

Poultry Production: Structure and Technical Performance

The structure and costs of production in the Indian poultry meat industry vary from region to region. While independent and relatively small-scale producers still account for most production, relatively large-scale integrated producers account for a growing share of output in some regions. Integrated operations include large regional firms that incorporate all aspects of production, including raising grandparent and parent flocks, rearing day-old-chicks (DOC), contracting production, compounding feed, providing veterinary services, and wholesaling.¹⁰ Most integrated firms also have some presence in retail marketing, largely for the purpose of establishing price leadership and having influence over wholesale-retail margins (see section on poultry marketing). Some integrators (about six to eight nationwide) also process a share of their production in modern, automated, or semi-automated plants.

India's poultry industry also has a number of smaller, partially integrated firms that typically omit one or more of the major input enterprises, such as breeding or feed milling, and may have little or no contract production. Large-scale integrated producers are most prominent in the southern and western regions. Smaller, independent, and sometimes partially integrated producers account for most poultry production in the northern and eastern regions.

Commercial broilers and eggs are produced by separate enterprises using specialized broiler and layer breeds and distinct management practices. Joint production of poultry meat and eggs from dual-purpose birds is confined to noncommercial "back yard" operations. Although data on noncommercial production of poultry and eggs is not available, industry sources indicate that this industry segment is declining and probably accounts for only 10-20 percent of India's total output. This study excludes analysis of this component of production.

¹⁰ The poultry breeding chain starts with "pure line" flocks that are multiplied into "grandparents" and then "parents," which are the source of eggs for the day-old chicks (DOC) used in broiler enterprises. Smaller enterprises may simply purchase DOCs from a hatchery, while larger enterprises can reduce DOC costs by integrating maintenance of parent and grandparent flocks into their operation.

Data Collection Methods

The data used in this study were collected during a field survey by an ERS team that visited India in August 2001. Because of significant regional variations in poultry demand and in the structure of poultry production, the team traveled throughout the country, visiting Delhi, Punjab, and Haryana in the North; Ahmedabad, Mumbai, Pune, and Nashik in the West; Coimbatore, Hyderabad, and Bangalore in the South; and the Calcutta region in the East. In the absence of a reliable listing of producers from which to draw a sample, and to contain data collection costs, survey respondents were selected based on recommendations of industry sources, who identified individuals that had both knowledge of the industry and reliable records.

In each region, the team visited poultry hatcheries, producers, processors, wholesalers, retailers, and feed producers, asking each respondent the same operations-related questions. The production and marketing cost data are based on 18 respondents (4 in the North, 5 in the West, 8 in the South, 1 in the East) who provided complete and consistent data. Although the sample size is small for such a large country, the variation in responses within regions is generally small, increasing confidence in the reliability of the regional and national averages. Because of the small sample size, however, the results should be interpreted with caution. In particular, the sample size is very small in the East (1) and is likely skewed toward larger integrated operators in the West.

The Role of Integrated Poultry Production

Poultry integrators have been expanding most rapidly in southern India, particularly in the Coimbatore area of Tamil Nadu, where, reportedly, integrators now account for about 75 percent of production and consumption. Integrators have recently become more prevalent in western India, including Pune, Nashik, and Mumbai, where they now account for about 35 percent of production and consumption. In northern and eastern India, integration has moved more slowly,

accounting for about 10 percent of the market. In the North, integrators have found it difficult to enlist and manage contract growers and, despite the presence of the large and affluent Delhi market, there are no major, fully integrated contract growers in the region. In the East, lower per capita incomes and low demand for poultry meat are likely contributors to the slow rate of growth.

In southern India, the process of integration began in the mid-1990s and accelerated rapidly as independent growers found the guaranteed returns of contract farming preferable to the vagaries of market returns. As integration expanded, some formerly independent hatcheries and feed millers found it necessary to become integrators themselves or risk going out of business. Integration has brought two important changes to the poultry industry in southern India: lower average costs of production through improved technology and management practices and, particularly, a collapsing of the margins previously commanded for the various production inputs; and smaller producer-retail margins and lower retail prices for poultry meat, which has been a key demand stimulus in the southern and western regions (see section on poultry marketing and prices).

In the last 2-3 years, several integrators have begun to operate around the Mumbai market in western India, primarily in the Pune and Nashik areas. They include poultry integrators who are expanding from southern India, ventures by national or regional hatchery and feed businesses, and local poultry wholesaling firms, all competing to enlist contract growers and expand market share in the region. This competition, combined with seasonally weak demand due to religious observances, led at times to severely depressed producer and retail prices in the Mumbai market in 2001.

For integrators to succeed in the Mumbai market as they have in southern India, they must overcome the dominant role of the traditional Mumbai wholesale trade. Traditional trading relationships, together with the high cost of establishing an effective retail presence, may prevent integrators from competing down marketing margins and expanding their share of the market. The firms that are entering this market, however, all have significant financial resources and plan to address this issue through strategic links with existing food retailing operations.

Integrators are also expanding in the areas of Bangalore and Hyderabad in the South and Calcutta in the

East. The only major region where large integrators have not yet made significant inroads is in North India, including the large Delhi market. In this region, some individual producers have expanded into feed mixing and direct retail marketing. No producers, however, are involved in rearing parent or grandparent flocks, and very few are contracting out production. The lack of poultry integration in the North may be due to difficulties in enforcing contract-farming agreements.¹¹ Also, climatic extremes of hot and cold make poultry production more management- and capital intensive in the North, compared with the other regions. Lastly, unlike other regions where the integrators have flourished, the Punjab-Haryana-Western Uttar Pradesh area near Delhi is heavily irrigated and highly productive for crop farming. As a result, allocating management and labor to contract farming for the margins fixed in standard broiler contracts may be less appealing. Contract models that call for farmers to serve only as the owner of the houses, with the integrator providing all labor and management, may be more successful in this region (see section on farmer's compensation under integration).

According to most of the survey respondents, the primary constraint in expanding integrated poultry operations is marketing. Most integrators sell the bulk of their output as live birds in the wholesale markets, with a small share sold in retail markets as either live or dressed birds or products. With limited demand or capacity for frozen products, and the high cost of moving live birds to distant markets, integrators are mostly confined to their local regional market and its seasonal demand patterns (see section on marketing). Another common concern among survey respondents is high interest rates. Producers or integrators looking to expand facilities can expect to pay interest rates of about 15 percent on commercial loans that, at the current rate of wholesale price inflation, imply a 9-10 percent real cost of borrowing. In general, the availability of feed grain or oil meal was not considered to be a significant problem, although seasonal shortages of corn can and have resulted in higher prices. Only in northern India did integrators regard enlistment, organization, or management of contract farmers as a significant problem.

¹¹ At present, India does not have a law covering contract farming and the contracts between farmers and contractors cannot technically be enforced. Integrators and growers in other regions appear to be working together smoothly despite this problem, but this is not the case in North India.

So far, foreign direct investment (FDI) has been a minor factor in the expansion of integrated poultry operations in India. A large integrator in both the southern and western regions operates a processing facility built recently with the assistance of private Saudi Arabian investment. Two large Asian integrators, Japfa from Indonesia and CP from Thailand, have been in the feed business in India for several years but have, so far, not expanded into poultry integration.

Poultry Breeds

Although a number of poultry breeds are available in India, the Cobb 100 breed owned by Venkateshwara Hatcheries (VH) currently accounts for 60-70 percent of all broilers in India. VH has a nationwide infrastructure that supplies its breed to broiler operators, either as grandparents, parents, or DOCs, and also provides comprehensive veterinary services to its growers. At present, all broilers supplied by VH are the Cobb 100, a relatively older breed based on breeding stock imported from the United States and benefiting from a long period of adaptation to Indian climatic and disease conditions. A Cobb 500 line, based on more recently imported breeding stock, is reported to be under development, as is a Cobb 400 line, based on a cross between the Cobb 500 and the acclimatized Cobb 100. Other breeds present in India include Ross (U.K.), Hybro (Netherlands), Hubbard (U.S.), Avian (U.S.), and Anak (Israel).

The dominant position of VH and its Cobb 100 in broiler breeding in India stems from a combination of factors: government restrictions on imports of grandparent lines that were in place until 1995, and the entrepreneurial skills of the late VH founder, who is known as the founder of the Indian poultry industry. Prior to loosening restrictions on imports of grandparent stock, only pure line imports were permitted. Cobb became one of the few imported pure line breeds available in India, and the breed was developed, acclimatized, and spread throughout the country as VH built a nationwide infrastructure of hatcheries and veterinary services. Most of the other imported breeds now present in India have entered only since 1995. As a result, promoters of other breeds have had a much shorter period to acclimatize their breeds to Indian conditions, establish products in the marketplace, and develop production facilities and marketing networks.

Industry sources report that the dominant role of the Cobb 100 breed and VH in the Indian broiler hatchery

industry has both advantages and disadvantages for the growth of the broiler industry. On the technical side, the well-acclimatized Cobb 100 is known for its hardiness in Indian climate and disease conditions. It has also proved to be a good “breeders bird,” producing a relatively high number of hatching eggs per parent, compared with other breeds. Another advantage is the generally ready availability of chicks and veterinary support services from VH’s widespread operations. The Cobb 100, however, is primarily a layer and, hence, provides a relatively low 75-percent meat yield, compared with 77-78 percent for newer, specialized broiler breeds. The Cobb 100 is also a very old breed, with superior breeds available internationally.

Perhaps a more significant concern with the dominant role of the Cobb 100 relates to the implications of concentration and market power in the broiler chick business. Several integrators indicated that their allocations of grandparents, parents, or DOCs have been reduced in certain market conditions, ostensibly to support broiler prices, but also having the effect of limiting the growth of some integrators. With the owner of the Cobb 100 breed also venturing into integrated operations, other firms feel they are at a competitive disadvantage. Several integrators resorted to importing and developing their own breeding operations because they felt they could not rely on sufficient allocations of Cobb 100s to meet their needs and expansion plans. Data collected from study respondents suggest that firms that integrate grandparent breeding enterprises into their business, as opposed to purchasing Cobb 100 parents or DOCs, experienced significant cost savings (table 4).

With the expansion of large-scale integrators since the mid-1990s, and the liberalization of grandparent imports in 1995, imports of breeding stock of various international breeds have increased. Given the apparent cost advantages to integrated firms, this trend is likely to continue. But it is unclear how long it will take for the new breeds to become sufficiently accli-

Table 4—Average day-old-chick costs in India

Region	Integrators	Other farms
<i>Rs/bird</i>		
North	NA	11.79
West	8.75	14.00
South	7.89	10.00
East	10.00	NA

NA = Not available.

Source: ERS field survey, August 2001.

matized to Indian conditions to counter the hardiness and breeding advantages of the Cobb 100. Although Indian firms are importing breeding stock and technology from foreign breeders, there is currently no FDI in broiler breeding in India.

Poultry Production Practices

Poultry production practices in India vary across regions, based on differences in climate and on the presence of poultry integrators, who impose a standard level of technology and operational efficiency on poultry enterprises. In general, the larger and/or integrated operations, particularly in southern India and the Mumbai region, appear to be quite technically and economically efficient, with operators exhibiting strong knowledge of correct breeding, feeding, veterinary, and rearing practices. In general, technical performance indicators for these operations, including numbers of DOCs per parent, days-to-market, feed conversion, and mortality, are comparable with average levels achieved in U.S. operations.

Facilities and equipment. Climate conditions are most suited to poultry production in southern India, where average temperatures, though fairly high, tend to avoid the extreme heat of the eastern and western regions, and the extremes of both hot and cold found in northern India. The capacities of houses range from 8,000 to 20,000 birds and from 6,000 to 15,000 square feet. Based on the field survey, production facilities and equipment in the four regions can be characterized as follows:

- ◆ *South.* In the South, poultry houses tend to be built of brick pillars, with open sides, tile roofs, and concrete floors. Cooling, when needed, is provided by ceiling fans, and heating is unnecessary except for brooding. Bedding is generally paddy husks. Manual feeders and bell-type drinkers are most common, with little use of automatic watering and feeding systems.
- ◆ *West.* In the Mumbai region, where average summer temperatures are higher than in the South, houses are also built of brick with tile roofs and concrete floors, but tend to be mostly enclosed with evaporative automatic cooling systems. Automatic watering and feeding systems are more common in this area.
- ◆ *East.* In the region north of Calcutta, houses are constructed of brick pillars with open sides, very similar to houses in the South, although side curtains are generally present to help hold in warmth in

the slightly cooler winters. Feeding and drinking equipment is generally manual, and ceiling fans provide summer cooling.

- ◆ *North.* In the North (Punjab, Haryana, western U.P.), both summer and winter weather are more extreme than in the other regions. Houses are built of brick and concrete and have either enclosed sides or side curtains and concrete floors. Some houses have automatic systems for both evaporative cooling and heating. Because land prices are significantly higher in this region, two-storied houses are common. Both manual and automatic watering and feeding equipment is seen in this region.

Breeding practices. While independent operators generally purchase DOCs from local hatcheries, such as VH, integrators generally produce their own chicks from either parent stock or grandparent stock raised in their own facilities. For integrators, producing DOCs from their own parent or grandparent operations is a key source of savings. Integrators reported DOC costs from their own grandparent operations of Rs6-10 per chick, compared with costs of Rs10-15 per chick for other operations. In addition, market prices of DOCs are, reportedly, quite volatile depending on local supply and demand conditions. At times, market DOC prices can crash to as low as Rs3 and rise to as high as Rs16-18. Recently, hatcheries in some areas jointly agreed to destroy hatching eggs because of large surpluses of DOCs.

The parent and grandparent operations visited were run with strict standards of environmental control and sanitation to protect the health and productivity of the flocks. According to industry sources familiar with both Indian and U.S. practices, it is typical for Indian poultry breeding operations to achieve levels of performance, in terms of eggs per parent and hatching percentage, superior to those achieved in U.S. operations. Using Cobb 100 parents or grandparents, growers typically achieve about 170-180 eggs per parent with a hatching percentage of 90 percent or higher. These relatively high levels of productivity are attributed to the hardiness of the Cobb 100 breed, as well as higher labor inputs relative to U.S. operations.

Feeding practices. Growers tend to cite feed costs as the critical component of controlling and lowering production costs. Reducing feed costs includes steps to improve feed conversion, including innovations such as pelletization and automated feeding, as well as improvements in feed purchasing and logistics.

Poultry farmers have a strong understanding of the importance of balanced feed rations. They recognize corn and soybean meal as technically superior ingredients for broiler rations, with corn generally accounting for most of the energy in the feed ration and soybean meal providing most of the protein. Most operators, however, use substitutes for both the energy and protein ingredients in the ration based on changes in relative market prices. The most common corn substitutes for energy are broken rice, millet, and wheat (table 5). Fish meal, sunflower meal (decorticated), and peanut meal are the most common protein substitutes for soybean meal.

Given the key role of feed costs in overall costs of production, feed conversion rates (FCR) are a major concern for growers, most of whom have a clear understanding of their FCR, as well as the impacts of alternative ration ingredients on FCRs. Most operators use mash-type feeds, but a number are beginning to experiment with pelletized feeds. Although pelletized feeds are more expensive than mash feeds by Rs0.50-1.00 per kg, or about 5-10 percent, they result in less wastage, assure a more balanced ration for each bird, and lower FCR. Several operators that use pelletized feed report about a 0.1-kg improvement in the FCR.

The price volatility of local feeds, particularly corn, and the absence of futures markets to manage price risk make it difficult to control and predict feed prices. Some operators pursue a strategy of buying and storing ingredients when prices are low, but others do not because of the difficulty in accurately predicting price movements. Concerns with feed costs tend to be greatest in southern India, where both corn and soybean meal are not available locally and must be purchased from suppliers in central and northern India. Feed imports are normally not an economically viable option because of large national surpluses of soybean

Table 5—Major poultry ration ingredients in India

Energy	Protein	Other
Corn	Soybean meal	Soy oil
Broken rice	Fish meal	Sunflower oil
Pearl millet	Sunflower meal ¹	Minerals
Wheat	Peanut meal	
Sorghum	Rice bran	
Rice bran	Meat meal	
Shares:		
60-65 %	30-35%	5%

¹Decorticated.

Source: ERS field survey, August 2001.

meal and a restrictive tariff-rate quota (TRQ) regime for corn imports (see feed trade policy section).

Most poultry integrators include feed milling as one of their integrated enterprises. Most also indicate significant cost savings, as well as more consistent quality, from producing their own feed. A number of feed milling companies, threatened by integrated operations cutting into their customer base, have evolved into poultry integrators.

Veterinary practices. Poultry operators also appear to have a strong understanding of the steps needed to safeguard the health of their flocks. Most independent growers retain consultant veterinarians to monitor and address health problems in the flocks. Poultry integrators provide medicines and veterinary services as part of their package of inputs for contract growers. Diagnostic facilities and medicines are readily available. Outbreaks of flock-threatening diseases, though possible, are rare.

Foreign direct investment in poultry inputs. FDI in poultry production inputs is most common in the area of pharmaceuticals, as most of the companies operating in India are multinational corporations or Indian joint ventures with multinationals. Although some items are imported, most drugs and vaccines for poultry production are produced in India.

The major Indian feed companies are Indian owned. Two foreign companies, Japfa from Indonesia and CP from Thailand, now have feed operations in India, but they do not account for major market shares. Most poultry equipment, including feeders, waterers, and climatic controls, is produced by Indian-owned companies. Some equipment, however, is imported and some items are produced in joint ventures with foreign companies.

Technical Performance and Production Costs by Region

Summary performance indicators, including days-to-market, weight, FCRs, and mortality rates and variable production costs for the operations visited, are shown in table 6. The results should be interpreted with caution because they are based on a small number of firms that may not represent overall regional or national averages. In particular, the sample is very small (1) in the East and is likely skewed toward larger integrated operators in the West. In general, however, the indicators suggest greater technical efficiency in

Table 6—Summary of performance indicators and variable costs for poultry in India, by region

Variable	North	West	South	East
Harvest weight (kg/bird)	1.83	1.68	1.89	1.50
FCR (kg/kg)	1.88	1.88	1.85	1.90
Mortality rate (percent)	4.3	3.9	3.9	3.9
<i>Rs/kg, live harvest weight</i>				
DOC cost	6.72	6.14	4.35	6.67
Feed	16.13	15.96	16.58	17.10
Mortality	0.71	0.65	0.62	0.75
Other ¹	5.88	4.87	4.38	3.98
Total variable costs (US\$/kg)	29.44 (0.62)	27.63 (0.59)	25.93 (0.55)	28.50 (0.60)
Feed share (percent)	54.8	57.8	63.9	60.0
Feed price (Rs/kg)	8.58	8.55	8.97	9.00

¹Includes medicines, labor, energy, grower fees, and overhead.

Source: ERS field study, August 2001.

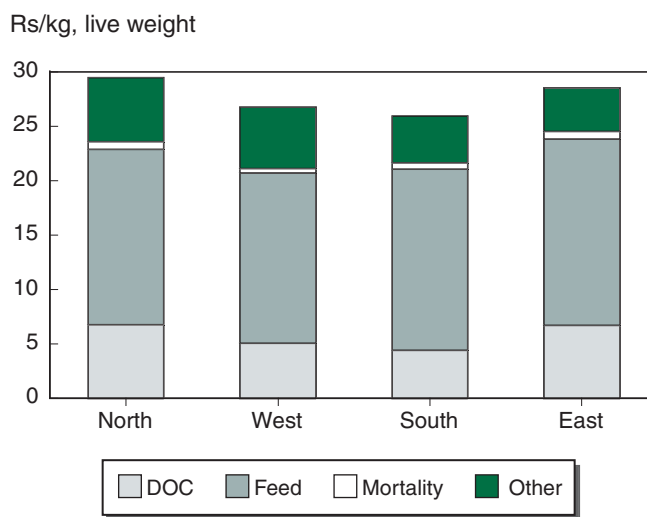
the South and West, compared with the North and East. Findings also suggest greater technical efficiency in those operations employing automatic climate controls in their houses, regardless of region. Operations in the South, as well as the firm surveyed in the East, tend to achieve roughly equivalent or better technical performance than the other regions without having to use costly environmental controls (other than simple ceiling fans).

FCRs and days-to-market are generally higher in the North, at least in part because of higher market weights. Mortality rates are also highest in the North, where the extremes of hot and cold temperatures are most problematic. Growers in this region clearly face the greatest challenge from climatic conditions, which they cite as a key reason that their costs are higher than in the South. Northern Indian growers, however, have less difficulty with corn supplies because of local production.

Variable production costs by region. Average variable costs of production are lowest in the South, followed by the West, East, and North (fig. 5). However, the range of average variable production costs across regions, from Rs25.92 per kg to Rs29.44 per kg, is not very large. Feed is the largest component of costs, ranging from about 55 percent of total vari-

Figure 5

Variable poultry production costs in India, by region



Source: ERS field survey, August 2001.

able costs in the North to about 64 percent in the South. DOCs are the second largest cost component, ranging from 17 percent of variable costs in the South to about 23 percent in the North.

- ◆ *South.* Variable production costs in the South average Rs25.92 per kg. Some of the larger integrators in the region reported costs below Rs25.00 per kg. The South has the lowest total costs despite facing the highest feed prices (both corn and soybean meal generally must be shipped from greater distances than in the other regions). DOC costs are lowest in the South, and mortality costs are also low relative to two other regions. The greater cost efficiency in the South likely stems both from favorable climate and better management by the integrated poultry operations. Relatively low energy costs for both heating and cooling hold down “other” costs in the South.
- ◆ *West.* Average variable costs in the sample of western region operations were Rs26.75 per kg, with this region having the lowest feed costs per kg of output and the lowest mortality costs. Producers in this region benefit from close proximity to Madhya Pradesh, which produces soybean meal and corn, and to Karnataka and Andhra Pradesh, which also produce corn. As noted earlier, however, all of the firms visited in this region were relatively large and well-managed integrated operators using climatic controls in their houses; hence, these findings may not be indicative of the region as a whole. “Other” costs are

relatively high in this region, in part due to the energy costs associated with operating climate controls.

- ◆ *East.* The eastern region had the third highest total for variable production costs, although the sample consists of only one, relatively large, integrated operator. Based on the data from this firm, this region has the highest feed costs, due to relatively high feed prices and FCR, as well as relatively high mortality and DOC costs.
- ◆ *North.* Average total variable production costs were highest in the sample of northern India producers, at Rs29.44 per kg. The benefits of relatively low feed prices in this region are offset by relatively high FCRs, DOC costs, mortality rates, and energy costs. To some extent, performance and costs are affected by the climatic extremes in this region. The absence of integrated poultry operations probably also affects costs, particularly for DOCs.

Fixed production costs by region. Data were collected on fixed costs of production, including housing, equipment, and, where applicable, environmental controls (table 7 and fig. 6). As expected, given differences in climate and production practices, there are sizable regional differences in fixed costs of production. Fixed costs tend to be lowest in the South and the East and highest in the West and North. In both the South and East, the favorable climate permits relatively low housing costs, automatic climate controls are generally unnecessary, and most producers use lower cost manual feeding and watering equipment.

By contrast, costs of both housing and equipment are significantly higher in the North and, at least for the operations visited, in the West. On a square-foot basis, housing and equipment costs in the West and North are two to three times higher than for typical producers in

Table 7—Summary of fixed costs of production for poultry in India, by region

Variable	North	West	South A ¹	South B ¹	East
<i>Rs/sq. ft.</i>					
House	72.92	100.00	67.13	52.83	57.50
Equipment	45.43	88.61	51.53	13.15	11.11
Total	118.35	188.61	118.66	65.98	68.61
<i>Rs/sq. ft./flock</i>					
Memo:					
Interest cost ²	2.96	4.72	2.97	1.65	1.72

¹South A includes all respondents; South B excludes one, high-cost respondent.

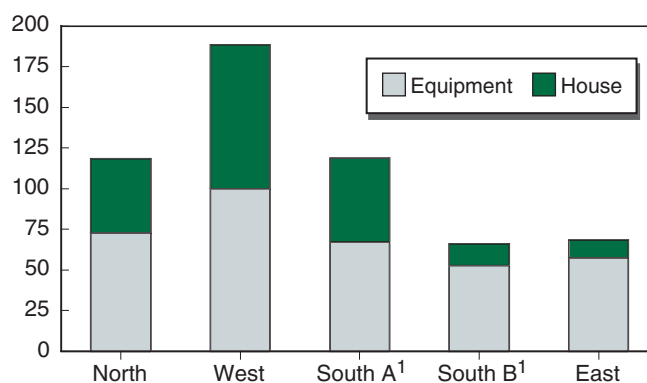
²Assuming a 15-percent interest rate and six flocks per year.

Source: ERS field study, August 2001.

Figure 6

Fixed poultry production costs in India, by region

Rs/sq. ft



¹South A includes all respondents; South B excludes one high-cost respondent.

Source: ERS field survey, August 2001.

the South or East. With interest rates on bank borrowing for poultry operations of about 15 percent, according to most respondents, the differences in fixed costs can translate into significant differences in interest costs across the regions. Assuming a 15-percent interest rate, financing of 100 percent of construction costs, and six flocks per year per house, interest costs are Rs2.96-4.72 per square foot per flock in the North and West, and Rs1.65-1.72 in the South and East.

Although estimates of land costs are not available across all regions, industry sources indicate that land costs are highest in the North (Punjab, Haryana, western Uttar Pradesh), where farm land is more likely to be irrigated and more productive for crop farming. In the Punjab region, farmers quoted land prices ranging from of Rs150,000 to 1,200,000 (\$3,100-\$25,000) per acre, depending on location.

Overall, the data collected suggest that lower fixed costs may tend to hold down poultry costs and prices and favor industry expansion in the South and East. However, because it is not feasible to ship large numbers of live birds across regions, producers in the South and East will not be able to exploit this advantage until there is a larger market for processed chilled or frozen poultry (see section on marketing). The relatively high fixed costs in the North and the West may also tend to restrict the participation of smaller growers in industry expansion in this region. While the integrated operations in the South and East tend to enlist both small and large growers, growers in the West and North may have to be larger firms with greater financial resources to invest.

India's Production Costs Relative to Other Countries

To assess the relative competitiveness of Indian poultry production, Indian variable production cost and farm price data can be compared with data for other countries, including the United States, Brazil, and several Asian countries (tables D-1 and D-2). The Indian cost data comprise costs of day-old-chicks (DOC), feed, mortality, medicines, labor, and power reported on the basis of a kilogram of live-weight production, a common industry approach for computing variable costs. Data for other countries are those reported by USDA's Foreign Agricultural Service in annual "attache reports" on the poultry industry in each country. Although the cost accounting methods may vary across countries, it is likely that all the estimates include the key cost items—DOCs, feed, and mortality—which generally account for 80-85 percent of the variable costs of poultry production. Thus, although accounting methods may vary, the data should still be useful for comparison purposes.

The comparisons suggest that, while Brazil is the lowest cost producer, production costs in the southern, western, and eastern regions of India are very competitive with those in other countries, including the United States. Poultry costs in these Indian regions appear to be competitive with those in

Thailand, a major exporter of poultry meat, and significantly lower than those in East Asia and other parts of Southeast Asia.

Data that would permit more detailed comparisons across countries are not available, so it is unclear how India compares on key productivity measures and major itemized costs. Given the dominant role of feed costs in the total variable costs of poultry meat production, it is likely that feed prices and feed use efficiency are important factors in India's apparent competitiveness. The two other relatively low-cost producers among the countries compared, Brazil and the United States, are, like India, large producers of soybeans and corn. Significant local production of both corn and soybean meal allow producers to benefit from relatively low transport and handling costs, and to avoid the costs of tariffs on imported feeds.

As the least developed among the countries compared in tables D-1 and D-2, India also has the least developed poultry sector, with a relatively small share of production from operations that use the most advanced technology. Indian poultry producers likely benefit from lower labor costs but may also pay relatively high real interest rates for operating and investment capital.

Table D-1—Broiler variable costs of production by country

Country	1999	2000	2001
	<i>\$/kg, liveweight</i>		
Argentina	--	0.93	--
Brazil	0.59	0.47	0.38
Malaysia	0.74	0.72	--
Philippines	--	0.86	0.94
South Korea	0.91	0.85	--
Taiwan	--	1.03	--
Thailand	0.74	0.65	0.61
United States	0.54	0.56	0.56
India:			
North	--	--	0.62
West	--	--	0.59
South	--	--	0.55
East	--	--	0.60

-- = Not available.

Sources: Foreign Agricultural Service, USDA, various attache reports; *Poultry Yearbook*, Economic Research Service, USDA.

Table D-2—Broiler farm gate prices by country

Country	1999	2000	2001
	<i>\$/kg, liveweight</i>		
Brazil	0.44	0.50	0.48
Indonesia	0.94	0.79	0.74
Malaysia	0.83	0.83	--
Philippines	1.34	1.17	0.78
South Korea	1.02	1.05	--
Taiwan	1.18	1.08	1.03
Thailand	0.71	0.64	0.68
United States	0.82	0.76	0.87
India:			
North	--	--	0.84
West	--	--	0.48
South	--	--	0.52
East	--	--	0.66

-- = Not available.

Sources: Foreign Agricultural Service, USDA, various attache reports; *Poultry Yearbook*, Economic Research Service, USDA.