		36	0		Finisher
12	2	Gamboro	Grower		37	1		Finisher
13	1		Grower		38	3		Finisher
14	0		Grower		39	3		Finisher
15	1		Grower		40	1		Finisher
16	0		Grower		41	1		Finisher
17	1		Grower		42	2		Finisher
18	0	Clone	Grower		43	1		Finisher
19	1		Grower		44	0		Finisher
20	1		Grower		45	4		Finisher
21	2		Grower		46	2		Finisher
22	1	Gamboro Stress	Grower		47	1		Finisher
23	6		Grower		48	2		Finisher
24	3		Grower		49	1		Finisher
25	1		Grower		50	1		Finisher
					Total Deaths		89	
					Total Out		2971	
		Date Out		:	25/12/2009			

Table 7. Cash flow for the broiler production farms representing the major costs, income, and net profit. The farm was located in South Lebanon, 2009.

	Cost Per Flock
Cost of chicks ($0.55 per chick)	$1,683
Poultry house preparation cost	$270
Cost of labor	$500
Cost of poultry house rental	$500
Vaccines	
B1	$6
Gamboro	$9
Gamboro Stress	$16
Cole	$23
Total vaccine cost	$54
Feed	
Starter (1 ton at $507/ton)	$507
Grower (7 tons at $475/ton)	$3,325
Finisher (6 tons at $435/ton)	$2,610
Total feed cost	$6,442
Cleaning and sanitation	
Skid-steer loader rental Cost	$50
Sanitation Material Cost	$30
Other Machinery Cost	$0
Total Cleaning & Sanitizing Cost	$80
Other Costs	
Slaughtering Cost	$550
Packaging Cost	$100
Electric Cost	$300
Total Costs	$10,639
Income	
Sale of chicken meat (4428 kg at $3.10/kg)	$13,726.80
Net Profit	**$3,247.80**

management practices followed throughout the operation to reduce feed losses. The price is also affected by market prices, with variation of about 10%, to a maximum of 15%.

Post-Production Costs

Other costs of the broiler operation were the slaughtering and packaging costs. Slaughtering was done over a period of four days. The laborers were hired for slaughtering and packaging with a lump sum price of $550 per flock. They were given the flexibility to finish slaughtering in one day, but the traditional Islamic way of slaughtering was used, therefore the slaughtering took four days to finish, including packaging and storing the meat in the refrigerators. The labor cost for packaging was included in the slaughtering cost. However, the cost of plastic bags for packaging was $100 for one flock. The electric cost for refrigeration was $300 per flock for one month storage. Depending on the speed of sales and the market requirements, the electric cost could be reduced if the meat products are sold within 3 weeks or less.

Cleaning & sanitation are two important steps in the broiler production operation. The poultry house was cleaned after the flock was removed. A skid-steer loader was rented for one day at a cost of $50 /day (Table 7). After cleaning, sanitation material was sprayed in the poultry house to remove germs. The cost of sanitation material was $30. If a broiler producer uses other machinery such as cleaning brush machine, then the total cost would be higher. Waste removal with a skid-steer loader was the least expensive method. The laborer taking care of the flock also took care of cleaning (labor cost included in the $500 total labor cost).

Income

Poultry meat from the study was sold on a kilogram basis. The flock produced a total of 4,428 kg, and the price of meat was $3.10/kg. Therefore, the total sales of poultry meat were

$13,726.80. Subtracting the total costs ($10,479) from the total sales, the net profit was $3,247.80. Therefore, under conditions of this study, the broiler operation was profitable.

Sensitivity Analysis

Sensitivity analysis was used to examine profitability under high cost circumstances, as well as forecasts of likely future movements in costs and revenues. If the price/chick rose to its maximum of $0.75/chick, the cost/flock would become $2,295, and thus the net profit would become $2,635.8 (Table 8). Therefore, increases in chick prices would reduce net income, but the operation would still be profitable, assuming other costs remained constant.

If the price of feed increases to 15% above the current prices, then the total cost of feed would become $7,408.3. Assuming a stable price per chick of $0.55, net profit would be $2,281.8, which is still profitable (Table 8).

Assuming the price per kilogram of meat dropped to its minimum of $2.80/kg, and the costs remained at current levels, then net sales will be $12,398.4 and the net profit would become $1,919.4 (Table 8).

Now, taking the worst case scenario, where the cost/chick is at its maximum $0.75/chick, the feed cost is 15% higher than normal, and the price per kilogram of meat is at its minimum of $2.80/kg, then the total cost per flock would be $12,057. The total sales would be $12,398.40 (Table 8). Subtracting costs from sales, the net profit would be $341/flock, which would be considered a break-even operation. It is rare to have costs and meat prices at these extreme levels. With proper management, the costs could be reduced, increasing profitability of the business.

Table 8. Sensitivity analysis examining the effect of increasing the cost per chick, the cost of feed, and reducing the prices for chicken meat.

	Increased Cost/Chick	Increased Feed Costs	Reduced Meat Prices	Worst-Case Scenario
Number of Broilers	3,060	3,060	3,060	3,060
Cost/chick	$0.75	$0.55	$0.55	$0.75
Cost/flock	$2,295	$1,683	$1,683	$2,295
Poultry house preparation cost	$270	$270	$270	$270
Fixed labor cost/P.H.	$500	$500	$500	$500
Rental cost	$500	$500	$500	$500
Total vaccination cost	$54	$54	$54	$54
Total feed cost	$6,442	$7,408	$6,442	$7,408
Slaughtering Cost	$550	$550	$550	$550
Packaging cost	$100	$100	$100	$100
Total cleaning & sanitizing cost	$80	$80	$80	$80
Electric Cost	$300	$300	$300	$300
Price per kg of meat	$3.10	$3.10	$2.8	$2.8
Sales	$13,726.80	$13,726.8	$12,398.4	$12,398.4
Net Profit	$2,635.80	$2,281.8	$1,919.4	$341.4

Historical Prices and Forecasts for 2010

Looking at historical data on price per chick in Lebanon (Figure 2), one can see that the price of chicks vary from $0.20 to $0.75 depending on the season. The classical decomposition model was used to forecast chick prices for 2010. However, comparing forecasted prices to the actual prices for the beginning of 2010 (Table 9) shows that prices for day-old chicks has increased beyond forecasted prices due to increased market demand from neighboring countries.

Prices of chicks would be expected to reach their maximum in March and April, and then drop back to lower prices in May, with a second increase in the prices in the month of October (Table 9). However, with the fluctuating market and increased demand, the actual prices are increasing, but without exceeding the maximum prices ($0.75/Chick) used in the sensitivity analysis. Chick prices are expected to drop back to normal by May 2010, as the demand on chicks begins to decrease, and as new hatcheries are constructed in neighboring countries.

Variation in the average cost of feed didn't follow any seasonality (Figure 3). Instead, it fluctuates with market variations and political situations. However, in 2009, there was some seasonality, when cost increased approximately every three months.

Plotting the trend line for feed costs over time (Figure 3) shows that there is a little evidence that a linear trend exists. Linear regression analysis showed that there was no significant linear trend (P= 0.719, Table 10). Therefore, a stationary model with the weighted moving average technique was used to forecast feed costs for 2010.

Actual feed costs for 2010 were higher than forecasted costs in January, February, and April but lower in March (Table 9). Therefore, it is difficult to predict the cost/ton of feed due to external political factors as well as market variations. However, what can be predicted from

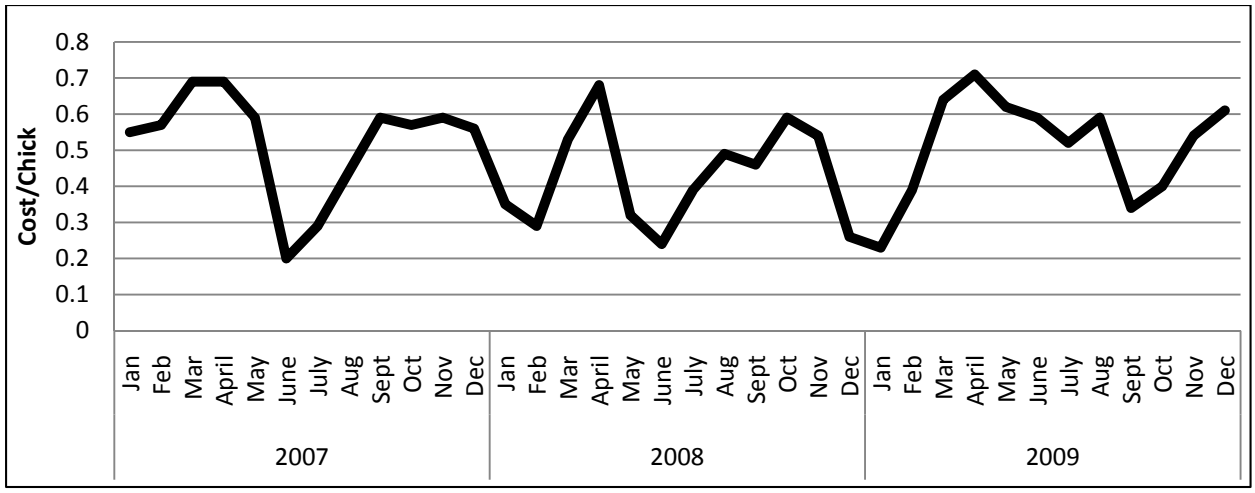

Figure 2. Price of chicks in Lebanon, for 2007 to 2009 (Data collected on April 3rd, 2010)

Table 9. Forecasted prices of chicks, feed, and chicken meat for 2010, compared to actual prices for January through April of 2010.

2010	Price per Chick		Feed price per ton		Price per kg of Meat	
	Forecast	Actual	Forecast	Actual	Forecast	Actual
January	$0.28	$0.59	$356.50	$390	$3.29	$3.10
February	$0.31	$0.69	$371.15	$420	$3.30	$3.15
March	$0.54	$0.74	$377.10	$340	$3.31	$3.10
April	$0.65	$0.74	$374.70	$390	$3.33	$3.20
May	$0.44	N/A	$365.96	N/A	$3.34	N/A
June	$0.38	N/A	$372.30	N/A	$3.36	N/A
July	$0.32	N/A	$373.04	N/A	$3.37	N/A
August	$0.44	N/A	$372.90	N/A	$3.39	N/A
September	$0.49	N/A	$369.41	N/A	$3.40	N/A
October	$0.55	N/A	$372.26	N/A	$3.42	N/A
November	$0.53	N/A	$371.86	N/A	$3.43	N/A
December	$0.38	N/A	$372.26	N/A	$3.44	N/A

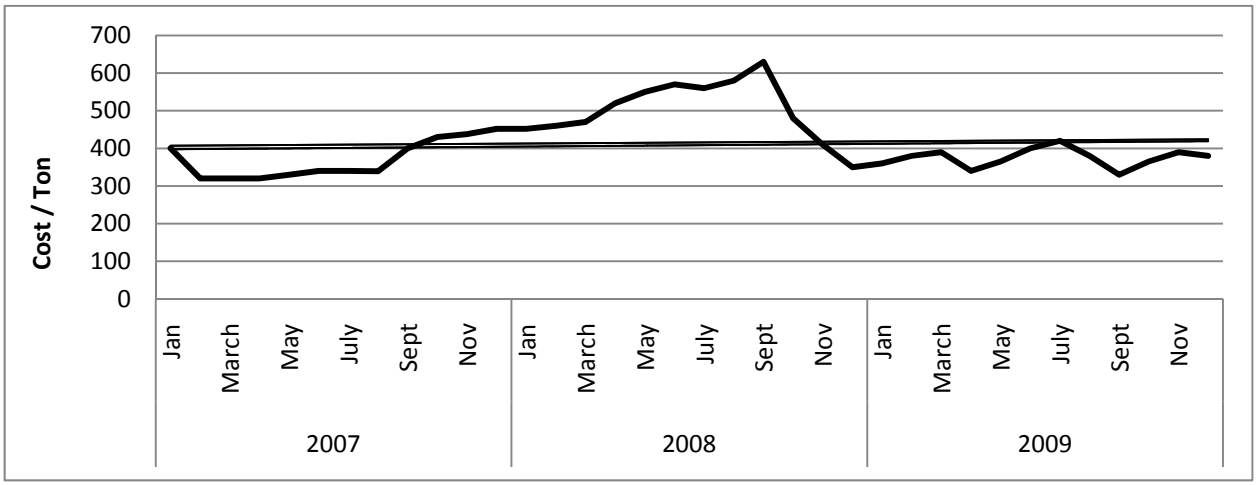

Figure 3. Cost per ton of chicken feed in Lebanon, for 2007 to 2009 (Data collected on April 3rd, 2010)

Table 10. Regression Analysis for Cost/ton of feed for 2007, 2008, & 2009 data

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	406.5048	28.69728	14.16527	7.99E-16
Month	0.490734	1.352552	0.36282	0.718985

reviewing the historical data is that the cost/ton of feed stays within a range that keeps the cost of feed low enough to maintain high profits.

The price/kg of meat didn't follow any seasonal change; it fluctuated with market changes (Figure 4). However, regression analysis showed that a linear trend over time exists ($P = 3.99 \times 10^{-6}$, Table 11).

Comparing forecasted data for 2010 to actual data per kg of meat (Table 9), one can see that the forecasted prices are a bit higher than the actual prices. However, with the actual prices at a higher value than the expected, it compensates for the higher cost/chick, maintaining profitability.

Sensitivity analysis was done using the forecast prices for 2010. The lowest price/ kg of meat and highest costs of chicks and feed from either forecasted or actual data for 2010 were used in this analysis. The cost/chick was assumed to be $0.75, the feed cost/ton was assumed to be $420/ton or $5,880 (14 tons @ $420/ton) for the 3,060 chicks, and the price per kilogram of meat was assumed to be $3.10/kg.

Considering this worst-case scenario for 2010, a net profit of $3,197.8/flock should be possible, assuming other all other costs remain constant (Table 12). This net profit was compared to that of September 2008 which had a peak cost for feed. The cost/chick was replaced by its maximum limit ($0.75), price/kg of meat was assumed to be $3.55/kg, and feed cost of $630/ton or ($8,820 for 3060 chicks) was used. The net profit under these conditions would be $2,250.4 (Table 12).

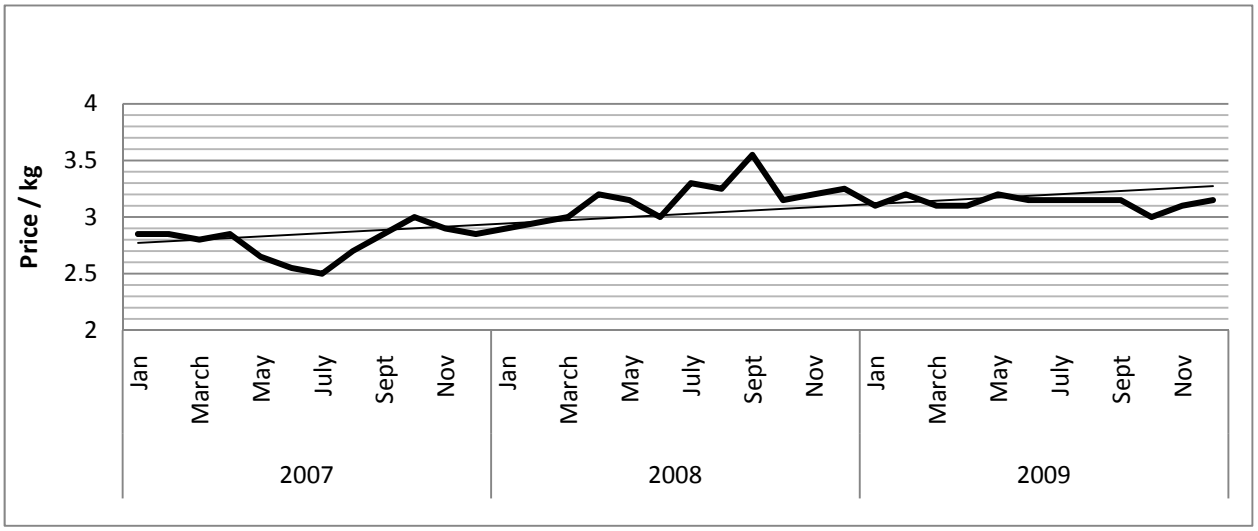

Figure 4. Price of chicken meat per kg in Lebanon, for 2007 to 2009 (Data collected on April 3rd, 2010)

Table 11. Regression Analysis for the Price/kg of meat for 2007, 2008, & 2009 data

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	2.757222	0.055385	49.783	2.34201E-33
Month	0.014324	0.00261	5.487444	3.9952E-06

Table 12. Net profit with extreme prices for 2010 & Maximum Cost/chick with 2008 data

	Extreme Prices for 2010	Maximum Cost/chick & 2008 data
# of Broilers	3,060	3,060
Cost/chick	$0.75	$0.75
Cost/flock	$2,295.00	$2,295
P.H. Preparation Cost	$270.00	$270
Fixed labor Cost/P.H.	$500.00	$500
Rental Cost	$500.00	$500
Total Vaccination Cost	$54.00	$54
Total Feed Cost	$5,880	$8,820
Slaughtering Cost	$550.00	$550
Packaging Cost	$100.00	$100
Total Cleaning & Sanitizing Cost	$80.00	$80
Electric Cost	$300.00	$300
Total Weight Obtained	$4,428.00	$4,428
Price/Kg	$3.10	$3.55
Sales	$13,726.80	$15,719
Net Profit	$3,197.80	$2,250

Conclusion

This study shows that the broiler business in Lebanon is profitable assuming variation in prices of chicks, feed, and price/kg of meat remain within reasonable levels, while all other costs are fixed. Even when the cost of feed is high, the price/kg of meat could be above the average, compensating for the high costs of the operation. Also when the cost/chick is high, the feed cost could be low, compensating for the initial high cost per flock. Sensitivity analysis in this study has shown that even if chick and feed costs are high while meat prices drop, the poultry farm would still break even.

A poultry farm investment focusing on broiler production is a relatively easy business to run. The fluctuating prices tend to compensate for each other for a positive net profit. However, if a worst-case scenario of low prices of meat/kg and high prices of feed and chicks occur, good management practices would be critical to maintain profitability.

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