The broiler industry being recently introduced in India has as yet not crossed the teething stage. It is, therefore, imperative to nourish this industry at production and marketing stages with all types of the required guidance. It would, therefore, be useful to review research work carried out by different scholars on this subject in India and abroad. In this section an attempt is made to critically examine the earlier studies.

Gordenk (1956) examined the best growth period for broilers. The study revealed that the highest performance efficiencies were scored by birds sold during September and October. That means the birds started during July and August were the most profitable (assuming the same selling price for each month). The study showed that during the hottest part of the year all the growers increased the watering space even if these growers had to use feed troughs, pots, pans or foot tubs to get in job done.
George & Bardwell (1959) studied the economics of scale inherent in chicken processing and the effects which such conditions could have on the efficiency of the New England Industry and individual firms within it. The data on inputs and outputs and accounting costs were obtained from 15 processing plants. These plants were among the most efficient in their size groups and approximately corresponded in capacity to some of the synthetic model sizes selected. The ten model plants constructed for subsequent analysis were standardized. Both the resource and input-output levels were synthesized on the basis of known attainable levels of requirements and efficiency. The basic projections were made for the 100 per cent of capacity level for each model size. The study revealed that economics of scale were more pronounced for plants processing broilers than for those processing fowl. Under standard conditions and with each of 10 sizes of model units operated at 100 per cent of capacity, unit costs in processing broilers declined from 5.1 cents per pound (live weight basis) at 150 birds per hour to 2.6 cents per pound at 10,000 birds per hour. About 75 per cent of the decrease occurred between the smallest (150) unit and the 2400 size.

May (1961) conducted a case study which indicated that 90 per cent of the bruises were 0-12 hours old, 7.5%, 12 to 14 hours old; 2% were 24 to 36 hours old and 0.5% were over two days old. The location of the bruises was,
38% breast, 32% wing, 3% thigh and 7% leg. All the birds were found to be equally susceptible to bruising regardless of age. The average heating time was 3.6 days for 4-6 week old birds, 4.4 days for those 19 weeks old and 5.2 days for 28-30 weeks old birds. The bruises were easier to inflict in old temperature but sudden drops in temperature lowered the susceptibility to bruising. Healing took longer in the cold temperature.

Crothers and Helbacka (1960) evaluated the broilers grade defects by quality control methods and found that low quality poultry adversely effects all the segments of the industry including the consumer. Many consequences reflecting broiler quality are not measurable in dollars and cents but tabulation of those that are measurable indicated that lower quality poultry was costing the Delmarva broiler industry about twice as much as condemnations. The study showed that the average percentage of grade A birds on the Delmarva Peninsula at the particular time of the study was approximately 67 per cent with one-third being down grades for various reasons. The major causes for down grading were bruising, breast blisters, flushing and mishled and general discolouration. Considerable variation existed between flocks and between plants. They suggested that number of bruising broilers could be reduced by modernishing methods of catching, transporting and unloading poultry and by stressing certain areas of management. The study also
suggested improvements in processing procedures. These are indicated by the fact that operational bruises, cuts and tears and unskilled and general discolouration are also important in over all quality picture.

Smith (1961) pointed out that it would be difficult to predict the price a broiler flock would bring on a given day solely by examining the characteristics of the flock. In fact knowing the conditions of the flock in advance would be of little value to the grower in terms of his expectations as to the price he would receive. Far more important in estimating price would be good information regarding aggregate supply and demand factors in the market.

Cover (1961) in a survey of management factors completed at Delmarva brought out the following facts about condemnation.

(i) Keeping large number of chicks around one stove tended to increase the rate of condemnation (ii) Condemnation was less in narrow houses (4.29%) than in wide houses (6.98%) (iii) Condemnation in houses using individual gas stoves was higher than in those using oil stoves (iv) Average condemnation rate in houses having solid partitions between pens was 3.32% while in houses having open partition it was 7.87%, (v) Washed and disinfected houses showed that 86% of the flocks had less than 4% condemnation. In non-disinfected houses 63% of the flock had less than 4% condemnation. (vi) Average condemnation rate of flocks receiving the recommended vaccination programme was 2.39%. They recommended that good management and disease control reduced the condemnation rate.
Sathe and Bose (1962) conducted experiment to explore the possibilities of economic poultry rations from 12 industrial by-products. The study revealed that although increased growth responses were obtained by inclusion of terramycin feed supplement (TM 5) to vegetable poultry ration. The inclusion of animal protein supplement such as fish meal was, however, necessary for economy of gain in weight, low mortality and better flock uniformity. Appreciable growth responses were obtained by inclusion of lower dry residue, meat meal, incubator waste and penciline mycelium residue, each replacing fish meal in growing poultry rations with significant economy of grain in live weight. Both the processed and non-processed air-dried cow manure could be very satisfactorily used upto a level of 10 per cent in growing rations replacing costly maize poultry with considerable saving in the cost of feeding. The use of grain meal as low as 12.5 per cent of all mash growing poultry ration had a deteriorating effect as growing ration and feed efficiency when used at 6.25 per cent level the growth rate was maintained but the feed efficiency was lower. The results suggested the possibility of the presence of an unknown deletarian factor in grain meal for growing chickens. A satisfactory non-cereal growing ration could be prepared by fully replacing yellow maize with groundnut cake and tapioca meal.

Ogra, Sidhu and Singh (1963) undertook a study in India
to evolve cheap poultry feed by including agricultural and industrial by-products. Twenty different poultry feed materials readily available in Punjab State were collected and subjected to chemical analysis in order to determine proximate principles contained in them. On the basis of chemical data obtained, eight experimental mashes (E-1 to E-8) were prepared which had almost the same over all chemical composition as that of the standard mash recommended by the poultry committee of the Indian Council of Agricultural Research. However in the experimental mash, the costly cereal grains and fish meal were replaced to a larger degree by cheap agricultural and industrial by-products and meal respectively. The mashes were fed to day old W.L.H. chicks for a period of eight weeks kept in electrically heated battery brooders and observations made on the rate of growth, feed consumption, feed efficiency, rate of feathering, sex influence and percentage rearability. All the experimental mashes except E-3 gave significantly higher gains in weight and lower cost of feed per unit gain in live weight. The average weight of chicks fed on E-7 was 55.5 per cent higher than the standard mash at eight weeks of age and its cost was 28.2 per cent less. The cost of per unit gain on E-7 was 35 per cent lower than on the standard mash.

Krueger, Ryan, Cawley and Quinsenberry (1963) conducted an experiment on space for broilers and indicated that better gains in broilers could be attained if adequate space
used. In the experiments broilers were allowed 1.2, 1.0, 0.8 and 0.6 square feet of floor space each. The broilers grown at 1.0 square feet space recorded a gain of a tenth of a pound more compared to those broilers raised on 0.6 sq. foot space. This would give 2000 pounds of more meat to a producer with 20,000 birds. Birds raised on 1.2 square feet of space gained no more than those allowed 1.0 square feet. Broilers raised on 1.0 sq. foot of floor had 95.2% livability compared to 96% for those on 0.6 square foot. The experiment indicated that there was no advantage in growing males and females separately as far as growth and livability were concerned.

Pauls, Spencer and Brooks (1963) brought out that shrinking of cut up tray packed layers was a problem for the supermarket manager. An experiment was run for 68 supermarkets and 44 managers told the shrinkage problem. The most important cause of shrinkage was loss of moisture. It was also found, that longer the chilling time, the greater was the uptake of the moisture. Ready-to-cook frayers chilled for 72 hours in slush ice gained an average of approximately 9.8 per cent in weight. When chilled for 16 and 2.5 hours they gained 6.7 and 3.4 per cent respectively. Chilling for 72 hours in drained ice resulted in a gain of only 3.3 per cent moisture. For 16 hours chilling in drained ice there was a gain of 2.5%, about one-third of that from using slush ice. During six days of storage, frayers chilled
in slush ice lost 6.9 pounds per 100 pounds while those drained in chilled ice lost 4.5 pounds. Most of the loss occurred during first day of the storage. Between one-half and three-fourth of the weight loss occurred during the first day.

Zahik, and Dawson (1963) in an experiment to test the effects of coated poultry meat, dipped cut up broilers for 10 seconds in an acetylated monoglyciride at 221 degrees F. to a coating on the meat. Coated birds and nontreated controls stored in a plastic bag were held for one and two weeks at 36 degree F and for one and eight months, minus seven degrees. Flavour scores of the cooked poultry showed that when stored with other foods; off flavour were acquired by the coated birds. Juiciness, moisture and fat were essentially the same in both coated and uncoated poultry. Coated poultry had less total cooking losses and larger percentages of press fluid than the uncoated ones. The coating reduced weight loss of poultry during storage. The use of edible coating on poultry for retail sale is of dubious value since an over-rap would still be needed because of consumer handling of the product. The study indicated that edible coating on poultry may be useful in institutional or other bulk packages but not for consumers.

Dawson L. E. (1963) observed that many individual turkey carrying a U.S. Grade A label were not related worth the consumer's dollar. A few studies were conducted to
determine if the consumers have preference for graded turkeys and the factors influencing them. It was found that the consumers and retailers were overwhelmingly in favour of grade labelling. Producers and processors on the other hand were not in favour of compulsory labelling, possibly because of the term 'compulsory' and possibly because they believe such a programme would curtail competitiveness or increase costs excessively.

Jackson Hilliard (1964) suggested that market reporting must eventually hinge on operation in the dressed market when the product was bargained daily. With 75 per cent more of production integrated by processors in some areas more problems were likely to develop in reporting live market prices. The processors having vertical integration reported that prices were actually established in the dressed market. It was expected that live broiler transactions might become non existent during the next few years. Further, the vertical integration had reduced the open market transactions to the extent they cannot be used alone to establish prices on live broiler.

Roy (1964) analysed the data of broilers' production, prices and gross income of the broiler grower in the United States for the years 1934-1960. The production of broilers showed a constant upward trend. Average live weight per bird also improved to 3.5 lbs. during 1963 as compared with 2.8 lbs. during 1934. The prices received by the farmers
improved from 19.3 cents per pound live weight in 1934 to 36.0 cents in 1948. However later on prices showed a downward trend and winched to 14.5 cents per pound live weight during 1963. This happened as production of broilers increased at a much higher degree than its demand for export and for consumption of local population., The study concluded that the price of broilers can improve if increase in broiler production are held to about 2-3 per cent a year (40 to 60 million head). This would probably bring farm prices to about 15 cents per pound.

Noles (1964) brought out that the cost of production of broilers was constant and the variations in broiler prices influenced the weights at which profits were maximised. Secondly, only in the break even situation the producer actually operated at his minimum average costs and lastly, the profits were maximised where added gains are more than the added cost.

Noles, (1964) pointed out that for earning maximum broiler profits both fixed and variable costs must be considered. They found that if the bird was sold at 15 cents per pound, the maximum returns of 4.78 cents per bird would be obtained by growing the bird to 10 weeks of age. However the added costs exceeded the added returns at that age. However, if the price received per pound of broiler decreased from 15 to 13 cents, maximum returns were realised by feeding the broilers to nine weeks of age. At a broiler
price of 17 cents, returns would be maximised at 11 weeks of age. It is worth mentioning here that the cost structure of the birds did not change yet returns were maximised at three different stages.

Johndrew O. M. (1964) made comparison of broilers grown under contract and independently. He found that the broilers grown under contract were generally grown at a lower cost per pound than broilers produced on an independent basis. The difference in production costs amounted to an average of 1.5 cents per pound in favour of contract lots. Major factors contributing towards low cost were: firstly, the more favourable weights and feed conversions in contract lots were probably the result of superior technical knowledge, management and supervision employed by the relatively large, vertically integrated broiler operations and secondly, there were economies associated with large volume purchasing of feed, chicks and supplies that the large integrated operations might be able to take advantage of more readily than smaller independent growers.

Roy (1964) in a study in selected areas of the U.S.A. compared the spatial and over time shares of the grower and retailer in consumer's dollar and also farm-consumer spread under these two situations. The study indicated that retail price of broilers decreased to 41 cents per pound during 1962 compared with 60 cents in 1952. However, the farm-consumer spread dropped only by 0.4 cents per pound during
the 1952-62 period. Thus, the decline in retail prices affected the growers' share in consumers' dollar. Further, in New York city the retail store's spread went up 53 per cent while the farm to retailer margin dropped by 5-7 per cent. In Chicago the retailers' margins rose by 11 per cent and farm to retailer margin rose about 14 per cent.

In Atlanta the retailer's margins dropped by 5 per cent during 1957-63 period. But in farm to retailer spread went up 23 per cent, mainly because of increase in receiver to retailer spread by 60 per cent. In San Francisco marketing spreads decreased nearly 18 per cent while retailers margins dropped about 27 per cent and spread from receiver to retailer was down by 28 per cent. Therefore, the marketing margins are so tied up with inflexible business costs that they do not change. When broilers prices go up or down, it is the broiler man's piece of pie that is sliced accordingly.

Nichols (1964) studied the impact of cut rates (by 60 per cent) by the Southern Railways on shipments on grains into the South East on broilers cost of production. The competitive balance between the South East, New England and Delmarva had changed. The author has indicated that by assuming the corn cost 10 cents lesser than it did previously and using a feed conversion of 2.3 and feeding to a 3.5 lbs. bird the cost of production would decrease by about one cent per bird or 0.3 cents per lb. live weight. The reduction in freight rates has improved Cocorgia's
position relative Delmarva by 0.01 and 0.12 cents per pound and to New England by .26 cents per pound. But it had weakened its position relative to North Carolina by about 1/16th cent per pound. In all cases North Carolina is a net gainer while New England is a net loser.

Somaiah and J. V. Shirley (1964) conducted research on broilers performance and egg size. The results showed that the body weights of broiler type chicks at one day, first week and eight weeks of age were found to be correlated with the weight of eggs from which key hatched checks from larger eggs consumed more feed per bird to eight week of age, lot feed required to produce a pound of broiler was unrelated to egg size. The heavier eight week weights of the broiler from the larger eggs resulted in a slightly greater cash returns per bird over feed costs.

Richard (1964) analysed the factors affecting the sales of broiler. It was found that 75 per cent of the variation of broiler sales was accounted for by price, display area (quantity) and amount of newspaper advertising. Weekly average sale of 2050 pounds increased by 875 pounds when the price was reduced by 5 cents, increased 158 pounds with a two square feet of display space increase and 225 pounds for each additional increase of 25 square inches of newspaper advertising. However gross dollar sales were not increased when broilers were advertised even though more quantity was sold.
Wisman (1964) listed the broiler chickens (upto 4 weeks age) provided with 4 1/2 per cent ration from the furnished hatchery by-products, which replaced an equivalent amount of soybean protein, amounting to 1.2 per cent protein. The chicks showed better growth and efficiency with the hatchery by-products than when soybean oil meal and corn were used to provide the proteins. This hatchery by-products could be used to feed broilers upto 4 weeks age and economised the costs.

Krenger (1965) studied the price fluctuations in broiler for the year 1954 to 1964. He indicated that profit margin in producing broilers was decreasing. He felt the broilermen can do little about it but they must know the price fluctuations and their causes.

The possible solution of cyclical price fluctuations were: i) stabilize the irregular pattern of industry expansion to about three per cent per year. ii) stabilize the slaughter of breeders and size of eggs set for broiler chicks. The causes of erratic movement were hinted; as lack of balance between buying and selling power, in-complete knowledge of supply and demand conditions and other merchandising emphasis. Possible solution to avoid this movement has been suggested as contract marketing and organised bargaining associations, a better understanding of production and marketing statistics and the development of a system for processing these statistics so they may be useful.
decision making tools to improve the industry and bargaining position. The increasing off season demand by developing additional off season uses and products, better acceptance of frozen chicken, additional further processed products, increased school bench usage and non off season promotion for home and restaurant use were suggested to check seasonal movement in prices. The solution to the downward trend was that the increase in supply should be limited in accordance with the increase in population and increase in consumer demand.

Bender (1965) considered several alternatives for working out the seasonal broilers prices in the North Carolina. It was found that peak demand occurred during July and the low occurred in November i.e. the same quantity of broilers brought higher price in July than in November. It was also found that summer demand was the highest. This happened because industry attempting to adjust its production to conform to the desires of consumers became over balanced when compared with Winter production. The study suggested that to maintain a constant monthly price the industry must cut back in production or hold the present level of production until population and consumer demand increased.

George and Conley (1966) examined major commodity segments of poultry industry changes and problems of the industry. The study indicated that for all
the major items like shell eggs, broilers, and turkeys the farm-retail spreads declined or remained stable even though wage rates and other factor prices increased. Improvements in plant operating efficiency, larger production units, improved quality, higher density of production, and more direct marketing channels had been responsible for the reductions in marketing costs. Numbers of both producers and processing and marketing firms had been declining rapidly. Economics of scale in production, processing and marketing; increasing density of production; and the growth of enterprises which consolidate production, input-supplying, and processing under common management were all forces tending to reduce numbers of units. At least 95 per cent of the commercial broiler and 60-65 per cent of turkey production was carried out under contractual arrangements between producers and either suppliers of inputs or processors. About 30-35 per cent of market-egg production was under some type of contract or marketing agreement with a packer or a feed company. Basic levels of prices for eggs and poultry were determined at the processing or wholesale levels. Producer prices were determined by subtracting margins to cover transportation, processing and packing and assembly functions. Prices at other levels were determined by adding margins to cover distributing and retailing functions.

Gibson (1967) undertook a study in 3 broiler growing
areas viz. Sydney, New Castle and Tomworth, for examining the specific effect of batch size, and feed and capital investment on net returns to the broiler growers in these areas. Effect of conversion rate, age of turn off, batch size and mortality rate on profits was also examined. The study indicated that the locational advantage was not a significant factor for net returns. Similarly, batch size had no significant effect on net returns. However, per bird returns were found to be highest in New Castle. However, specific item cost advantages existed but these were found to be not economical. While comparing the prices received by the broiler growers, though these were found to be small on a per pound basis but these led to large differences in net returns when spread over a number of batches.

Prescott and Hinks (1968) undertook an investigation to provide a comprehensive description of the carcass quality of steer. Freisian steers raised on intensive (barley beef) or semi intensive (silage beef) system of management were compared. The second stage involved barley beef from Freisian steers and Grass Fed Beef from Aleideen Angus Cross Steer and in third stage related to the Eating quality of Beef from traditionally fed Beef-type and Silage-fed Dairy Type Steers. In conclusion attention was focussed on the small difference in meat yield and cut out value between contrasting types. The within group variation in these characteristics contrasts with considerable variation in live
weight gain which was shown to be four times as important economically. Small differences in the existing quality of various types of beef were detected by the tenderness sheer and the tasting panel but the customers of a particular supermarket find both barley and silage-fed friesian beef quite acceptable.

Summers, Pepper and Shinger (1968) conducted a comparative study of different types of rations. The study revealed that a high wheat bran ration seemed to have merit as a growing ration for meat type pullets. The experiment revealed that the wheat bran ration gave a lower point for live body weight without delaying the onset of production. The wheat bran growing ration appeared to improve egg production, feed conversion, fertility hatchability but these results did not turn out to be statistically significant. In a second test comparing high wheat bran with high wheat shorts growing rations, the wheat bran ration again appeared to produce better laying performance and again, the differences were not statistically significant. The study pointed out that these combined results, plus a reported superior feathering and quieter nature of the wheat bran-fed birds made that type of growing ration look good.

Via, and Crothers (1970); Delmarva ranked first in the national broiler production until 1954 but dropped to 4th place by 1968. Average annual rate of increase in broiler production for Delmarva between 1959 to 1968 was 5.5 compared
with 10 to 14 per cent for the corresponding period in Arkansas, Alabama, North Carolina, and Mississippi. This study was planned to examine the reason for decline in Delmarva broiler industry compared with other major producing areas. Based on aggregate cost differences, Alabama, Arkansas, Georgia, Mississippi, and North Carolina had a cost advantage over Delmarva for broiler meat shipped to all nine major city markets in both 1961 and 1967. As a group of factors, those related to disease incidence play a major role in Delmarva's cost disadvantage relative to other areas. From the standpoint of individual cost factors, chick cost, basic feed cost, and contract grower payments contribute most heavily to Delmarva's cost disadvantage. As long as the Delmarva area had to import about 80 per cent of its hatching eggs, broiler chicks cost would continue to be an area of cost disadvantage. Contract grower payments were larger per pound of broiler meat produced in the Delmarva area than in other areas. Competition between areas for the same markets at a given price level returned higher net revenues to areas having a cost advantage. This resulted in higher rates of capital
accumulation. Broiler areas with this advantage have apparently used accumulated capital to expand their production. This explained why average annual broiler product expansion ratio were much higher in some areas than in the Delmarva area.

Sivaraman & Jayaram (1970) conducted two feeding trials to know the relative values of fish meal and infertile egg meat as animal protein supplements in the ration of poultry for growers. The values were assessed based on the data recorded on live body-weight gain, feed-consumption and feed-efficiency per unit of gain in body weight.

The Agricultural Research Service of USDA (1970) conducted a test on broiler to study the bruises leading to downgrading of the live birds. It was found that out of 27.3 per cent of total defects on broilers defeathered in 14 plants, bruised keels accounted 6.8 per cent, bruised breast (other than keel) 3.6 per cent; bruised wings and drumsticks accounted for 3.4 per cent each. Breast blisters were 2.8 per cent of the total down grades. The remaining 5.5 per cent out of total (27.3 per cent) down grades resulted from bruised thighs, broken legs and other bruises. The study suggested that the farmers can reduce the bruises by improving the building design including placement and cushioning of roof and equipment supports.

Nagpal (1970) observed that broiler raising was almost
unknown in India about a decade ago and most of the table meat came from surplus cockerels of replacement stock raised for egg production, culled out pullets, hens and cocks. He was of the view that the poultry industry in India being poorly developed, the annual per capita consumption in India was merely 0.5 lbs. of poultry meat and 12 eggs while for the U.S.A. the corresponding figures were 30 lbs of poultry meat and 350 eggs. Thus, there was a great scope for developing broiler industry in India. This was more true when the supply of mutton (which was very popular in India) was limited in India and beef and veal were not consumed by the Indian population. Besides providing nutritious food, the poultry industry would provide subsidiary livelihood to a large number of unemployed and under-employed man-power.

Deaton and Reece (1970) conducted a study to examine the impact of temperature on broilers' body weight and feed efficiency at the USDA's South Central Poultry Research Laboratory, State College. It was found that the poorest feed efficiency was scored by birds reared in highest temperature with the smallest eight-week body weight. There appeared to be a point where feed efficiency decreased as temperature increased. In one set of trials, body weight at eight weeks was 1344 grams where the temperature was 95°F and the humidity was 38 per cent. When the temperature was reduced to 80°F by evaporative cooling with an increase
in relative humidity to 76 per cent body weight at the same age was 1615 grams. This indicated that while evaporative cooling has been used by poultrymen in arid regions to protect their birds from extremely high temperatures, it also proved useful in the humid areas.

Cox (1970) examined the factors contributing to downgrading of broilers and found that bruising is the major cause. The author indicated that approximately 98 per cent of all the bruises were inflicted less than 24 hours before slaughter. Therefore, bruising usually was attributed to rough handling during catching, cooping, loading, unloading and hanging on the processing line. Further it was indicated (based on field surveys) that 19.6 per cent of the birds handled by catching crews were bruised. Of this total, 33.9 per cent occurred in the poultry house before the crews arrived at the farm. These findings indicated that many factors including house design, equipment design and layout, flightness of the flock, flock density and caretaker practices and procedures could have a bearing on the bruising rate.

Panda and Srihari (1971) examined methods of processing, marketing and distribution of poultry birds. The study indicated that cost of transportation to a processor at a distance of 100 miles amounted to 26 paise per bird. The bruising percentage was found to be 8.6 per cent in case of solid bottomed crates, 16.6 in
wire bottomed and 10.7 in bamboo bottomed crates. Grade specifications laid down by Indian Standard Institute were not enforced. The study indicated that the prices were falling during summer and improving during winter. Household consumption accounted for 60.7 per cent, hotels 19.5 sub-retailers 17.1, and retailers 2.7 per cent. The study indicated that losses to poultry in transport were 1.0, in processing 0.2, in retailing 5.0, during retaining of dressed birds 2.00 per cent. The total loss amounted to 8.2 per cent. The study calculated a total loss of 6983 tonnes of poultry meat in a year. To avoid these losses, the study suggested preservation arrangements, quick and refrigerator train and truck services. Quality control at dressing places need to be adopted. For encouraging production, farmers should be provided proper prices and market forecasts.

Wormeli (1971) observed that getting maximum yield of edible meat from fowl was important to the egg producer, for the sale value of his flock reduces his laying flock cost and his cost per dozen of eggs. For achieving this the author suggested (i) effective control of parasites to prevent emaciation caused by internal parasites and skin blanishes and emaciation caused by external parasites, (ii) good nutrition which is helpful for better eggs and for good carcasses, (iii) minimum condemnations so as to minimise the meat losses, and (iv) better management to keep hen bruises and break at a minimum during catching,
loading, transporting to the processing plant and unloading at the processing plant.

Roy and Francois (1971) indicated that broilers in Louisiana were usually produced and marketed under contract, the contractor providing chicks, feed, medicines and some form of supervision and the farmer providing land, housing, equipment labour, etc. The contractor normally collected, processed and marketed the birds to retail outlets. A stratified sample of production units was investigated, classified into small, medium and large. Five production factors (chick mortality, pounds of live broilers delivered, feed conversion, efficiency index, production costs) and five marketing factors (average live weight per bird, distance to processing plant, percentage rejects, net contract payment per pound, net returns per pound) were selected for regression analysis as dependent variables and models were developed. Only two variables, viz. contract payment and total cost per pound of live broiler were found necessary for computing net returns. Net returns per pound of live broiler, therefore, could be calculated by subtracting total production cost per pound from contract payment per pound for each of the broad sizes. Average net returns per pound increased with the number of pounds delivered and the average live weight per bird because the large deliveries of broods had lower per unit costs. Large broods, however, indicated a decline in net returns per pound beyond a certain broiler weight.
Fred H. Irwin (1971) examined the production-pattern, processing, marketing, consumption and demand for broilers in the United States. Also projections for consumption during 1975-85 were made two decades earlier. The broilers were grown in small flocks but during 1969, 43 per cent of all broilers were produced on farms raising one million or more birds a year. In 1934, 34 million broilers were raised and this touched 2.8 billion birds during 1969. As a result per capita consumption in the corresponding year increased from 0.5 lbs. to 35 lbs. To produce a 3.5 pound live-bird it took 12-14 weeks 20 years ago but now with improvement in nutrition the time has been reduced to 8-9 weeks. Man-hours per thousand broilers produced declined from 250 in 1940 to 15 in 1969 because of improvement in poultry farm technology. More than 95 per cent of all commercial broilers were grown under contract or by integrated firms themselves. The production costs for feed, chicks, grower payment, fuel, medications, vaccination, litter and miscellaneous items have been indicated at 62.4, 19.2, 12.0, 1.6, 1.2, 0.8 and 0.8 per cent respectively. The farm equivalent value of broilers produced in 1934, $19 million and by 1969 it stood at $1.5 billion. The average price received by producers was around 20 cents till 1940, 36 cents in 1948 and dwindled to 14-15 cents in mid 1960's. In 1967 it dropped to 13.3 cents but has since increased. There was a
trend towards greater concentration of broiler processing into fewer plants with processing by fewer firms. Number of processed firms decreased from 286 in 1962 to 153 in 1968. By 1968, 31 per cent of the total firms handled 70 per cent of the volume. Of the total number of broilers 89 per cent were slaughtered in processing plants under Federal Inspection and 11 per cent on farms or in processing plants not under Federal Inspection. The poultry processing plants have mostly shifted from cities to rural areas. Seasonal variation in processing varied from 82 to 117 per cent of the annual monthly average. The low months were November through April and high months were May through October. The seasonal variation seems to be low compared with other commodities.

A breakdown of average costs of processing, transporting and selling broilers to retail outlets showed that in 1963, processing costs accounted for 52 per cent transportation and selling costs for 48 per cent. The highest cost items in processing plants were wages and supplies. The costs could be reduced by working the plant at full capacity. Losses in processing plants occurred due to antimortem, which was 0.3 per cent during 1969 and post-mortem condemnation which was 4 per cent in 1967. Major reasons of these losses were; diseases or infections, bruises, cadavers, contamination, and oversealed. Storage losses were found to be very small as the peak amount stored
was less than 0.4 per cent of the amount certified. Processors' selling price trended downward as farm price for live birds showed a downward trend since 1948 and as processors became larger and more efficient, costs decreased and their margin narrowed. The states with largest surpluses in 1969 were Georgia, Arkansas, Alabama, North Carolina, Mississippi, Maryland, Delaware and Maine. The state with shortage were New York, California, Illinois, Ohio, Michigan, Pennsylvania and New Jersey. California, one of the 10 leading states in production was different where its needs were considered. Consumption of broilers varied seasonally. Domestic consumption was the highest during second and third quarters of the year. The two major outlets other than domestic use were further processing and exports. Seasonal variations for these seemed to follow the seasonal variation in broiler slaughter. The monthly pattern for farm and retail prices were inversely related to the seasonal variations in slaughter. When slaughter was the highest the price per pound was the lowest. But farm to retail price spreads were the narrowest in December and January and widest in early spring. By 1969 about two third of this volume moved direct, and only one-third went through wholesale distributors. In 1969, 66 per cent of the plant's output was packed for retail outlets, 30 per cent for institutional outlets and the remaining 4 per cent for export and military outlets.
Super-markets handled about three-fourth of the broilers sold through retail foodstores.

For 1963-69, farm value of frying chicken varied from 18.2 to 21.00 cents per pound, while retail price varied from 39.4 to 43.6 cents per pound. The farm - to - retailer margin varied from 9.0 to 11.7 cents per pound while retailer to consumer margin varied from 10.5 to 11.4 cents. The farmers' share of consumers' dollar was 50.0 cents in 1963 compared to 47.8 per cent in 1969. Spoilage during marketing was found to be 3.2 per cent which occurred due to cutting loss weepage of both moisture from the cooling process and fluids from the meat and wastage due to mishandling and spoilage. These losses also varied with the length of the fresh birds' one in the marketing channels. The study also discussed price elasticity, cross elasticity and income elasticity of demand for broiler. Coefficients from various studies varied over wide ranges because of the years included, the data sources and the varied scope and methodology of these studies.

Based upon per capita broiler consumption in 1969 at 35.1 pounds ready-to-cook weight, the study has predicted the consumption projections for 1975 at 7.3 billion pounds and 8.4 billion pounds in 1985.

Govt. of India (1972) conducted a study during 1967-68 in four important poultry raising centres namely, Ludhiana, Samrala, Patiala and Kharar. In all, there were 46 farmers
for which results were presented in the study. The poultry farms were divided into five groups according to number of birds. Out of the selected farmers, 13 farmers run the poultry business alone, for 10 it was the main occupation and for the rest 23 farmers it was a subsidiary occupation. The value of assets per selected poultry farm was Rs. 15684 varying from Rs. 3519 for poultry farm of the size group less than 200 to Rs. 51768 for size group 1000 and above. It was found that the poultry farmers were generally running their business with their own funds. Of the total labour employed, family labour accounted for 59 per cent and hired labour 41 per cent. The overall utilization of human labour per hundred units in a year worked out to 78 man-days costing about Rs. 250.00. The overall cost of feed per 100 chicks in a month worked out to Rs. 60.95. For 100 layers feed cost per day worked out to Rs. 5.97. The value of eggs produced accounted for 71.1 per cent and for birds and manures 25 and 3.9 per cent respectively of the total income. Out of the total eggs produced, 33.9 per cent were sold at the farm, 62 per cent in the market, 2.1 per cent were used for hatching and 1.8 per cent were either consumed or spoiled and the remaining 0.1 per cent were disposed off in other ways. The sale of birds was exclusively in live form as none of the selected poultry farmers had arrangements for dressing the birds. The study indicated that the farmer faced the following difficulties: non-availability of superior
breed chicks, feed, non-availability of veterinary aid at proper time and lack of finance for expansion purposes. Lack of proper agencies for marketing of poultry products constituted further problems. However, this study dealt with economics of egg production, and marketing channels and practices for eggs.

Deaton, Lott and May (1972) in their study for Southern Mississippi broiler growing area found that temperature in the summer varies from 23.9 °C to 35 °C to 23.9 °C cycle with a 21 °C dew point. Thus at least one group of broilers reared each year is subjected to temperatures in the 35 °C range during the afternoon hours. This study was undertaken with interest in cooling broiler houses in summer months, so that bird response data would be available to determine the growth and feed utilization response of broilers mechanical refrigeration broiler houses as used. It was found that maintaining a constant temperature of 23.9 °C for the 4-8 week growing period rather than allowing the temperature to vary from 23.9° to 35° to 23.9°C in a 24-hour period significantly increased male body weight i.e. by 170 gms. and female body weight i.e. by 111 gms. The amount of feed required per unit of body weight at 6 weeks of age for the group reared under the varying temperature regime was significantly greater than for the bird reared at a
constant 23.9°C temperature. By 8 weeks of age, however, no significant differences existed between any temperature group for feed utilization. Broilers reared in a constant 29.4°C temperature responded the same for body weight and feed utilization as broiler reared under a diurnally varying temperature of 23.9°C to 35°C to 23.9°C.

Dev (1972) observed that commercial poultry farming for broiler production started only about four decades ago. This industry made a rapid development because of genetic improvements brought about through the application of systematic breeding techniques. In the U.S.A., the average body weight of broilers during 1969 doubled compared to 1952. The annual production of broiler meat in U.S.A. during 1964 was estimated to be more than lbs. 750 crores.

Tests reported by U.S.D.A., indicated that average body weight at eight week was from 1.8 to 1.9 kgs., feed required to produce one kg. of live broiler weight was about 2 kgs. and mortality upto eight weeks was about 2 per cent.

In India, broiler breeding projects have been in progress to study the performance of crosses between the weak known exotic meat-type breeds such as white Rock, white cornish, New Hampshire and the Indian breeds, Aseel and Harringhata black. The general conclusion from these investigations is that the cross breeds are superior to pure breeds. However, growth rates of even the last crosses among these breeds turned to be low compared with imported commercial stocks and average body weight did not exceed
1100 gms. at 10 weeks age, while for imported strains, average body weight under Indian conditions turned out to be 1510 to 1800 gms. at the same age.

A broiler breeding project was taken up at Punjab Agricultural University Ludhiana in 1959 and three generations of soldier breeding (pure bred) have yielded an average body weight of 1200 gms. at eight week and more than 1700 gms. at ten week. Further selection is continued and it is hoped that the growth rate will improve further.

Experiments conducted on broilers during rainy season, winter and summer showed that damaged maize or wheat used at half or full replacement of normal maize (incorporated at 60 per cent level in the reference diet) supported normal and a standard growth in broilers showing no significant difference in growth due to treatments. Supplementation of methionine and lysine to damaged grain diets was not found economical.

The economics of the diets used in their experiments was worked out and it was seen that diets containing damaged wheat at half and full replacement of normal maize proved most economical since the average cost of feed required for producing 1 kg. of edible meat was Rs. 1.97, 2.15 and 2.30 respectively whereas on an reference diet it was Rs. 2.24, 2.38 and 2.62 at 8, 9 and 10 weeks of age respectively. For diet containing damaged maize it was Rs. 2.10, 2.17 and 2.40 respectively at 8, 9 and 10 weeks of age. The
following conclusions can be drawn from this investigation:

1) damaged/sub-standard maize/wheat can be used in broiler/feeds at full replacement of the normal maize provided the damaged grains are free from Aspergillus flavus and thus zinc acid content is not very high and 2) supplementation of damaged grains diets with methionine and lysine is not economical.

Thakur observed that to feed the growing population, it is necessary to minimise competition of poultry for human food. The author indicated that about half a million ton of damaged/sub-standard food grains may be available with Food Corporation of India, which handles about 10 million tons of food grains annually. The study was undertaken to examine how far damaged/sub-standard food grains were useful and economical as a poultry feed.

Auckland (1973) conducted an experiment on 160 white male turkeys of an early maturing strain (River Rest) by feeding them on diets containing either adequate (29 per cent) or inadequate (20 per cent) amounts of crude protein from 1 day to 6 weeks of age.

At one day age all the birds were weighed and length of the lower leg was also measured. The birds were allocated to one of four groups and kept under similar conditions, two groups were offered an adequate diet and two a low protein diet. The initial mean body weight was 53 g. and length of lower leg was 32 mm. At 6 weeks mean body weights
were 1160 g and 828 g and mean lower leg length were 93 mm and 82 mm, for birds fed on the adequate and low protein diets respectively. There was thus a 29 per cent depression in weight and a 12 per cent depression in length of the lower leg due to low protein feeding. Mortality during the 6 weeks was 8.7 per cent and 7.5 per cent in the adequate and low protein groups respectively. In case of under-nourished turkeys, body weight at 1 day was useful in predicting body weight at 6 weeks. This was probably due to the fact that the poultry were unable to exhibit their maximum growth potential and therefore individual weight advantages at 1 day tended to be maintained. This finding has significance in view of the current interest in feeding low protein diets in the early life and exploiting the potential for compensatory growth at later stages (e.g. Walters, 1972). The relationship between initial length of the lower leg and body weight at 6 weeks of age was highly significant for adequately fed poultry and suggests that the initial length of the lower leg is a useful measure for predicting body weight ranking at 6 weeks.

Baron, Cowie, Hughes, and Lesser (1973) conducted a study for a large scale survey of house-wives' attitudes to four main meats viz. beef, pork, lamb and chicken. The study was located in North East England. Two pairs of approximately matched towns were selected for the investigation. Sunderland and Middlesbrough as large
industrial complexes, Hexham and Morpeth as medium sized market centres. In all 1518 questionnaires were collected and analysed.

Attitude of housewives for purchase of the selected meats was as follows: Beef: nourishing, appetising, digestible, edible fat, re-usable, traditional but expensive of all the meats. Chicken: Modern, a supermarket buy, appetising smell and taste, tender, lean, cheap, re-usable good as cold meat and for fancy cooking but least nourishing nor tasty of all the meats. Lamb: thrifty, tender, digestible but the least appetising of the four, fatty, unpleasant cold, not versatile, difficult to carve. Pork: fairly appetising and nourishing, tender tasty, good cold, but greasy, too fatty, indigestible, not versatile and expensive.

Attitudes towards providing meals and cooking were as follows: Meat is the necessary basis of a meal to provide good diet but it is expensive. Fish was considered a good substitute for meat. High quality meat can be obtained by finding and keeping to a traditional hatcher. Variety of meat meals was desirable. Many housewives were a little unsure as to their ability to cope with all cooking situations.

The study indicated that on Saturday there were peak purchase (30 per cent) of the week and lowest being on Monday i.e. 7 per cent only. In terms of weekly expenditure,
beef accounts for 51 per cent; lamb, chick and pork account 22, 11 and 8 per cent respectively of the total. The rest included offals and sausages etc.

Age of housewife and family size were important factors in purchasing habits and expenditures. Small households purchased more of the expensive cuts which were also easy to cook. The socio-economic class analysis showed few significant differences in purchasing patterns.

Govt. of India (1972) conducted a random sample for broilers performance at 5 selected centres during 1971-72. The average live weight per chick at 8 weeks age varied from 0.73 to 1.422 kgs. with a feed conversion ratio varying from 2.82 to 3.48. The meat percentage on dressed ready-to-cook was reported as high as 78.5 per cent.

The studies reviewed covered a great variety of the broiler rearing and marketing problems but majority of them had their origin in the foreign countries. This limited their applicability to Indian conditions. The studies conducted in this country, besides being scanty, covered only a few aspects. Hence the present investigation was necessitated to study, almost all the segments of broilers industry.