The beef chain in Costa Rica: Identifying critical issues for promoting its modernization, efficiency, and competitiveness

F Holmann, L Rivas*, E Pérez,C Castro***, P Schuetz** and J Rodríguez*****

International Center for Tropical Agriculture (CIAT) and International Livestock Research Institute (ILRI).
Cali, Colombia
F.Holmann@cgiar.org
**International Center for Tropical Agriculture (CIAT), Cali, Colombia*
L.Rivas@cgiar.org
*** International Livestock Research Institute (ILRI), Managua, Nicaragua*
Edwin.ilri@cablenet.com.ni ; Paul.ilri@cablenet.com.ni
****Corporación Ganadera CORFOGA, San José, Costa Rica*
cristina@corfoga.org ; Julio@corfoga.org

Abstract

The objectives of this study were to (1) describe the economic agents of the chain and their commercial and legal relationships; (2) identify the articulations between links, technological levels, indicators of efficiency, installed capacity (scale), and degrees of occupation; (3) characterize and estimate the costing and pricing structures, and the generation of value in different links of the chain; (4) identify those critical costs that can be modified through technological interventions, policy, or other activity; (5) determine the biological and economic risk factors throughout the chain; and (6) develop a methodology to identify and estimate the costs and benefits in each segment and evaluate the generation of value throughout the beef chain.

Data at the farm level was obtained from a national livestock survey (CORFOGA 2005b), which provided data on production systems, inventories, productivity, culling, and labor. In addition, surveys were carried out in different segments: (1) auction houses, (2) slaughterhouses, (3) butcher shops, and (4) supermarkets. The aim of these surveys was to describe behavior, determine risks and costs, and identify problems.

The weak dynamics of livestock production in Costa Rica are reflected in unsatisfactory productivity indicators. The annual gross income was estimated as US$44/ha for cow-calf operations, $126/ha for dual purpose (including income from milk sales), and $135/ha for fattening activities. Such income rates are considered extremely low, if one uses as reference the commercial value of land allocated to livestock production (ranging between $1000 and $2000/ha).

The aforementioned biological inefficiencies, combined with high land costs, impede the recovery of opportunity costs for the capital invested in land, thus making beef production uncompetitive. The cow-calf operation, with its low productivity, remunerates family labor with wages below the legal minimum. On the assumption that the only cash cost is that of labor, cow-calf farms pay family workers at a wage that is equivalent to 60% of the legal minimum.

Auctions present relatively good profits per event. However, when these profits are analyzed on a calendar-day basis, they are unattractive because of the low use of installed capacity. One strategy that would usefully improve the efficiency of the auction system in Costa Rica is its integration to reduce the number of fixed operational costs or encourage sharing of these houses so that administrative and operational personnel are rotated among the several existing auctions, taking advantage of the fact that they differ in their days of operation. This scheme would help reduce fixed costs and the commission collected without affecting profits, thus improving efficiency in this link of the chain. However, this option is not easy to implement, as auctions are run by private operators, whose various interests do not always coincide.

The industrial sector formed by rural and industrial slaughterhouses shows a low occupation of installed capacity, resulting in high operational costs and low labor efficiency. The total operational costs of slaughtering and dressing are estimated as being between US$32 and $66 per animal. If the estimated unit costs are compared with the rates charged per slaughtered animal (between $15 and $23), then we have to conclude that rural slaughterhouses work at a loss and that industrial slaughterhouses

cover their operational costs with processing services and the very small profit margins from sales of byproducts.

The best performance in terms of efficiency and profitability is found in the retail sector of butchers and supermarkets. The rate of profits, expressed as the fraction of the final price paid by the consumer that remains in the butcher's hands as remuneration of his work, ranges widely between 3% and 40%, with an average of 32%. If these profit rates are compared with those of other retail businesses, which are about 8%, then this type of activity presents excellent profit margins with relatively low risk. If, in addition, we take into account that this sector also offers the consumer a broad range of meat cuts from other animals such as pork and chicken, and processed meats, then profit margins are still higher.

The value generated throughout the chain, as a percentage of the final value of the young steer at retail price according to activity, is distributed as follows: fattener (34%), retailer (33%), breeder (19%), slaughterhouse (7%), transporter (6%), and auction house (1%). As observed, the distribution of value throughout the beef chain is totally inequitable and incongruent with the level of individual risk confronted by the actors who form it. The inequity observed in the distribution of added value reflects a clear dominant position in the market of some actors of the chain, which enables them to capture a very high fraction of the profits.

The value generated in the chain, adjusted for operational time in each link, ranges between US$0.28/animal per day for the breeder and $45.85/animal per day for the butcher. Thus, the highest proportion of the total added value concentrates on the final link of the chain. The butcher or supermarket obtains, on the basis of one animal in the same unit of time, 164 times more value that the breeder located in the first link of the chain. The latter has to confront biological and economic risks not covered by insurance policies, whereas retailers may mitigate risks through insurance policies for their raw materials, equipment, and infrastructure.

The competitiveness of the beef chain is the aggregate of the efficiency and productivity of all the links that form it. In a situation where, in the final segment, the demand for beef is low and weakly dynamic, then economic signs of modernization and the technological change it promotes, are not being generated in other components of the chain, particularly in the first link of production. This, in turn, results in a vicious cycle, generating low productivity and lack of competitiveness. To promote technological change, efficiency, and competitiveness in the value chain for beef in Costa Rica, we propose the following six recommendations:

1. That successful experiences of other chains such as that of poultry be analyzed and learned from to identify strategies that would increase the efficiency of the beef chain as a whole.

2. That strategies for promoting the milk production of breeding cows be developed to increase family income, as remuneration of labor is currently below the minimum wage. This option would be viable only in localities where a milk market exists.

That livestock producer funds [a livestock producer fund consists of granting livestock in company to produce meat, provided that the producer concerned has adequate pastures for this purpose on his farm] be created as mechanisms to develop social capital, reduce transaction costs, and help improve the chain's productivity and profitability. These organizations would bring together the different classes of the chain and favor synergies in the interaction of public and private actors.

3. That incentives be created to promote the large-scale adoption of already available improved forage species, as most of the problem of low livestock productivity originates in poor and deficient feed. This strategy would emphasize feeding during dry seasons, thereby minimizing seasonal weight losses in the national herd and improving the profitability of farms.

4. That a carcass classification system be established, based on quality and price that would permit differentiating supplies for different segments of the market.

5. That consumer education be promoted on the health benefits of beef, forms of preparation, and differentiating between cuts, uses, and qualities of beef products.

Key Words: Beef value-chain, competitiveness, consumer, marketing, productivity, quality

Introduction

In Costa Rica, livestock represents the most important economic activity within the agricultural sector, accounting for 31% of the sector's gross domestic product (GDP) and 11% of the national GDP (CORFOGA 2005a). It is a strategic activity in that it supplies food staples for the population. Its linkages with other sectors of the economy give rise to multiplier effects in terms of employment, income generation, foreign exchange, and general economic growth.

Likewise, livestock production occupies a major fraction of available land resources, as 69% of agricultural

areas are found under permanent pastures (FAO 2005). Livestock production in Costa Rica is distributed throughout all thermal floors, ecosystems, and regions. This fact generates significant environmental externalities, as inappropriate use of the soil degrades its productive capacity, affecting a very large part of the country's agricultural lands. Over the long term, poor soil management results in low productivity and sustainability of production systems and in strong pressures towards occupying lands that are unsuitable for livestock. Nevertheless, many livestock production farms, unlike those dedicated to monoculture for export, certainly use practices to improve the sustainability of resources by using live fences, planting trees within pastures, protecting water sources, and planting improved forage species that increase cover and prevent deterioration of soils.

For cattle production, major contrasts can be observed. On the one hand, the dairy sector is markedly dynamic, its production having grown without interruption over the last 20 years at an annual rate of 2.5% (Cámara Nacional de Productores de Leche 2005). On the other hand, the beef sector has clearly declined from the mid-1980s, with production decreasing by an annual 0.1% over the last 20 years, despite the cattle inventory declining from 2.3 million head in 1985 to 1.1 million in 2004 (CORFOGA 2005a).

Aside from the technological and economic problems that oppress the agricultural sector, state support has declined notably. State investment fell from 5% of the national budget at the beginning of the 1990s to 1.5% at the beginning of the current decade (CORFOGA 2005a). Within this general context, agricultural credit has deteriorated markedly. In 1990, it represented 15% of the total placements (4% in livestock) but, in 2002, it had fallen to 5%, with 1.7% granted to livestock production.

Most of the problems in the area of primary production stem from imperfections and deficiencies in other links of the chain. Accordingly, if an efficient, competitive, equitable, and sustainable livestock development is to be promoted, the efficiency of the chain as a whole must be improved, ensuring that the benefits of modernization are distributed equitably throughout all its segments.

A central hypothesis of this study is that the crisis of beef production in Costa Rica is a result of multiple causes originating in the first sector of production, in other links of the food and agricultural chain, and in external factors, including economic policies. We therefore reviewed and conducted an integrated and contextual analysis of all the chain's components to identify the critical points at which technological interventions and economic policy would be more efficient in accelerating the sector's modernization.

Objectives

General

To characterize and analyze the beef chain in Costa Rica. The goal is to generate strategic information that would help establish priorities and implement lines of action for those in public and private sectors who are in charge of promoting technological change and competitiveness of the nation's livestock agro-enterprise. We also aimed to gain experience in developing analytical instruments for application in similar studies in other countries of Central America.

Specific

The specific objectives of this study are to:

1. Describe the economic agents of the chain and their commercial and legal relationships;
2. Identify the articulations between links, technological levels, efficiency indicators, installed capacity (scale), and degrees of occupation;
3. Characterize and estimate costing and pricing structures and the generation of value in different links of the chain;
4. Identify those costs that are critical, and can be modified through technological interventions, policy, or other activity; and
5. Determine the biological and economic risk factors throughout the chain.

Materials and methods

Data

A combination of primary and secondary information was collected to describe, characterize, and analyze the different segments that form the beef chain of Costa Rica. Basic information on the production sector comes from various secondary sources that have conducted diagnoses, and analyzed the livestock trends and situation in the country. Information was also available from a national livestock survey (CORFOGA 2005b), which provided data on production systems, inventories, productivity, culling, and labor.

To analyze other links of the chain, primary information was compiled from actors of the same, in terms of volumes of operation, installed capacity, production of products and byproducts, costs, buying and sale prices, modalities of negotiation, risks and losses, client type, and number of intermediaries.

Surveys were carried out in May 2006 in different segments: (1) auction houses, (2) slaughterhouses, (3) butcher shops, and (4) supermarkets. The aim of these surveys was to describe behavior, determine relationships, estimate costs, and identify problems. In no case, were statistical inferences made. The surveys were accordingly directed at the principal actors, previously identified, and to skilled spokespersons, qualified to understand and analyze the chain's situation.

Five administrators from the 19 auction houses existing in the country were interviewed. For slaughterhouses, visits and surveys were made to El Arreo-CIISA, CoopeMontecillos, and El Valle that, together, account for more than 80% of the total slaughter. We point out that, even though we explained that the information requested was strictly confidential and would be used only to analyze general trends in the industry and not the particular situation of each plant, we could not obtain complete information. The entities considered that very sensitive themes of a private nature were being dealt with. The information involved was available only for the entity's own decision making. Hence, any information we obtained from any given industrial slaughterhouse was accordingly partial. We also conducted interviews of three rural slaughterhouses to discover differences and similarities with the industrial slaughterhouses.

The distribution of end products to retail was more "atomized" than that observed for wholesale markets. In 2003, 1392 butcher shops existed, marketing 65% of the country's beef (Barrionuevo and Associates 2003). Retail distribution was through butcher shops, with 60% of beef sales occurring in urban open-air markets, 35% in traditional neighborhood butcher shops, 4% in rural markets, and 1% in modern neighborhood butcher shops. Information was obtained from seven butcher shops, five being urban (three in neighborhoods and two in markets) and two being rural (both in markets) to adjust and broaden available information. These surveys were conducted directly with the butcher shops, with the valuable collaboration of CORFOGA officials.

About 35% of the distribution of meat to retail was through supermarkets, which themselves are grouped into chains. Supermarkets visited were MegaSuper, Corporación de Supermercados Unidos (CSU), Periféricos, and Automercados. However, as with the slaughterhouses, many of the interview questions were regarded as highly sensitive. Again, the information obtained from this source was limited to a few general considerations. Accordingly, analyses refer more to butcher shops than to supermarkets as agents of this link in the chain.

Generating value added beef

To estimate and analyze the generation of value in monetary terms throughout the beef chain, we used the following illustrated equation:

$$AV = PC_2 - PB = CT_1 + AC + CT_2 + (PF_2 - PF_1) + CT_3 + TS + CT_4 + CR + MR \quad [1]$$

where,

AV	=	Added Value throughout the chain (per equivalent animal unit)
PB	=	On-farm price received by the breeder
PC_2	=	Final price paid by the consumer

CT_1 = Cost of transport from the breeding farm to the auction
PA_1 = Price on entering the auction
AC = Commission charged by the auction house
OA = Operational costs or expenses incurred by the auction house
MA = Operational margins of the auction house
PA_2 = Price on leaving the auction
CT_2 = Cost of transport from the auction to the fattening farm
PF_1 = Price on entering the fattening farm
PF_2 = On-farm price received by the fattener
CT_3 = Cost of transport from the fattening farm to the slaughterhouse
PS_1 = Price on entering the slaughterhouse
TS = Tariff per animal charged by the slaughterhouse
OS = Slaughterhouse's operational costs
MS = Slaughterhouse's operational margins
PS_2 = Price on leaving the slaughterhouse
CT_4 = Cost of transport from the slaughterhouse to butcher shops or supermarkets
PC_1 = Price on entering butcher shops or supermarkets
OR = Retailers' operational costs (butcher shops or supermarkets)
MR = Retailers' operational margins (butcher shops or supermarkets)
PC_2 = Final price paid by the consumer

Thus,

$$PA_1 = PB + CT_1 \quad [2]$$
$$PA_2 = PA_1 + AC \quad [3]$$
$$MA = AC - OA \quad [4]$$
$$PF_1 = PA_2 + CT_2 \quad [5]$$
$$PS_1 = PF_2 + CT_3 \quad [6]$$
$$PS_2 = PS_1 + TS \quad [7]$$
$$MS = TS - OS \quad [8]$$
$$PC_1 = PS_2 + CT_4 \quad [9]$$
$$MR = PC_2 - PC_1 - OR \quad [10]$$

Characterization of the Beef Chain

Structure of the Beef Chain

Primary production

The livestock sector of beef production shows deficient production performance, as reflected by declining rates of production (-0.1% per year for 1980–2004) and of the cattle inventory (-2.5% per year in the same period). Such rates contrast with the country's population, which grew at an annual rate of 2.5% in the same period (Table 1).

As a result of the falling cattle inventory, areas under permanent pastures have also reduced significantly, dropping from 2.4 million ha in 1988 to 1.1 million in 2004 (Table 1). Because both factors were declining, the average stocking rate (heads/ha) remained relatively stable over the period (Table 1).

Nevertheless, the area planted with improved grasses grew at an annual rate of 23% during 1990–2003 (Holmann et al 2004) as a result of the dramatic increase in grass seed imports, mainly of the *Brachiaria* genus (45% per year during the same period). Although the adoption of improved pastures did not increase the average stocking rate, it may have indeed caused an increase in the average carcass weight, which rose from 0.6%/year between 1990 and 1999 to more than double (1.4% per year) during 2000–2005 (Table 1).

Table 1. Descriptive variables of the historical evolution of beef production in Costa Rica during 1980–2004

Year	Beef production			Cattle inventory		Land use (´10³ ha)		Human population, ´10³ inhabitants
	Total, ´10³ t	Kilos per inhabitant/ year	Kilos per head in stock	Total, ´10³ heads	Heads/ ha	Annual and perennial crops	Perennial grasses	
1980	76.5	33	35.1	2181.4	0.9	506	2420	2347
1981	80.0	33	35.2	2275.0	0.9	509	2420	2413
1982	66.0	27	29.0	2276.3	0.9	512	2420	2482
1983	67.0	26	28.3	2364.8	0.9	515	2420	2552
1984	76.8	29	31.6	2429.0	0.9	518	2420	2624
1985	93.5	35	40.5	2309.0	0.9	523	2420	2697
1986	92.0	33	39.9	2306.0	0.9	526	2420	2771
1987	97.0	34	42.3	2294.0	0.9	526	2420	2846
1988	86.0	29	39.3	2190.2	0.9	523	2420	2922
1989	85.5	29	39.4	2168.0	0.9	510	2323	2999
1990	87.5	28	39.7	2201.0	1.0	510	2230	3076
1991	94.0	30	43.2	2175.0	1.0	515	2141	3153
1992	80.9	25	37.9	2132.0	1.0	510	2055	3230
1993	81.9	25	38.6	2122.0	1.1	500	1973	3309
1994	95.5	28	50.4	1894.0	1.0	520	1894	3390
1995	93.6	27	56.9	1645.0	0.9	515	1818	3475
1996	96.4	27	60.8	1585.0	0.9	510	1745	3564
1997	86.1	24	56.3	1529.0	0.9	505	1675	3655
1998	82.0	22	53.7	1527.0	0.9	505	1609	3748
1999	84.4	22	59.2	1427.5	0.9	525	1544	3840
2000	82.3	21	60.6	1358.2	1.0	525	1350	3929
2001	74.3	19	57.7	1288.9	1.0	525	1296	4013
2002	68.3	17	56.0	1219.5	1.0	525	1244	4094
2003	74.1	18	64.4	1150.2	1.0	518	1194	4173
2004	68.8	16	63.6	1080.9	0.9	518	1146	4224
Annual growth rate, %								
	-0.1	-2.6	4.1	-2.5	0.0	0.0	-2.6	2.5

Source: FAO 2005

According to Pérez (2003), among the major problems that the beef sector in Costa Rica faces are:

(a) A marked seasonality in forage production, which generates deficits of feed for livestock at particular times of the year;
(b) The advanced age of beef cattle at slaughter (more than 3 years), which results in low culling rates. This problem is probably related to limitations in the livestock's genetic base and to poor availability of forages with high nutritional value. Moreover, the lack of a classification system of carcasses according to quality discourages the production of animals of a younger slaughtering age;
(c) The severe lack of mineral supplements, which is linked particularly with problems of forage availability and explains the low productivity indices and modest birth rates;
(d) The problems caused by external and internal parasites, especially in animals growing under the dual-purpose system.

Risks in beef production

Livestock production is, by nature, long-term, encompassing different sequential phases over time. Figure 1 shows the process of beef production, from conception to slaughter. As can be seen, for 1.3 years (about 15.5 months), the producer has capital invested in land, work, livestock, and operational expenses, and receives no monetary return while the animal is in gestation.

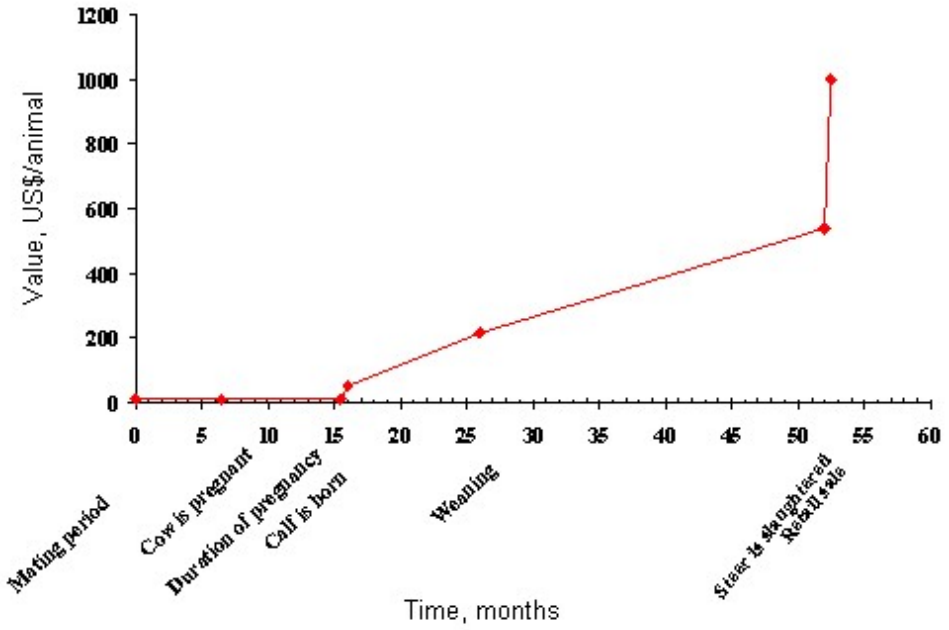

Figure 1. Life span of a calf from conception to slaughter, and its commercial value in Costa Rica

The process starts with a mating period that takes about 6.5 months to ensure that the female becomes pregnant (12 months ´ 0.54 is the annual calving rate). This is followed by a pregnancy lasting 9 months.

The calf is born with an approximate weight of 35 kg and a commercial value of US$50. Its growth occurs over three phases: (1) before weaning, which lasts 8 months and has a mortality risk of 5%; (2) a period of growth that usually lasts an additional year, with a probability of death of 2%; and (3) fattening, which takes another year, with a mortality risk of 2%. Because they are very desirable for immediate marketing, fattened animals are at additional risk of theft, conservatively estimated as being about 3%.

In addition, in beef production, the annual replacement of cows and bulls should be considered. According to the last farm survey in Costa Rica (Table 3, CORFOGA 2005b), the annual replacement rate for cows is estimated at 2.4%, that is, 4.7% divided by 2, assuming that 50% of births are males. The rate for replacing bulls is estimated at 0.1% per year, assuming a ratio of 25 cows per reproducer.

In short, for each steer that is slaughtered, we must add 14% for mortality from birth to slaughter, 3% for theft, and 2.5% for replacement of its progenitors, thus totaling 19.5%. That is, 1.2 calves are needed to ensure one reaches the slaughterhouse, or 5 calves are needed to obtain 4 fattened steers. This risk over 4.2 years (50 months) is assumed by the producer. The slaughterhouse answers for the carcass after veterinary inspection and until approval. Other links of the chain (slaughterhouse, exporter, or supermarket) face fewer risks over the short period of operation and transfer, via prices, the risks they face to the consumer and/or producer. Furthermore, to cover other associated risks, they use mechanisms such as insurance policies and future contracts.

The next exercise illustrates the increase in marketing margins along the chain (Pomareda and Pérez 1996). In 1995, a steer weighing 500 kg was worth US$480 before slaughter. After 24 hours, it left the slaughterhouse as a carcass and traditional byproducts. The carcass had a sale price of $503; the viscera, $62; and the hide, $20, all totaling $585. This represented a 22% increase over the live animal. Later on, the retailer purchased this meat at $565 (no hide) and, 3 to 4 days later, sold it for a total value of $658, an increase of 12.5% over slaughterhouse, but 37% over live animal.

If we update the figures of the previous paragraph to 2005 prices (Table 2), the producer would have received US$582 for a 485-kg steer before slaughter. After 24 hours, it leaves the slaughterhouse as a carcass with a sale price of $611, and traditional byproducts such as the viscera, with a sale price of $35, and the hide, with value of $25, totaling $671, that is, 15% more. The retailer buys the steer as a carcass and viscera at $646 (no hide). The steer is sold 3 to 4 days later at a total price of $952 ($904 for the carcass and $48 for the viscera)

with a margin of 47% against the acquisition cost of carcass and viscera. In short, a steer for which the producer received $582 at slaughter (almost 4 years after it was conceived), generates products and byproducts that, within 1 week, are sold at $977 (including the hide), that is, at an increase of 68% over the live animal. In other words, the difference between the final price paid to the producer and the final price by the consumer, over 10 years, increased 84% in real terms, that is, 68% in 2005 in contrast to 37% in 1995. This simple analysis suggests that major asymmetries exist in terms of risks and profits for the different links of the agro-industrial chain of meat products in Costa Rica.

Such information indicates that, as we move along the chain, marketing margins expand substantially and risks decline. This situation generates low profitability for primary production and limits its possibilities of modernizing and incorporating technological change.

Livestock marketing

Marketing is mostly carried out through the auction system, which operates in all livestock production areas. It is an efficient and transparent mechanism that permits direct transactions between breeders and buyers of livestock for fattening and/or slaughter. The 19 auction sites together conduct 24 weekly events (Pomareda and Cordero 2005). The auctions simultaneously market all categories of animals, except for fattened males, which are usually sent directly from the farm to industrial slaughterhouses. Transport cost from farm to auction is assumed by the seller. Freight is estimated at US$6.00 per animal, assuming an average distance of 40 km.

Table 2. Carcass yield of females and males at slaughter age, yield of different cuts, and consumer prices for Costa Rica during 2005

Variable	Females (n = 83)			Males (n = 95)		
Live weight, kg		415			485	
Warm carcass weight, kg		210			270	
Cold carcass weight, kg		208			267	
Carcass yield, %		50.9			55.6	
Yield of cuts	**Yield, kg**	**Price, US$/kg**	**Total value**	**Yield, kg**	**Price, US$/kg**	**Total value**
Prime cuts						
Tenderloin	3.0	12.50	37.50	3.4	12.50	42.50
Strip loin	4.7	6.39	30.03	5.9	6.39	37.70
Ribeye	4.3	5.45	23.44	5.4	5.45	29.43
Choice cuts						
Knuckle	8.6	4.90	42.14	10.4	4.90	50.96
Top sirloin butt	5.4	5.10	27.54	6.9	5.10	35.19
Inside round	12.7	5.00	63.50	15.8	5.00	79.00
Outside round	7.9	4.88	38.55	10.4	4.88	50.75
Sirloin cup	1.6	5.25	8.40	2.1	5.25	11.03
Sirloin tri tip	1.8	4.26	7.67	2.3	4.26	6.56
Blade	5.6	4.30	24.08	8.1	4.30	34.83
Top blade	3.6	4.55	16.38	4.5	4.55	20.48
Chuck Mock	2.1	4.60	9.66	2.7	4.60	12.42
Eye of round	3.4	4.99	16.96	4.8	4.99	23.95
Ribeye lip	3.4	4.51	15.33	4.7	4.51	21.19
Other cuts						
Chuck + neck	4.7	4.33	20.35	8.2	4.33	35.50
Neck steak	1.3	2.51	3.26	2.3	2.51	5.77
Brisket	5.1	4.17	21.27	8.1	4.17	33.77
Shank joint	3.3	4.18	13.79	4.2	4.18	17.56
Shank	10.3	4.08	42.02	13.4	4.08	54.67
Hump	1.3	3.77	4.90	4.0	3.77	15.08
Flank steak	1.9	4.07	7.73	2.3	4.07	9.36
Hanging tender	2	4.42	8.84	2.8	4.42	12.38
Ribs	10.7	2.87	30.71	13.2	2.87	37.88

Chuck	8.3	2.46	20.42	12.4	2.46	30.50
Boneless chuck	41.7	2.65	110.51	50.8	2.65	134.62
Fat trims	5.4	0	0	6.4	0	0
Bone trims	44	1.19	52.36	51.3	1.19	61.05
Boneless beef, kg	158.7	NA	NA	209.3	NA	NA
Salable carcass meats	76.2%	NA	697.34	78.3%	NA	904.13
Viscera	15	3.00	45.00	16	3.00	48.00
Hide	1	25.00	25.00	1	25.00	25.00
Total value of beef	1	NA	767.34	1	NA	977.13

NA = not applicable

The appearance of auctions as a mechanism for marketing livestock is relatively recent, with the first auction initiating operations in 1984. The system's success is based mainly on its transparency, which especially benefits small producers, as it provides them with key information on the market (prices, supply, and demand) in a timely and reliable fashion. Thus, they can prepare effective strategies for reducing risks and marketing their livestock more efficiently.

Every auction is obliged by law to contract an official veterinarian. This person is responsible for verifying the state of health of all livestock brought in. The animals reach the facilities 2 hours before the event starts, which takes as long as there are animals to be sold. An auctioneer may negotiate between 110 and 125 animals per hour, with the average for each event being 450 animals (SIDE 2005). Hence, in Costa Rica, an estimated 11,000 head of beef cattle pass through the auction system every week (Pomareda and Cordero 2005). An advantage of the system is that, if there is no demand for a given animal, the auction house will purchase it. Hence, the animals do not return to the farm.

The marketing of live cattle is governed by the free play of supply and demand. If the auction prejudices a seller, then he or she will seek another means for marketing their livestock. If buyers find the prices are too high, then they will seek better options in other places. Hence, to maintain the volume of operations in their establishments, owners of auction houses must rigorously conduct their procedures expeditiously and transparently. The reserve prices established by the auction house must faithfully reflect current market prices.

From the small producer's viewpoint, auctions constitute a very useful selling center for live cattle. An analysis carried out by SIDE (2005) showed that, about 2,850 sellers attended a given auction during 2003, 98.2% of whom were small producers [According to the classification of producers used by the National Council for Production (CNP) of Costa Rica, producers with a gross income of up to US$25,000 per year are classified as small producers; those with $25,000 to $70,000 are medium producers; and those with more than $70,000 are major producers]. Only 0.2% (i.e., 6 people) were large producers, and 1.6% (45) were medium-size producers.

The annual frequency of marketing (i.e., the number of times a producer sells at auction) is very low. In 63% of cases, less than 10 animals/producer are sold in the entire period. About 17% of sellers market twice per year and 9% three times. Only 5% of livestock producers sell more than 40 animals per year (SIDE 2005).

The slaughtering industry

The concept of industry refers to all plants of differing scales where livestock is slaughtered (Blandino 2005). Two types of slaughterhouses are recognized in the Costa Rican meat industry:

Type A. Large-scale industrial plants, with a high technological level. These are usually legally empowered to export. They have modern refrigeration facilities, de-boning rooms, and vacuum-packaging. They process wastes, and closely observe standards for health and wholesomeness. On their pay roll, they have at least one veterinarian and a sufficient number of inspectors for the volume of slaughter.

Type B. Small slaughterhouses, located in rural areas and near villages. They have the lowest technological levels and present major deficiencies in terms of hygiene and quality of production.

The principal industrial plants (El Arreo-CIISA, CoopeMontecillos, and El Valle) together slaughter more than 80% of livestock, slaughtering about 267,000 animals in 2004 (CORFOGA 2005a). These establishments comply with international standards in terms of health and wholesomeness, control of environmental impact, and the animals' welfare. This implies that they have established procedures of control at critical points, so much so, that two of the plants are certified by the U.S. Department of Agriculture (USDA) for export to that country (Pérez et al 2005).

Costa Rica has 17 rural slaughterhouses that, together, sacrifice less than 20% of all slaughtered livestock. Most have systematically reduced the volume of slaughter (Blandino 2005). They do not comply with established hygiene, sanitary, and environmental requirements. Their processes of slaughtering and cutting are not technical and their employees have not received appropriate training. Some operate with very modest volumes and, consequently, with a reduced use of installed capacity. Installations present important deficiencies of infrastructure and innocuousness, as their controls are inadequate for preventing problems from physical and biological contamination, pesticides, or drug residues. These lead to a high risk of disease transmission and infectious outbreaks from contaminated meat food. In most cases, no ante-mortem veterinary surveillance or inspection is conducted, thus increasing the probability of sick animals being slaughtered. The absence of sanitary controls in these slaughterhouses generates an information gap that complicates the detection and prioritization of problems of animal health and wholesomeness of meat. This is especially true in areas remote from the Central Valley, the country's most populated region and where the capital district is located.

About half of the animals the industrial slaughterhouses receive are slaughtered according to processing contracts. They are purchased by a supermarket chain or butcher shop from the producer and dressed in the slaughterhouse. Processing costs are about US$10 for slaughter and $20 for de-boning. Hence, operational expenditures for slaughterhouses are estimated at about $30/animal.

Trade and retail sale of beef

Previous diagnoses of beef marketing in Costa Rica indicate this segment is a highly critical link within the chain. It has a multiplicity of actors and many forms of marketing. It is dynamic, having only recently undergone qualitative and quantitative transformations. It was not long ago that marketed meat was transported directly from the slaughterhouse to the shop without processing. Now, more complex systems operate where high-level processing plants appear and supermarkets offer a wide range of meat products, with higher added value and centralized processing.

From the mid-1990s, Costa Rica has consistently consumed between 80% and 90% of its domestic production. The remainder is exported to USA and other Central American countries (mainly El Salvador) as meat cuts and sometimes as carcasses.

Exports

The crisis of productivity and competitiveness of Costa Rican beef has slowed down the access of domestic production to international markets. This phenomenon is clearly seen in Figure 2, which shows how the country has been systematically reducing its volumes of export over the last 25 years, despite significant reductions of its livestock inventories.

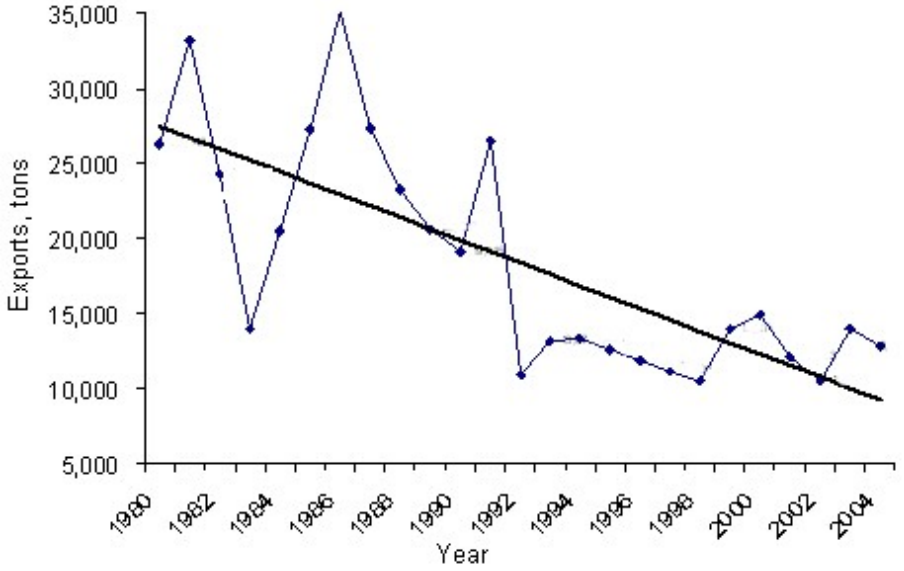

Figure 2. Linear adjustment of the evolution of beef exports, Costa Rica 1980–2004 (CORFOGA 2005a)

This is caused by problems found throughout the production chain (Pérez 2003):

(a) Low on-farm productivity because of technological lag, as mentioned above,
(b) Deficient levels of hygiene in slaughtering and dressing tasks,
(c) Low rate of byproduct recovery, which reduces the possibilities of diversification and profitability of livestock,
(d) Lack of adequate systems for reducing environmental impact, and
(e) Absence of a general framework of policies for livestock development.

As a result of these problems, only two of the industrial slaughterhouses are exporting today.

Local consumption

Per capita beef consumption has been decreasing from 19.3 kg in 1994 to 14.1 kg in 2005, an annual reduction of almost 3% over this period. This decline in beef consumption has been compensated by a higher per capita consumption of chicken, which increased from 17 to 21 kg, and pork, which increased from 6 to 9.2 kg per year (CORFOGA 2005a).

The low beef productivity has led to a growing loss of competitiveness of domestic production in domestic and external markets. In the 1970s, beef had accounted for almost three fourths of total domestic consumption of meats. Now, however, it accounts for only one third.

The changes in meat consumption can be explained by technological and economic factors. The production, processing, and marketing of chicken and, to a lesser extent pork, have undergone profound technological and organizational transformations since the mid-1960s, triggering rapid reduction of real prices for these products (Sanint et al 1985). Because beef production and productivity of beef remained stagnant, compared with the monogastrics, the relative prices of beef to chicken and beef to pork increased, thus unleashing a process of substitution in consumption and the loss of beef's relative importance in the domestic meat market. The substitution of beef has occurred, with differing intensities according to country, throughout Central America and in many South American countries.

The distribution of beef products to retail concentrates on small butcher shops, which market 65% of the total supply. The number of these establishments registered in 2003 was almost 1,400 (Barrionuevo and Associates 2003). Most are small businesses, located mainly in traditional city and town markets. They combine beef sales with those of pork and chicken. Such shops are found in densely populated areas and in most rural areas. This type of business is supplied, preferably, with live cattle from auctions, processed by various industries (industrial plants or small slaughterhouses), and the carcasses transported to the butcher shops for later de-boning and sale of cuts, either as entire cuts or diced, according to client requests.

Costa Rican supermarkets have experienced significant growth in recent years. They are estimated as currently marketing 35% of the beef consumed (Barrionuevo and Associates 2003). In 2003, about 317 supermarkets (i.e., stores with more than 3 checkout points) were identified, of which 199 belonged to 11 chains and the rest (118) being independent units. The most important groups in terms of marketing beef are the Corporation of United Supermarkets (CSU, its Spanish acronym), the MegaSuper group (CCM), some cooperatives (SuperCompro, CoopeCompro, and CECOOP), the Periféricos group, and Automercados (Barrionuevo and Associates 2003).

The consumer

Consumers form the last link in the chain of beef products. Consequently, their attitudes, preferences, and tastes strongly determine the type and quality of products being offered on the markets and the prevailing marketing forms. They also explain some of the changes observed to be occurring on the farm, the first link of production. Overall, little up-to-date information is available on consumer tastes and preferences or on changes in consumption trends. Studies of this nature require broad samplings by region, locality, and socioeconomic stratum. They are time costly and demand considerable economic resources, hindering permanent updating of this strategic information on market evolution.

CORFOGA (2005c) conducted a market study of 1,060 families to determine consumption habits and preferences, and demand for meats in Costa Rica. The Corporation found that (1) chicken is preferred by 46% of the homes visited; (2) beef by 36% of homes; and (3) of minor relative importance, fish and pork (each, 5% of homes). A small proportion (8%) of homes showed no marked preference towards a specific type of meat.

Beef is a staple in the Costa Rican diet, with 95% of buyers preferring to consume it fresh. A very small proportion (5%) prefer matured meat [The term maturation refers to the process by which meat is tenderized while stored in a cold room. The improved tenderness results from enzyme action that occurs naturally in meat, and which destroys muscle proteins. Tenderness increases rapidly over the first 7 days, decreasing over the next 7, and is very slow after day 14. For most cuts, 14 days is the optimal maturation time for obtaining adequate tenderness. Some restaurants use longer maturation periods, seeking even greater tenderness and increased flavor in the cuts]. As a result of modern trends in health and nutrition, the demand for lean meats has grown substantially in recent years, with 54% of homes preferring beef with a little fat, 41% with no fat, and 5% preferring it with a lot of fat. The frequency of beef consumption is high, with more than half of the homes (56%) consuming it 2 to 5 times per week, 8% consuming it daily, and 25% consuming it once a week. The remaining 11% of homes surveyed had very low levels of consumption, perhaps once or twice a month, or even less. Despite the progress achieved by supermarkets in marketing foodstuffs, most (65%) meat purchases are still made in butcher shops. Another third of meat produced is marketed by supermarkets and the remaining 2% in other classes of establishment.

Among the reasons consumers give for preferring beef are: (1) good flavor (37%), (2) the need for a varied diet (19%), (3) improved health and nutrition (18%), (4) easy preparation (17%), and (5) custom and tradition (9%) (CORFOGA 2005c). The deciding factors for purchasing meat are color, followed by presentation, tenderness, smell, price, texture, and packaging.

The study on preferences shows that, within the country, people willingly consume beef on any occasion. It is mostly eaten at informal events (76%), with 15% of interviewees consuming it on special events such as parties (13%) and excursions (2%). Almost three fourths of beef consumption in the home concentrates on lunches (72%), one fourth on the evening meal (26%), and a very low proportion on breakfast (2%) (CORFOGA 2005c).

Consumer preference for ground beef is almost equal to that for steak. Table 7 shows that the two types of preparation account for almost 50% of all consumption. Ground beef is preferred by 26% of homes and steak by 24.3%. Sirloin appears in second place with 11.5% (CORFOGA 2005c). The principal attribute of ground beef according to interviewees is its freshness and low fat content, which helps explain its high consumption, at 2 to 5 times per week, mainly for lunch. The preference for ground beef masks a problem of quality. In fact, this form of presentation corrects toughness, a major defect in quality.

Results of the surveys: identifying critical issues for promoting technological change and improving the sector's efficiency

Farm survey

In 2004, CORFOGA conducted a national survey, which sampled 1074 farms. This survey included production systems and found that the predominant activity was cow-calf operations (56% of farms), followed by dual purpose, that is, joint meat and milk production (27.6%), and fattening (16.4%) (Table 3). The highlights of this survey are presented below:

1. Farm scale. Cattle exploitations in Costa Rica are small in scale. The average farm has 27 animal units and an extension of only 35 ha. The herd concentrates on larger farms. That is, 41% of beef farms have an average size of less than 10 ha and control 11% of the national herd, whereas farms that average more than 80 ha constitute 10% of all cattle exploitations but control 43% of the national herd.

2. *Productivity indicators.* These reflect the poor of livestock dynamics in Costa Rica. The birth rate stands at 54%, fluctuating between 49% and 63% according to production system. This coefficient tends to be higher for small farms with fewer than 30 head, with the average being 55%. In larger production units, having more than 300 head, the coefficient is only 51%. The foregoing corroborates findings of studies of Colombian livestock, which show better birth and mortality rates on smaller farms, thus suggesting that, on these farms, management is better and the care of the beef herd is more intensive (Rivas 1974).

The low birth rate on these production systems indicates that a very low annual culling rate is generated, ranging between 8% for dual-purpose systems and 24% for fattening systems, with a national average of 13% (Table 3). This rate is very low and significantly limits beef production. Increasing the birth rate is critical to expanding the herd and achieving high culling rates. In Costa Rica, it is imperative for the average birth rate of cattle to be raised, because of the need to rebuild herd numbers after a prolonged liquidation period.

3. Productivity of beef cattle. The reduced birth and culling rates generate low sale flows, being, on average, 12 head/farm per year and ranging from 7 animals in dual-purpose systems to 25 animals in fattening systems. Not only are sale volumes of beef cattle very limited, but light weight animals are also being marketed, that is, weaned male calves at 164 kg, female calves at 158 kg, young bulls at 330 kg, steers at 440 kg, bulls at 582 kg, heifers at 335 kg, and cows at 439 kg.

Table 3. Selected indicators of the productive performance of beef cattle in Costa Rica for 2004

Variable	Production system			Total, average for sector
	Cow-calf	Dual purpose	Fattening	
Farms, no	602	296	176	1074
Variable per farm				
Area, ha	68.4	54.7	80.5	66.5
Cattle inventory, heads	93	82	105	92
Meat production				
Heads, no.	10	7	25	12
kg	3018	2261	10,138	3976
Milk production, liters	0	23,439	0	6425
Gross income, US$				
Meat	3012	2217	10,895	4085
Milk	0	4699	0	1295
Total	3012	6916	10,895	5380
Employment				
Total, no. people/farm/year	1.7	2.1	2.2	2
Total cost, US$	3346	4133	4330	3936
Labor costs/gross income, %	111.1	59.8	39.7	73.2
Productivity				
Calving rate, %	51	63	49	54

Mortality rate, %				
Calves	2	2	3	2
Adults	1	1	0	1
Culling rate, %	11	8.3	24	12.6
Replacement rate, %	4.7	5.1	3.9	4.7
Stocking rate, AU/ha	1.4	1.5	1.3	1.4
Gross income, US$/ha	44	126.4	135.3	80.8
Gross income/animal, US$	32.4	84.3	103.8	58.5
Gross income/worker, US$	1772	3293	4952	2690

Source: CORFOGA 2005b

As a consequence, annual sales per farm are very low, ranging from about 2260 kg in dual-purpose systems to about 10,140 kg in fattening systems, with a national average of 3980 kg/year per farm. This implies that annual productivity is about 60 kg meat/ha, fluctuating between 41 kg/ha per year for dual-purpose systems and 126 kg/ha per year for fattening systems.

4. Income. The average gross income from meat sales (at 2005 prices) were US$2217/year for dual-purpose farms (or $6916 if income from milk sales is included), $3012/year for breeding farms, and $10,895/year for fattening farms. The annual gross income per unit of area was estimated as $44/ha for cow-calf operations, $126/ha for dual-purpose farms (including income from milk sales), and $135/ha for fattening systems. Such gross income is extremely low if the commercial value of farm land, ranging between $1000 and $2000/ha, is taken into account. The biological inefficiencies cited, together with high land costs, prevent the recovery of opportunity costs for the capital invested in the land, making beef production an uncompetitive activity (Pomareda and Pérez 1996).

The estimates discussed above were made for 2005 prices and corresponded to (1) cattle (live weight) for slaughtering at US$1.20/kg for males and $1.03/kg for females; and (2) other categories marketed at auctions, that is, female calves at $0.91/kg, male calves at $1.06/kg, heifers at $0.88/kg, young bulls at $1.01/kg, culled cows at $0.76/kg, and bulls at $1.08/kg (CORFOGA 2006; Pomareda and Cordero 2005).

The stocking rate is estimated at about 1 an/ha, which demonstrates the low efficiency of use of this resource, considering the high land prices. As is traditional in extensive production systems, this investment represents a high fraction of the total livestock capital. Currently, this situation can be reversed, because improved technologies exist such as adapted forage species of high productivity that permit doubling or tripling stocking rates on farms. As pointed out above, even though the adoption of improved pastures has been significant and is partly responsible for the increase in average carcass weight per slaughtered animal, it has not led to higher averages in the stocking rate.

5. Remunerating family labor. The livestock systems analyzed present a low capacity to absorb labor, as indicated by the average of only two full-time workers being used per year. Nevertheless, we point out that labor costs constitute a high fraction of the gross income of cattle farms, being on average 73% (Table 3). The cow-calf (breeding) system, because of its low productivity, remunerates family labor with wages below the legal minimum. Assuming that the only cost in cash is that of labor, breeding farms would pay family workers a wage that is equivalent to 60% of the legal minimum.

Although it is a troubling situation, it also represents an opportunity for reducing poverty through the adoption of livestock technologies of higher productivity, thus permitting improved pay for family workers. In terms of gross income per unit production factor (land, livestock, or labor), the operation of cattle fattening appears to be the most attractive option, in contrast with breeding, which exhibits poorer indicators.

The foregoing allows speculation on the risks, profitability, and marketing margins of the meat-products chain. In the first link—breeding, the basis of production—presents lower gross margins per unit production factor, suggesting that it may be the least profitable system of the entire meat chain. The fattening system is less risky and more intensive in terms of capital use, and presents the best indicators for gross income.

An alternative technology is to incorporate the fattening system into the breeding system and, where a market exists, include milk production to improve profitability and increase cash flow and family income. The

strategy for achieving this purpose should include various components, among them:

1. Strategic partnerships with organizations that promote financing mechanisms such as livestock producer funds that would provide for requirements as needed by the farms, such as additional livestock.

2. Programs for improved pasture plantings with the support of promotional and credit organizations to maintain, in a timely fashion, the quantity and quality of forages and improve livestock productivity indices.

This strategy has been successful for more than 40 years in Colombia and has been replicated with good results in Honduras during the 1990s and in Costa Rica by the Cámara de Ganaderos Unidos del Sur (CGUS) at the beginning of the millennium.

Another innovative alternative is the concept of contract production, through which a given entity, for example, a major producer, an industrial slaughterhouse, or supermarket, delivers animals to another producer for fattening on his or her farm. The weight gain achieved is distributed according to previous agreements between the parties. We point out that small-scale producers, after improving the condition and quality of pastures on their farms, are frequently severely limited for capital to acquire the additional animals needed. Sometimes, as in Caquetá, Colombia, the improved offer of forage from new pastures on beef farms does not result in increased stocking rates because the producers are financially constrained from acquiring the livestock needed to use the pastures (Rivas and Holmann 2000).

Auction houses

Table 4 shows some characteristics of the operational mode of five auction houses from different provinces in the country. A major feature of these auction houses is the bringing together of cattle of different ages such as culled cows (28%), weaned calves (28%), young steers for fattening (18%), heifers for mating or slaughter (21%), and few finished steers (5%).

The average commission charged by auction houses is about 3.8% of the price paid by the buyer. The most frequent distance from farm to auction is about 41 km. The average number of transactions per event is 446 animals, which implies that only 68% of the installed capacity is used during event days. Most auction houses operate only 1 day a week, reducing the average use of installed capacity down to 15.8%.

Table 4 also shows the operational costs of the auction houses, which are estimated as being US$7100 monthly, with a level of occupation of 1.4 days a week. Gross income is calculated on the quantity of animals traded per event and the proportion of animals in different age categories and their prices, that is, at about $32,337 monthly [Average prices (US$/kg live weight) at auctions during 2005 were $0.76 for culled cows, $1.06 for weaned male calves, $0.91 for weaned female calves, $1.01 for young steers for fattening, $0.88 for heifers for mating or slaughter, and $1.20 for finished steers]. If operational costs are subtracted from gross income then net earnings are $3655/day of operation, which is equivalent to $7.80 per animal traded. However, because of the underutilized installed capacity, net earnings calculated per calendar day are significantly reduced, to $1.65 per animal. This profit may be overestimated because, in this analysis, opportunity costs were not considered for the capital used to finance some of the animals—usually for a week's duration—that auctions must buy to supply the demand for animals.

Table 4. Characteristics of the operational mode of five auction houses, according to type of animal traded, operating costs, and income for Costa Rica

Feature	Auction house					Average
	1	2	3	4	5	
Year of foundation	1997	1993	1984	2001	1993	NA
Commission collected, %	4.0	3.5	3.8	3.5	4.0	3.8
Installed capacity, no. animals/day	900	500	600	500	800	660
Transactions per event, average no. of heads	500	390	300	290	750	446
Capacity used, %	55	78	50	58	94	68
Weekly operation, no. of days	1	2	1	1	2	1.4
Real capacity used, %	9.2	26	8.3	9.7	31.3	15.8
Categories of animals traded in						

auctions, %						
Culled cows	10	60	35	6	30	28
Weaned male calves	25	15	15	20	15	18
Weaned female calves	20	5	5	9	10	10
Young steers for fattening	30	5	10	25	20	18
Heifers for mating or slaughter	10	10	30	33	20	21
Finished steers	5	5	5	7	5	5
Most frequent distances from auction to farm, km	25	40	30	60	50	41
Labor at the auction house, no. of people						
Auction day	32	29	29	16	34	27
Day without auction	9	9	6	4	12	8
Operational costs per month [a] *,US$*						
Labor	7440	6200	5790	3500	11,363	6859
Services	250	220	240	200	290	240
Gross income per month [b] ,US$	22,733	36,151	14,679	12,076	76,048	32,337
Net income per event, US$	3,474	3,433	1,997	1,934	7,437	3,655
Net income per animal traded per event, US$	6.94	8.80	6.66	6.67	9.92	7.80
Net income per animal traded per calendar day, US$	0.99	2.51	0.95	0.95	2.83	1.65

a. Estimate based on an average cost of US$550/permanent worker, including social contributions for the days without auctions and $25/day for casual workers on auction days.

b. Estimate based on the proportion of animals according to the category in which they arrive at the auction, the number of animals traded per event, the 2005 sale price, and the commission charged by each auction house.

Profits per event are acceptable. However, when analyzed on a calendar day basis, they are unattractive because, as already mentioned, of the low use of installed capacity. A strategy that may help improve the efficiency of the Costa Rican auction system would be to integrate them so that fixed operational costs are shared and administrative and operational personnel rotated among several auction houses, taking advantage of having different days of operation. Such a strategy would help reduce fixed costs and the commissions they charge without affecting their profits.

Another alternative would be to seek additional activities during or outside auction days such as fairs of products used by livestock producers. These could be organized with commercial houses. In addition, other sporadic activities can be conducted such as auctions of purebred animals for reproduction purposes to generate additional income.

Slaughterhouses

Table 5 shows some features of the operational mode of three rural and one industrial slaughterhouses. They are very different in scale, where slaughtering may range from a few to thousands of heads per month. However, all are underutilized, as they operate in a range of 23% to 59% of installed capacity. Very few (<0.1%) slaughtered animals are rejected, demonstrating good veterinary inspection before slaughter. The risk of confiscation due to health problems after slaughter is assumed by the animal's owner, not the slaughterhouse. For smaller slaughterhouses, the butcher is the most frequent client but, as the size of the slaughterhouse increases, the principal client becomes the livestock producer. This finding could not be corroborated with industrial slaughterhouses, as they consider such information to be sensitive and confidential.

Table 5 also shows indicators of efficiency and operational costs. Efficiency of labor is low in the rural slaughterhouses, compared with the industrial slaughterhouse, ranging between 9.4 and 19.7 animals slaughtered per full-time worker versus 76 animals per worker in the industrial establishment. The foregoing suggests that economies of scale exist with regard to the work factor and that, from the viewpoint of the industry's competitiveness, strategies must be designed to promote slaughter in industrial slaughterhouses.

In the same table, estimates are given for total operational costs of slaughter and the unit cost per slaughtered animal. The latter cost ranges between US$32 and $66. When the estimated unit costs are compared with the rates charged per slaughtered animal ($15 to $23), then rural slaughterhouses seem to be operating at a loss, since they do not make additional income from the sale of byproducts such as hides, blood, and bones. Because this is a permanent and not a circumstantial situation, then this type of establishment will, over the long term, tend to disappear if it does not improve its technological level or capacity to efficiently take advantage of byproducts.

When analyzing the case of the industrial slaughterhouse, a different situation is found: the estimated cost of slaughter (US$15.60/animal) is similar to the rate charged for slaughter ($15/animal). Therefore, the industrial slaughterhouse covers its operational costs by providing this service. Moreover, it also takes advantage of byproducts such as hides, blood, and bones to generate value and income. It also sells viscera at an estimated value of $45 to $48 per animal. The industrial slaughterhouse also carries out other diversified activities such as buying cattle from producers to process for both domestic and external markets. These extra activities represent additional income.

Information from other industrial slaughterhouses could not be obtained that would have enabled us to determine whether we are dealing with a unique situation or a generalized situation in the context of this group of slaughterhouses. The previous analysis suggests that the low occupation of installed capacity in the slaughterhouses resulted in high operational costs and low efficiency of the work factor.

Table 5. Features of the operational mode of some rural and industrial slaughterhouses in Costa Rica.

Feature	Rural slaughterhouse			Industrial slaughterhouse[a]
	1	2	3	
Volume of slaughters, heads/month	45	150	650	7,635
Operational days per month, no.	17	13	26	26
Capacity for daily slaughter, no. of heads	7	50	85	500
Capacity currently used, %	38	23	29	59
Operations initiated, year	1985	2002	1974	1964
Proportion of rejections after slaughter, % of animals per year	<0.1	<0.1	<0.1	<0.1
Origin of slaughtered livestock, %				
Small producer				NA
Medium-scale producer		50	12	NA
Large producer			54	NA
Butcher shops	100	50	30	NA
Supermarkets				NA
Others				
Actor in beef chain who assumes the risks of seizure after slaughter	Producer	Producer	Producer	Producer
Availability of insurance policy (yes or no)	Yes	Yes	Yes	Yes
Permanent employees, no.[b]	3	16	33	757
Labor productivity, no. of animals slaughtered per worker	15	9.4	19.7	76.3
Operational costs, US$/month				
Labor	1650	8800	18,150	416,350
Electricity	140	1070	2,525	64,080
Estimated cost of slaughter, US$/head	39.80	65.80	31.80	15.60
Cost charged for dressing, US$/head	20.00	23.00	20.00	15.00

NA = not applicable

a. Of this total of employees, about 100 people work in slaughtering. The estimate is based on an average cost of US$550 per permanent worker, including social contributions.

Butcher shops

Table 6 shows general features of some urban and rural butcher shops in Costa Rica. Most of these establishments pay cash for the meat (71%). In all cases, beef sales represent the largest source of income (50% to 75%). Sales of chicken and pork contribute to the remaining income. About 6% of meat these businesses handle is lost due to yield losses. Losses to contamination of products are not recorded. About 75% of sales are destined for household consumption, 17% for restaurants, and 8% for other places such as hospitals. The equipment used in butcher shops is usually obsolete, being close to 10 years old, and, highly depreciated.

Table 6. General characteristics of urban and rural butcher shops in Costa Rica

Feature	Butcher shop[a]							Average
	Urban neighborhood		Urban open-air market		Rural neighbor-hood	Rural open-air market		
	1	2	1	2		1	2	
Beef sales, %	50	60	75	70	70	60	60	63.6
Form of payment for meat	Cash	Cash	Credit	Credit	Cash	Cash	Cash	Cash (71%); Credit (29%)
Yield loss, %	7	5	5	5	6	8	5	5.9
Losses to contamination, %	0	0	0	0	0	0	0	0.0
Destination of sales, %								
Homes	70	5	90	90	90	90	90	75
Restaurants	30	40	10	10	10	10	10	17
Others (e.g., hospitals)	0	55	0	0	0	0	0	8
Average age of equipment, years								
Freezer	10	NA	15	20	2.5	6	NA	10.3
Weight balances	4	6	15	6	8	3	4	6
Saw	10	1	15	15	NA	4	30	12.5
Mill	10	1	15	15	NA	4	NA	9
Cash register	NA	NA	15	12	NA	8	10	11.3

a. NA = not applicable.

The breakeven point for butcher shops in this study fluctuated between $4,600 ($800 for beef) and $13,000 ($5,000 for beef) kg of all meats per month. The average for the whole sample was of $6,350 ($2,800 for beef only) kg (Table 7). Each butcher shop employed, on average, 10 permanent workers, who represented its principal operating cost (69%). The average sales volume was about 11,850 kg of beef per month, with an operational cost estimated at US$8350.

Table 7. Costs per month of operation, breakeven point, and profits in US$/kg for urban and rural butcher shops, Costa Rica.

Variable	Butcher shop							Average
	Urban neighborhood			Urban open-air market		Rural open-air market		
	1	2	3	1	2	1	2	
Workers, No	22	13	3	24	5	2	4	10.4
Labor cost [a]	7150	12100	1650	13200	2750	1100	2200	5735
Energy cost	787	886	886	591	303	290	394	591
Site rental	3937	4000	3937	350	295	300	280	1871
Cost of insurance policy	157	158	160	158	157	150	140	154
Operational costs	12031	17144	6633	14299	3505	1840	3014	8351
Beef sales, kg/month	6495	25980	3464	30310	8660	4243	3810	11852
Total meat sales, kg/month[b]	12990	43300	4619	43300	12371	7072	6350	18635
Breakeven point [c], kg of beef/month	4500	4500	800	5000	1400	1200	1200	2800

Operational costs per kg of meat sold, US$/kg[d]	0.93	0.40	1.44	0.33	0.28	0.26	0.47	0.45
Average cost/kg of meat in carcass and viscera [e]	3.06	3.05	3.06	3.06	3.06	3.06	3.06	3.06
Average sale price per kilo of meat for breakeven point [f]	3.99	3.45	4.50	3.39	3.34	3.32	3.53	3.51
Average sale price to consumer [g] of carcass and viscera	4.63	4.63	4.63	4.63	4.63	4.63	4.63	4.63
Net earnings per kilo of meat sold, US$/kg	0.64	1.18	0.13	1.24	1.29	1.31	1.10	1.12
Net profit/kg of beef sold, %	16.0	34.2	2.9	36.6	38.6	39.5	31.2	31.9

a. Assuming an average cost per month of US$550 per worker, including social contributions.
b. Includes all species.
c. Quantity of beef that must be sold monthly to cover operational costs of the butcher shop.
d. Calculated by dividing the total cost of operating the butcher shop among the kilos of meat of all species sold monthly.
e. Calculated on the basis of the sale price of one carcass of 267 kg at US$611 by the slaughterhouse to the butcher shop plus 16 kg of viscera at $35 for a total of $646 divided between 211 kg of salable meat (267 kg of the carcass multiplied by 78% of meat that is salable minus a diminished return of 6%). This value was not asked for in the survey, but was estimated according to the carcass sales of the slaughterhouses.
f. Calculation based on the sum of operational costs per kilogram of beef sold plus the average cost of acquiring 1 kg of meat from the slaughterhouse.
g. Estimate based on Table 4 for a young steer. It does not reflect differences in prices that exist between butcher shops. Hence, it is an approximate indicator only.

The information obtained indicated that the breakeven point for these retail establishments is low, at almost one fourth (2,800 kg or 24%) of monthly sales. With the breakeven point being at such a low proportion of sales, the operational costs are covered early in the month, *excluding* the cost of raw materials. The operational costs/kg of meat sold were estimated at US$0.45. If we then add the cost of buying this kilo of meat from the slaughterhouse, we obtain the total cost per kilo of meat sold by the butcher shop to the consumer. Total unitary costs are lower in establishments located in open-air markets, as they handle larger volumes of product, thereby diluting fixed costs across a larger number of kilos marketed.

The net earnings per kilo of meat sold estimated for the butcher shops included in the sample ranged between US$0.13 and $1.31, with an average value of $1.02 (Table 7). The profit rate that remains in the butcher's hands, expressed as the fraction of the final price paid by the consumer, varies widely between 2.9% and 39.5%, with an average value of 31.9%. If these profit rates are compared with those of other retail businesses (about 8%), then we must conclude that this retail activity generates good profit margins with relatively low risk. Moreover, this sector offers the consumer a wide range of cuts from pork and chicken, and processed meats, which further increases profit margins.

Supermarkets

An obstacle to obtaining information from supermarkets was the belief that many of the survey questions were very sensitive and private. Three supermarket chains were visited and all presented the same difficulties in collecting information. However, we could obtain very general information such as modalities of purchasing and selling beef, risks of loss of products, employment, and the importance of beef in the business (Table 8). The lack of relevant information prevented the preparation of an exact and detailed estimate of the costing structure for this link of the chain under study.

Table 8. Characteristics of purchases of raw materials and beef sales in the three most important supermarket chains of Costa Rica

Characteristic	Supermarket chain			Average, %
	1	2	3	
Purchasing strategies				
Livestock	No	Yes	Yes	67
Carcasses	Yes	No	No	33
Domestic cuts	Yes	Yes	Yes	100
Foreign cuts	No	No	No	33
Place of purchase of beef cattle				

Farm	NA	Yes	Yes	67
Auction	NA	Yes	Yes	67
Mechanisms of purchasing livestock				
Own buyers	NA	Yes	Yes	67
Intermediaries	NA	No	Yes	33
Loss of meat to contamination, %	1	1	1	1.0
Beef sales as a proportion of the supermarket's total sales, %	7	5	7	6.3
Beef sales as a proportion of total meat sales, %	50	50	50	50.0
Employees in the meat section, no.	6	9	4	6.3

Two of the three (67%) supermarkets bought live cattle, processing the animals at industrial slaughterhouses. The third supermarket purchased only carcasses from slaughterhouses. Two supermarkets sold meat produced only in Costa Rica, with the third one directly importing beef for marketing in the country. The supermarkets that purchase live cattle buy directly from farms or from auctions, using their own buyers, and to a lesser extent from livestock intermediaries. The level of risk is crucial to the business, as beef marketing represents half of the total meat sales. One risk, that of losing meat to contamination is, however, low (1%).

Estimating the generation of value in the chain

We applied the methodology developed for estimating the generation of value in the meat chain to determine the actual generation of value during 2005. Results were as follows:

AV = Retail price of a young steer sold to consumers (US$977, Table 2) - sale price of a calf weaned by the breeder ($191 [Assuming an average weight of 180 kg at weaning and using the average price reported by auction houses in 2005: US$1.06/kg live weight]), which is:

AV = US$786.

Breaking down this added value for a finished steer in terms of the chain, we have the following:

AV = Breeder (US$191)
+ cost of transport from breeder to auction ($6, Assuming an average distance of 41 km from farm to auction)
+ commission charged by the auction house ($7, Assuming a commission of 3.8% for the sale of a calf weighing 180 kg at $1.06/kg live weight)
+ cost of transport from auction to fattener ($7)
+ cost of transport from fattener to slaughterhouse ($40 [Calculation based on a truck that transports 18 animals over a distance of 200 km])
+ profit margins for fattener ($331) {price received by the fattener on selling the young steer ($582 [Young steer with a live weight of 485 kg at $1.20/kg live weight]) - cost of calf purchased by fattener ($191) - costs of auction and transport ($60)}
+ profit margins for the slaughterhouse ($64 [Young steer with a live weight of 485 kg at $1.20/kg live weight]) {sale price of carcass to butcher shop ($611), sale of viscera ($35) - cost of young steer purchased by producer ($582)}
+ cost of transport from slaughterhouse to butcher shop ($10)
+ profit margins for the butcher shop ($321) {sale of the carcass and viscera to the consumer ($977) - the cost of acquiring the carcass and viscera from the slaughterhouse ($646) - the cost of transport from the slaughterhouse to the butcher shop ($10)}

The distribution of the value generated by the chain, as a percentage of the final value of the young steer at retail price is presented in Figure 3.

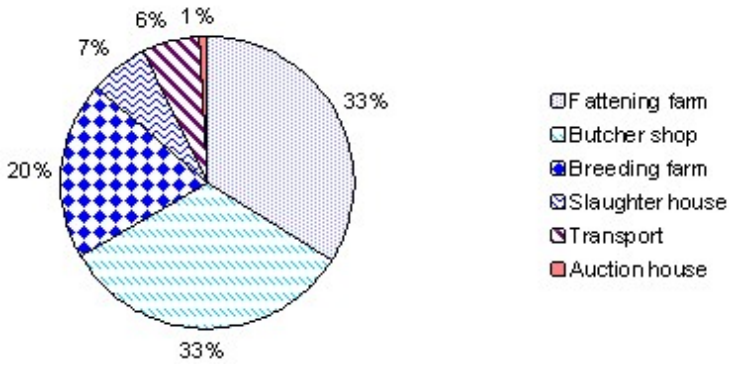

Figure 3. Values generated across the chain as a percentage of the final value of a fattened young steer at retail price

The values described above can be adjusted, taking into account the time animals remain within each link of the chain. On making such adjustments, we obtain the following estimates of added value per day of permanence in each segment of the chain:

Breeder: US$191 divided by 669 days (10 months of pre-weaning period + 9 months of pregnancy + 3 months of servicing) = $0.28/day.
Transporter: $63 for 3 days = $21/day.
Fattener: $331 for 790 days (where age at slaughter is 36 months and live weight is 520 kg - 10 months as calf to age of purchase) = 0.42/day.
Slaughterhouse: $64 for 7 days = $9.14/day.
Butcher: $321 for 7 days = $45.85/day.

The distribution of values generated through the meat chain is inequitable and is not commensurate with the risk confronted by the different economic agents that intervene in it. The unequal distribution of added value reflects the dominant position held in the market by some actors that enable them to capture a very high proportion of total benefits. The generation of value ranges from US$0.28/animal per day for the breeder to $45.85/animal per day for the butcher. Thus, the highest proportion of added value concentrates on the final link of the chain, where meat products are marketed to retail.

The butcher or supermarket obtains 164 times more value for the same animal in the same unit of time as the breeder, even though the latter faces a higher level of biological and economic risk. Butcher shops usually have insurance policies for their infrastructure and equipment, and their principal sources of risk are related to deterioration and loss of raw material through faults in energy supplies or equipment or by circumstantial shortages. In contrast, the breeder does not have insurance to face risks such as loss of animals through disease or theft, lack of grazing pastures because of extreme climatic conditions, or depressed livestock prices because of market situations.

Table 9 shows ratios of prices between producer and consumer in Costa Rica, Colombia, Chile, and Argentina. As can be observed, the case for Costa Rica is very similar to that for Colombia or Argentina, where producers capture between 23% and 26% of the final price paid by the consumer. Chile is an exception, as producers in that country achieve a larger proportion of the final price (43%), despite the price of live weight cattle being the lowest of the countries examined.

Table 9. Comparisons of beef price ratios between producer and consumer in Costa Rica, Colombia, Chile, and Argentina

Country	Producer's price, US$/kg live weight[a]	Consumer price, US$/kg[b]	Proportion of final price captured by producer, %
Costa Rica	1.20	4.70	25.5
Colombia [c]	1.06	4.68	22.6
Chile [d]	0.70	1.62	43.2
Argentina [e]	0.76	2.88	26.4

a. Price of fattened steers
b. Price of ground beef

c. *DANE (2006)*
d. *ODEPA (2003)*
e. *Mercado de Liniers S.A. 2006*

The primary sector (farm) is unlikely to increase its participation in the business if substantial improvements in productivity and competitiveness do not occur to facilitate the reduction of costs and increase of net income. Under current circumstances, no incentives exist to modernize at the farm level, which therefore represents a tight bottleneck that seriously degrades the competitiveness of the beef chain as a whole.

The competitiveness of the beef chain is the sum of the efficiency and productivity of all the links forming it. A weak demand for beef from the final link of the chain impedes technological adoption in the first link (production), thus creating a vicious cycle that generates low productivity and poor competitiveness.

The low demand for beef implies reduced levels of slaughter that do not permit full use of the installed capacity in slaughterhouses and processing plants. This impedes the generation of economies of scale and results in high unit costs that reduce the possibilities of access of beef products to domestic and external markets.

Discussion and implication of results

Potential and problems of the Costa Rican beef sector

The current analysis showed that, in Costa Rica, beef livestock is a sector with great potential to drive the country's general economic growth. Clearly, a large proportion of land resources of Costa Rica is allocated to this activity, which has significant economic, social, and environmental implications. Nevertheless, major difficulties of a technical and economic nature have been detected as preventing the full expression of this productive potential.

Traditionally, studies of the sector have had a very incomplete character, limiting analysis to certain links of the chain in isolation, that is, without taking into account their articulations and interactions with other links of the chain. This study attempts, from a holistic perspective, to give as complete a picture as possible of the potential and problems of the Costa Rican beef sector, and to propose comprehensive solutions that would promote its evolution and progress as a whole.

Primary production

This link of the chain uses the basic resources of the sector: land, livestock, and labor. On its efficiency largely depends the magnitude and sense of the economic, social, and environmental impact of beef livestock production. The main problems of this link are:

1. Although the area under permanent pastures is extensive at 1 million ha—equivalent to 69% of the land under agricultural use—the availability of forages in terms of quality and quantity is insufficient, particularly in dry seasons. The low productivity of the forage base is related to the use of native species of very low productivity and of introduced species that have degraded.

2. Even though many public and private institutions have implemented research and promotion policies, these have not had sufficient strength to raise the precarious indices of productivity that characterize the industry. Research on forages has increased the offer of new tropical forage species with high production potential, but adoption of these new species is slow and too insignificant to improve the national averages of productivity. Taking into account that investments in pastures are high relative to the low indices of profitability in primary activity, attaining high levels of adoption of improved pastures is difficult. Moreover, national efforts to transfer new technologies and provide technical and financial support practically do not exist, particularly for small producers. The direct consequences of these problems are slow growth in production and, more seriously, a downward trend in beef cattle inventories. This clearly shows the low level of economic attractiveness of this productive activity.

3. Low productivity results in high unit costs of production and high economic risk, compounded by the biological risks characteristic of primary production. That is, low and highly variable income becomes associated with high mortality indices, low birth rates, and low culling rates. As shown in this study, all these problems result in low profitability and competitiveness. Reduced competitiveness becomes manifest as a loss of place suffered by beef in the total consumption of meats within the country and as falling exports.

4. An important theme from the social viewpoint is that most livestock farms in the country are small scale and intensive in their use of family labor. However, the activity's poor profitability means that the economic reward for labor is less than the legal minimum wage. Hence, improvements made in the sector's productivity and profitability would, by increasing the income of the most vulnerable groups—the primary source of labor—would have positive social implications.

Marketing and processing livestock

These intermediate links of the meat chain have undergone an important change in dynamics, especially in recent years. The marketing of livestock through auctions is a successful innovation to the extent that a greater transparency of the markets is achieved. This is highly beneficial to small producers who have little access to timely and reliable key information on markets. Nevertheless, low annual participation in auctions is observed, as indicated by the low average of animal transactions per producer. As shown, the problems of productivity result in poor culling indices on the farm. One outstanding feature of the intermediate links is the heterogeneity of their actors, giving rise to technological dualisms that result from the coexistence of modern installations with high technological levels and small and marginal installations that continue using traditional methods.

The reduced volume of livestock from the primary sector results in the low use of resources in the intermediate segments of the chain. Hence, the capacity of installations at auction houses, slaughterhouses, and processing plants is also underutilized. The end result is inefficient use of capital and labor resources and absence of economies of scale that become manifest as high unit costs. Consequently, these segments of the chain exhibit low profitability and possible low competitiveness that, however, can be reversed by increasing the supply of livestock for processing and marketing, and modernizing and rationalizing some of the existing installations.

Distribution and consumption

Until the 1990s, beef in Costa Rica was the principal meat product demanded by domestic consumers. However, in this decade, beef has been displaced by chicken, which totals 44% of total meat consumption, versus beef at 36%. The foregoing establishes a marked contrast to the 1970s, when beef represented 74% of the country's total consumption of meat products.

To seek alternatives and new ideas that will encourage the development of the beef agro-enterprise, we need to examine successful changes and technology developments that have occurred in "clusters", such as those for the poultry agro-enterprise. The vigorous dynamics of the poultry sector resulted from profound transformations in all links of its agro-industrial chain. That is, it experienced major technological and organizational advances in the links of primary production, processing, marketing, and distribution of end products. The result of this process was a fast growth in productivity and competitiveness of the agro-industrial chain as a whole. This eventually manifested in lower unit costs and dramatic reductions of chicken prices, compared with substitute products such as beef and pork.

The loss of competitiveness of domestic beef production is also reflected in the drastic reduction of the country's total exports. In the early 1980s, annual exports of beef carcasses were about 27,000 t but, by 2004, they had fallen to almost 12,000 t. This export crisis is the result of low productivity levels, which lead to uncompetitive export prices, even within the regional context such as with Nicaragua.

As a result of the chain's current structure and organization, the links of processing and distribution of meat products capture a very high portion of the price paid by the end user. This is incongruent, considering that these segments face smaller biological and economic risks than those assumed by actors of the primary production link. This situation has serious implications, as it reinforces the vicious circle of low profitability → lack of adoption → low profitability, which then slows down the adoption of improved production

technologies by generating unattractive profit margins for potential adopters. All the inefficiencies throughout the agro-industrial beef chain in Costa Rica lead to a situation of high prices for the end user, thus reducing the sector's competitiveness and limiting consumption.

Recommendations for promoting technological change, efficiency, and competitiveness

To promote technological change, efficiency, and competitiveness of the value chain for beef in Costa Rica, we suggest the following recommendations:

Learning from the experience of successful chains

The poultry agro-industrial chain practically did not exist in Latin America during the 1960s. Production occurred on a small scale and was limited to live chicken production and sales, without added value. Production conditions in terms of races, nutrition, and health were rudimentary. Great changes in the sector began at the end of the 1960s, when new breeds were introduced that could more efficiently convert feed into meat and eggs. Balanced diets and rigorous plans for animal health were also introduced. These changes progressively reduced production costs and consumer prices.

Even though take-off began in a situation where per capita consumption was very low, the potential for very high demand existed, and was taken advantage of by the industry through transformations in other segments of the chain. The elements of success that led to the explosive growth of poultry farming can be summarized as follows:

1. Adoption of new technologies of production, processing, and distribution.

2. Reduction of biological risks through rigorous plans for animal health.

3. Vertical integration among segments of the chain, which helped reduce transaction costs, improve financing conditions, and increase the chain's profitability and productivity. An innovative element was the appearance of contract farming, which enabled segments located in the upper part of the chain to finance primary production through credits, input supplies, and technical assistance. One feature of this modality was to ensure demand for producers located farther down the chain and encourage the establishment of standards of quality and timely supplies as required by the buyer.

4. The expansion of demand made possible the development of economies of scale, which led to the rapid reduction of unit production costs.

5. Because demand expanded, the industry could diversify product supply and differentiate among prices, qualities, and market segments.

These transformations of the poultry chain over time encouraged consumption in all income strata by providing a highly diversified offer for all market segments.

Poultry production began as a highly incipient phase of development and, over 50 years, successfully became the leading agro-industrial chain of meat foodstuffs. With this chain as an example, guidelines can be drafted and ideas obtained on the potential and direction of changes that should occur in the beef chain so it may recover its productivity, profitability, and competitiveness.

Improving income and cash flow

A possible short-term strategy for increasing income and improving cash flow is to reserve a proportion of the herd for milk production. This would generate (as demonstrated above) an income that is equivalent to 60% of the legal minimum wage. Such an activity would be profitable insofar as markets for the additional quantities of milk exist.

Promoting organizations of livestock producers

The creation of social capital is a key tool for strengthening collective action in the country's meat agro-enterprise. The activities of livestock funds should be developed and expanded by involving the participation of actors from different segments of the chain. Such a mechanism would help increase social capital, reduce transaction and production costs, and generally tend towards improving the chain's productivity and profitability.

Large-scale promotion and establishment of improved forage species with emphasis for dry seasons

An important activity is to minimize seasonal losses of live weight in the national herd, thereby stabilizing the offer of meat products and improving the profitability and cash flow of commercial farms. Thus, modernization would be promoted through the adoption of already developed improved technologies that are appropriate for dry seasons. Greater efforts must be made to promote and adopt forage species of high productivity by granting facilities for financing and technical support to establish and manage new pasture options. For large-scale plantings, an adequate supply of inputs such as high-quality seeds, fertilizers, and timely availability of appropriate agricultural machinery must be guaranteed.

Designing and applying a carcass classification system

A standard system of carcass classification, based on quality and price, is urgently needed to permit the differentiation of offers for different strata of consumers, in both local and external markets. In this regard, CORFOGA is working on standards of quality.

Promoting domestic consumption and exports

This activity is imperative for achieving economies of scale throughout the chain. The expansion of domestic consumption should be stimulated through promotion and dissemination campaigns that show a broad range of products diversified in terms of quality and accessible prices to all sorts of consumers, especially to those that currently exhibit very low consumption levels. This strategy should emphasize the relatively high nutritional value of meat, its relatively low cost, and the positive social, economic, and environmental impact of livestock.

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Received 22 November 2007; Accepted 15 January 2008; Published 4 April 2008

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