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Small-scale producers in modern agrifood markets

Agrifood Sector Studies

Determinants, costs, and benefits of small farmer inclusion in restructured agrifood chains: A case study of dairy sector in India (B)

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Indian School of Management

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Micro study report of Component 1 (India)
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A case study of the dairy industry in India

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Regoverning Markets

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1 Introduction

Since 1991, the Indian government has liberalized its markets leading to fundamental changes in the agrifood sector. The structural adjustment and stabilization programmes substantially reduced controls and state interventions in the agricultural sector and foreign direct investment (FDI) was both encouraged and facilitated. This resulted in new investments in some sectors of the Indian agrifood system, particularly in food processing and retail distribution.

Rapid changes are taking place in the structure and governance of agrifood markets in developing countries including India. These changes include consolidation, institutional, organizational and technological transformation and multinationalization. These changes are occurring rapidly in many developing countries and are bringing changes in the organizational, institutional and technological practices all the way 'upstream' in agrifood systems.

Some agribusiness and food processing companies, often as part of their own restructure, have introduced modern procurement systems including contract relationships with farmers. The companies provide basic inputs in return for guaranteed and quality supplies and distribution strategies that have impacted institutional, organizational and technological aspects of the agrifood supply chain.

These modern supply chains provide both new opportunities (price and volume stability) and new challenges (quality and food safety standards, continuous supply). Socio-economic factors (income, population, tastes and preferences) on the demand side and trade liberalization, privatization and modernization of the agroprocessing and retailing sector on the supply side are major drivers of changes.

There have been growing concerns on the likely impacts of the rapid changes in agrifood market chains on smallholder producers in developing countries. Modern retail chains, particular supermarkets, have emerged in many developing countries since the early nineties (Reardon et al., 2005; Balsevich et al., 2006). Rapid marketing chain changes have also occurred in food processing, wholesaling and procurements (Reardon and Timmer, 2007).

Previous studies show that an increase in supermarkets could have serious distributional impacts downstream of the market chain. For example, there are case studies in Latin America, Central and Eastern Europe, Mexico, Brazil and Kenya that suggest that mainly large and wealthy farmers benefit from the rise of demand for high-value agriculture and emergence of supermarkets (Reardon and Timmer, 2007; Berdegué *et. al.*, 2005; Schwentesius *et. al.*, 2002, Dries and Swinnen, 2004, Hu. *et. al.*, 2004). Due to the high transaction costs involved with dealing with many small-

scale farmers as well as difficulties in ensuring quality and food safety, it is often assumed that supermarkets will concentrate on larger, wealthier farmers. As a consequence, the increase in demand for high-value agricultural commodities and the concomitant rise in supermarkets have created concern among the international community about the possible adverse consequences on small-scale, poor farmers (Reardon and Timmer, 2007).

There are few studies from India on the impacts of rising supermarket and other marketing chain changes on production and marketing at farm level. Some recent studies have provided anecdotal evidence of smallholder producers' participation in modern market channels (Joshi, et. al., 2007, Sharma, 2007 and Birthal, et. al., 2007). However, these studies are restrictive in terms of geographical coverage, commodities and market channels. Some household survey-based studies from other developing countries provided mixed evidence. Some studies showed that modernization has benefited large farmers and excluded smallholder producers. However some studies indicated that modernization can have a positive impact on smallholder producers.

This paper contributes to the literature on the impacts of the changing dairy market structures in India at farm level. The strategic issue, which this paper addresses, is: what has been the response of smallholder producers and processors to changing modern dairy supply chains in India?

More specifically, our research questions are:

- 'What are the determinants of smallholder dairy farmer participation in modern supply chains?' Key hypotheses to be tested include;
    - small-scale and poor producers are often excluded from the modern market channels;
    - market infrastructure, incentives, and risks have significant effects upon farmers' marketing decisions and choices; and
    - institutional factors such as farmers' associations facilitate their participation in modern marketing chains.

- 'What is the impact of this participation on smallholder producers' growth in terms of farmers' income, production, technology choices, etc.?' The major hypotheses to be tested is;
    - farmers' marketing choices significantly impact their income, scale of operation/herd size, and technology adoption.

The analysis presented in this paper is based primarily on interviews with key informants in the organized private, public, cooperative and unorganized milk processing and marketing sector and data from a survey of 390 dairy producers.

The dairy sector in India provides an interesting case study for different reasons. First, India is the largest producer of milk in the world contributing about 15 per cent of the world milk production (MoA, 2006). However, the organized dairy industry accounts for less than 15 per cent of the milk produced and less than one per cent in global trade for dairy products. Second, the per capita supply of milk in India is low compared with the world average and nutritional requirement, creating an opportunity, as well as a need, to strengthen the dairy sector from a nutritional point of view. Third, given the low level of processing, several players are making forays in the dairy market. Companies with interest include the global majors such as Danone, LandoLakes and Kraft Foods. Among the existing players, besides Nestle expanding its dairy business, Coca-Cola, Pepsico, Reliance Retail and Bharti intend to extend into the liquid milk market, while the domestic cooperatives - GCMMF (Amul) and NDDB (Mother Dairy) are looking at possibilities in global markets to improve profit margins.

Furthermore, the combination of lower milk supplies in neighbouring markets in South and Southeast Asia and the Middle East and the implementation of regional and free trade agreements provides growth opportunities for the Indian dairy sector.

The paper is structured as follows;

- section two provides an overview of the changing structure of the dairy industry in India is presented;
- section three briefly discusses the data sources and sampling methodology;
- section four discusses the summary statistics for socio-economic characteristics, production and marketing issues across various marketing channels;
- section five discusses conceptual approaches, econometric model specifications and estimation methods;
- section six discusses the econometric results from the participation of smallholder dairy producers in the restructured markets; and
- section seven summarizes key findings, concludes and provides broad policy recommendations.

2 The changing structure of the Indian dairy sector

Before 1991 the dairy processing sector was controlled by the government through licensing and it was mainly reserved for the cooperatives. By March 2006 about 117,575 dairy cooperative village societies, involving roughly 12.4 million farmer members (out of which 3.2 million are women), had been organized to supply milk to processing firms. From 1991, as part of domestic economic reforms and commitments to the World Trade Organization (WTO), the Indian dairy sector was liberalized in a phased manner.

On the supply side, the dairy sector was deregulated and trade was increasingly liberalized. Following decontrol of the dairy sector in 1991, many private actors entered the market and set-up milk-processing facilities, mostly in milk surplus areas. Some of the private sector plants also adopted cooperative models through the creation of informal contracts with local farmers as well as providing various inputs and services to the farmers. However, in 1992 due to pressure from the industry, some restrictions were brought back under the Milk and Milk Products Order (MMPO). The second major development in the Indian dairy sector policy was the removal of restrictions on the import and export of dairy products in the mid-nineties.

These changes were expected to have major impacts on the structure of milk production and upstream segments of the dairy value chain. The structure of dairy processing has changed considerably during the last decade. The number of private dairy processing plants has increased significantly, e.g. the number of milk processing plants in the private sector has increased from 250 in 1996 to 403 in 2002 (about ten per cent increase per year), while the number of cooperative milk processing plants increased from 194 to 212 (nearly 1.5 per cent increase per year) during the same period.

In contrast the number of plants under other categories (government milk schemes, government-owned plants and Mother Dairies) declined from 65 in 1996 to 63 in 2002 (Sharma and Singh, 2007 and MoA, 2006). The total installed capacity of the private sector increased from 24.4 million litres per day in 1996 to 32.4 million litres per day in 2002 (about 5.4 per cent increase per annum), while in the cooperative sector the installed capacity increased from 24.2 million litres to 28.3 million litres per day during the same period (2.9 per cent increase per year).

However, cooperatives witnessed an increase in the average installed capacity per plant from 125 thousand litres per day in 1996 to 134 thousand litres in 2002 and the average installed capacity of government owned plants and Mother Dairies experienced significant increases (112 thousand litres per day to 193 thousand litres

between 1996 and 2002). However, in private sector plants a marginal decline in the average capacity per plant (from 98 thousand litres to 80 thousand litres per day) was witnessed.

The possible reason for the increase in installed capacity in cooperatives and government plants could be their sustained presence in the sector along with their strong links with milk producers to obtain consistent supplies of raw milk. In the case of the private sector, most of these players are new entrants and are not willing to make big investments initially due to a lack of assured supply of raw milk.

Due to pressures from different quarters, the government amended the MMPO and removed all restrictions for setting up new milk processing capacities in March 2002. In addition FDI in the dairy sector was allowed in the early 2000s. These policy shifts fully exposed the Indian dairy sector to the forces of the open market. The milk processing and marketing sector witnessed significant expansion and new investments in the 2000s. The number of milk processing plants in the private sector increased from 403 in 2002 to 493 in 2006 (5.6 per cent increase per year), while the number of cooperative milk processing plants increased from 212 to 246 (nearly a four per cent increase per year) during the same period.

In contrast the number of plants under other categories (government milk schemes, government owned plants and Mother Dairies) declined from 63 in 2002 to 50 in 2006. The total installed capacity of the private sector has increased from 32.4 million litres per day in 2002 to 46.1 million litres per day in 2006 (about a seven per cent increase per annum). In the cooperative sector the installed capacity increased from 28.3 million litres to 36.6 million litres per day during the same period (a 4.8 per cent increase per year). At the national level, the total number of dairy processing plants has increased from 678 in 2002 to 789 in 2006 and the installed capacity has increased from about 73 million litres per day to 98 million litres per day in 2006.

Recently, many national and global players signaled plans to enter the sector and it is expected that these organizations will make huge investments. For example, Reliance (an Indian company) plans to procure milk directly through its collection centre networks mostly in Punjab and is likely to expand into Rajasthan and Andhra Pradesh. Existing corporates such as Amul, Nestle and Mother Dairy are also planning capacity expansions. However, the question that policy planners and other stakeholders are asking is 'will the entry of corporates guarantee a balance between market forces and societal concerns in rural India'?

There is also a general fear that foreign and domestic retail corporates and modern supply chains will push a large section of farmers, in particular smallholder producers, out of the market as they mostly fail to meet the quality threshold requirements. Transaction costs are also high when coordinating supplies from a

large number of small-scale producers compared to a few large farms. Small-scale farms are also financially constrained in making the necessary investments in infrastructure and post-harvest activities.

However, there is also a feeling that the currently organized sector accounts for about 30 per cent of the total milk marketed, making the sector much more attractive to new entrants. With the entry of new organizations, shares of the organized sector are expected to almost double in the next one and half decades (Sharma and Singh, 2007). Given this scenario, the timing for entry of corporates and other dairy companies and their impact upon the Indian dairy sector (particularly smallholder producers who form the backbone of the sector) is worth watching.

It is evident from the results of the meso reports (module 1 and 2) that restructuring of individual dairy industry segments, mainly in production, procurement and processing, is occurring in simultaneous and interdependent ways, albeit at different rates and in different ways across states. The study identified challenges facing primary producers and their economic organizations in negotiating market access conditioned by liberalization and modernization. Challenges include technological, organizational and financial demands placed upon small-scale farmers.

The study noted that it is important to analyze changes in procurement patterns in milk as a result of the recent policy changes. It also notes that it is important to know whether large-scale producers have cost advantages and greater efficiency within the market that will lead to the displacement of smallholders under a liberalized market. In order to investigate some of these issues, this micro-level study was undertaken in four states, namely, Punjab, Haryana, Uttar Pradesh and Gujarat, which have a strong presence of the modern (cooperatives and private) as well as the traditional sector. Major restructuring within the agrifood market is taking place in these states too.

3 Data sources and sampling procedures

This section briefly describes the sampling design of the household survey used in the study. Using the sample of milk-producing households, a market participation model is estimated to explain why some households engage in a particular marketing channel e.g. formal organized sector, whereas others do not. The section also focuses on identifying factors that significantly increase the level of participation in modern supply chains by households.

To study the impact of changing market structures upon market channel choices, scales of operations in milk production, livelihoods and welfare of rural households, a representative sample is needed. This sample contains a sufficient number of households with various scales of operations, different geographical regions, and different market channels. This section briefly outlines the survey design followed to select the regions and the sample households plus the methods employed to collect field data.

The data used in this study comes from a survey of 390 households in nine districts of four leading milk-producing states, namely, Gujarat, Haryana, Punjab and Uttar Pradesh, who have a well developed infrastructure and mix of milk marketing channels.

3.1 Sampling methodology

The major objective of the study is to understand;

- the patterns and determinants of smallholder producers' strategies,
- their responses to restructured dairy market channels; and
- the effects of participation in different marketing channels (traditional/informal and organized (cooperatives and private)) in different milk-producing regions in India that reflect the significant differences in structure of the industry.

The stratified random sampling technique was used to select the states, districts, talukas and villages. The Northern region is the largest milk-producing region in India followed by the Western region, both accounting for over two-thirds of total milk production. Northern India also has the largest number of dairy processing plants (356 with 73 in cooperatives and 280 in the private sector), followed by the Western region with 247 plants (89 in cooperatives and 119 in the private sector) in March 2006. The study was conducted in four states, namely, Gujarat in West India and Haryana, Punjab and Uttar Pradesh from North India. All states are well developed and leading milk producers. They represent different forms of organizational structure.

In Gujarat, success in the dairy development programme has largely been achieved through milk cooperatives. It is considered one of the most successful models of dairy development whereas Haryana, Punjab and Uttar Pradesh are dominated by the private sector and the presence of cooperatives is limited to few pockets of the states (Table 3.1).

Table 3.1: Dairy cooperatives and modern private sector presence in the major milk-producing states in India

Milk procured by cooperatives (% of production) – TE 2004-05	*% of milk output procured by cooperatives-states – TE 2004-05*	*Share in total milk procured by cooperatives – TE 2004-05*	*Share in national milk production – TE 2004-05*	*Share of private dairy plants in 2006*	*Traditional sector*
Above national average	***84.9% (Strong cooperatives)*** Gujarat (30.4), Karnataka (19.9), Maharashtra (16.3), Tamil Nadu (11.6), Kerala (6.7)	***69.6%*** Gujarat (29.1), Karnataka (12.8), Maharashtra (14.9), Tamil Nadu (9.3), Kerala (3.5).	***26.9%*** Gujarat (7.3), Karnataka (4.6), Maharashtra (7.2), Tamil Nadu (5.3), Kerala (2.5).	***34.8 (31.9)*(Moderate Organized Private Sector)*** Maharashtra (25.3), Karnataka (2.6)	***Moderate Presence***
Below National average	***24.2% (Moderate cooperatives)*** Andhra Pradesh (5.5), Rajasthan (5.6). Bihar (3.7), Madhya Pradesh (2.0),Orissa (4.4), West Bengal (3.0)	***18.8%*** Andhra Pradesh (5.4), Rajasthan (6.8). Bihar (2.3), Madhya Pradesh (1.9),Orissa (0.7), West Bengal (1.7)	***34.1%*** Andhra Pradesh (7.9), Rajasthan (9.1). Bihar (4.6), Madhya Pradesh (7.1),Orissa (1.2), West Bengal (4.2)	***11.7 (14.6)*(Weak Organized Private Sector)*** Rajasthan (3.5), Madhya Pradesh (3.1), Andhra Pradesh (2.8), West Bengal (2.1)	***Weak – Moderate Presence***
	8.3% (Weak cooperatives) Uttar Pradesh (1.8), Punjab (4.0), Haryana (2.5)	***10.8%*** Uttar Pradesh (4.4), Punjab (4.5), Haryana (1.9)	***34.7%*** Uttar Pradesh (19.3), Punjab (9.5), Haryana (5.9)	***52.1 (50.7)* (Strong Organized Private Sector)*** Uttar Pradesh (33.7), Punjab (10.3), Haryana (8.0)	***Strong Presence***

**: shows per cent share in total capacity in organized private sector*
Source: NDDB (2007), MoA (2006)

At the second stage, after the sample states were chosen, a similar stratified random sampling technique was used to select districts. The number of districts differed by the type of state and market structure. Specifically, four districts from Gujarat, two

districts from Haryana, one district from Punjab, and two districts from Uttar Pradesh were selected on the basis of milk production potential and presence of various actors within the market. In total, nine districts were selected for the present study.

Third, after the sample districts were selected, a similar stratified random process was used to select villages. In total farmers in 49 villages from nine districts in selected states were interviewed. The main focus in selecting the village was to represent scale differences and types of marketing arrangements existing in the study area.

3.2 Sample size and composition

Given the central importance of smallholder milk producer participation in restructured market channels in this study, efforts were made to select a representative sample of households. These samples represented various categories of households, types of marketing channels, changing structure of the dairy sector, etc. In order to analyze the response of milk producers to modernization of the dairy sector the study focused upon three major marketing channels; organized cooperatives, organized private sector, and the traditional/unorganized sector.

Farmers who live away from villages/catchments of organized sector processing plants/collection centres and/or are not members of these organizations are constrained to selling their milk in informal/traditional markets. Farmers who live inside the catchments of organized dairy processing plants have an additional option of selling to the organized sector.

For a given village, we have four types of farmers;

- farmers who have chosen to supply milk to the cooperatives (hence participation in the modern channel);
- farmers who have chosen to sell milk to the organized private sector (modern channel);
- farmers who have chosen to supply milk to traditional channels such as milk vendors, sweet shops, or directly to the consumer, contractor etc. ;and
- farmers who supply milk to multiple channels such as cooperatives and the private sector, cooperatives and the traditional sector, the private and traditional sector, etc.

Finally, based on the above mentioned criteria along with discussion with various stakeholders including government officials, cooperatives, private sector organizations and, village leaders households were selected from the sample villages. A stratified sample of 390 households consisting of 146 farmers from Gujarat, 85 from Haryana, 90 from Punjab and 69 from Uttar Pradesh was drawn. After

evaluation, 374 samples remained for analysis. Table 3.2 summarizes the distribution of the final samples of dairy producers in selected states and market channels. Sample selection was undertaken randomly, except that an effort was made to include statistically significant sub-samples of milk producers representing different marketing channels and sizes for each of the region.

Table 3.2: Distribution of sample households: state-wise and marketing channel-wise

State	*Modern Market Suppliers*		*Traditional Market Suppliers*	*Total*
	Cooperatives	*Private*		
Gujarat	93	28	20	141
Haryana	26	21	38	85
Punjab	38	20	22	80
Uttar Pradesh	41	1	26	68
TOTAL	**198**	**70**	**106**	**374**

Source: Survey data

3.3 Weights for analysis

Since the study obtained farm household population data from all districts (assuming that all farm households are milk producers), talukas and states along with the approximate share of different marketing channels in marketed surplus, Farm household-based weights were constructed to create point variable estimates. In this micro study, analysis of the first set of research questions (Who is supplying milk to modern marketing chains due to the restructuring of the dairy processing and marketing sector? What are major determinants of market channel choice?) should use the whole sample that includes both traditional and modern market chain households. Weights for the sample have been developed to estimate a representative of all farmers who participated in the marketing of milk to different marketing chains in selected areas.

The weight for the h^{th} household with milk production from k^{th} taluka of j^{th} district on i^{th} state P_{ijkh} is defined as:

$$P_{ijkh} = W_i * W_{ij} * W_{ijk} * W_{ijkh} * W_{ijkhl}$$

where,

W_i: weight for i^{th} state, its value corresponds to the shares of dairy farmers from the i^{th} state in selected states.

W_{ij}: weight for j^{th} district in i^{th} state, its value corresponds to the shares of dairy farmers from the j^{th} district in all farmers in the i^{th} state.

$W_{ijk:}$ weight for k^{th} taluka of j^{th} district in i^{th} state, its value corresponds to the shares of dairy farmers from the k^{th} category taluka in all dairy farmers in j^{th} district of the i^{th} state.

$W_{ijkh:}$ weight for h^{th} farmer of k^{th} taluka, j^{th} district in i^{th} state, its value corresponds to the shares of dairy farmers supplying milk to a particular channel from the k^{th} taluka in all dairy farmers in j^{th} district of the i^{th} state.
W_{ijkhl}: reciprocal of sample household numbers in k^{th} taluka in j^{th} district of i^{th} state.
The sum of P_{ijkh} over i, j, k and h equals one.

3.4 Survey timings and problems encountered

The household survey was carried out during the period March to June 2007. The data was collected using a pre-tested structured questionnaire. The questionnaire was pre-tested in all locations during the months of November 2006 and February 2007 and based on the response and experience, the questionnaire was revised for further effectiveness (see appendix). The questionnaire was given to the decision-maker in the family. The information collected in the survey included data on household demographics, land ownership, cropping pattern, agricultural production, livestock ownership, asset ownership, milk production and marketing, employment, feed and fodder use, animal health and breeding services and credit.

The household survey was carried out by research fellows/selected enumerators, who had fairly good experience and communication ability. Training was given to them to make them acquainted with the questionnaire. All enumerators/research fellows were able to understand the local language, culture and tradition of the area, which enabled them to overcome barriers of communication with the households. In the course of data collection, appropriate supervision was carried out to ensure improved quality of information. Incomplete questionnaires were detected and improved by carrying out revisits to the respondents, wherever possible.

Relevant secondary information related to study area was also collected from published and unpublished sources based on discussion with key stakeholders in the study area, to supplement the primary data collected from selected households. Local administration offices, state milk marketing federations, and dairy plants were visited to obtain supplementary information to the sample survey in the pursuit of an objective study

The survey experienced several problems common to many fieldwork studies. The most serious problem was to meet with the household head, who was always pre-occupied with his routine work. In the dairy sector, there are seasonal variations in milk production and feeding patterns, which have not been captured in the present study due to a one-time survey of selected households (along with time and other constraints). However, the study attempted to collect data for the pre-liberalization and post-liberalization period (major amendments occurred in MMPO in 2002) as well as for seasonal variability based on the recall method. There are wide regional,

cultural, social and lingual variations in India, which might have had some effect on the quality of the information.

4 Milk production and marketing

In this section, we first present salient characteristics of the milk producers selling to three different market channels. Table 4.1 shows characteristics of farm households in selected states. Table 4.2 compares modern channel farmers and traditional channel farmers with respect to a set of key characteristics. Table 4.3 shows size, production and market infrastructure related differences between modern and traditional channel farmer types.

Table 4.1: Selected statistics on the dairy farmers populations by states (averages)

Statistic	*Gujarat*	*Haryana*	*Punjab*	*Uttar Pradesh*	*All States*
Age household head (years)	41.9	49.3	48.6	51.7	46.7
Level of education of household head (years)	4.0	7.1	7.8	6.7	6.1
Household size (number)	5.7	6.2	5.5	6.9	5.9
Head's experience in dairy (years)	19.5	23.4	28.3	29.9	23.8
Herd Size (number)	9	6	5	5	7
Crossbreed Cow	3	1	1	1	2
Local Cow	2	0	0	0	1
Buffalo	4	5	4	4	4

Source: Survey data

Table 4.2: Selected socio-economic statistics on the dairy farmers populations (modern vs. traditional channel)

	Modern Channel Farmers			*Traditional Channel*
Farm characteristics	*Cooperatives*	*Private*	*Cooperatives & Private*	
Age of head of household (years)	46.2	44.9	45.9**	48.8
Educational level of head of household (years)	6.3	5.8	6.1	5.7
Highest education level of any HH member (years)	17	14	17	15
Head's experience in dairy farming	23.8	21.1	23.1**	25.7
Size of household	5.8	5.9	5.8*	6.2

***p <0.01, **p <0.05, *p <0.10.

Source: Survey data

Table 4.3: Herd size, composition and milk production related differences of selected households (modern vs. traditional vs. channel)

Farm characteristics	*Organized/Modern Channel*			*Traditional Channel*
	Cooperatives	*Private*	*Cooperatives & Pvt.*	
Herd size in 2006	6.4	11.2	7.7	7.2
Crossbreed Cow	1.8	4.4	2.4	1.5
Local Cow	1.2	1.4	1.3	0.3
Buffalo	3.4	5.4	4.0	5.4
% of herd with crossbred cows	28.1	39.3	31.2	20.8
% of herd with Buffaloes	53.1	48.2	51.9	75.0
Milk Output (litres/day)	29.8	49.4	34.9	46.5
Milk sales as % of total production	83.0	78.1	76.0	84.2
Distance to milk collection centre (km)	1.4	1.0	1.3	2.9
Distance to metalled road km)	4.4	3.5	3.8	2.8
Distance to main market (km)	5.7	5.9	5.8	6.2
Operational land holding size (ha)	1.9	2.1	2.0	1.2
Price (Rs./litre)				
Cow	12.80	13.78	13.18	14.11
Buffalo	14.16	15.85	15.05	16.28
Cow: Fat (%)	4.3	4.1	4.3	4.0
SNF (%)	8.5	8.4	8.5	8.4
Buffalo: Fat (%)	6.7	6.4	6.6	6.4
SNF (%)	8.7	8.7	8.7	8.6

Source: Survey data

4.1 Channel participation and household socio-economic characteristics

Tables 4.1 and 4.2 indicate that the average family size of the surveyed households was six members per household. It did not vary significantly across states and market channels. The age structure of households indicates that there is a significant difference in the age of the head of household between modern and traditional channel farmers. The average age of head of household is significantly higher (48.8 years) for traditional channel farmers compared with farmers supplying milk to modern channels (45.9 years). This indicates that young farmers have a preference for modern channels.

The education level (number of schooling years) as well as highest education level of any household member was greater for modern channel farmers than for traditional channel farmers. Education plays an important role in the adoption of new innovations/technologies and young farmers are expected to pick these up. Almost all the heads of households in the sample were male. The average family size was significantly higher (6.2) in traditional channel households than in modern channel households (5.8).

The selected households had fairly long experience in dairy farming and farmers had on an average over 20 years of experience in milk production activity. Traditional channel farmers had more statistically significant experience in dairy farming than modern channel farmers. Major sources of income for families was from agriculture in most cases and milk production activity was a secondary source of income, which shows that the majority of the farmers have been integrating their crop and milk production activities in rural areas. Smallholder dairy farming systems in rural areas are closely interwoven with crop farming activity as a subsidiary occupation based on crop residues/by-products, using cows for draft power and transport and their dung as manure in fields or fuel for cooking.

4.2 Milk production, marketed surplus and producer prices

Table 4.3 shows a summary of breed composition, milk production, marketed surplus and producer prices between the two farmer types. The results show that the overall herd size of dairy producers selling milk to modern channels is not significantly different from those selling to the traditional market. Indirectly this suggests that herd size is not an entry requirement. However, when we compare herd size between modern private channel farmers and cooperatives/traditional channel farmers, there is a significant difference that suggests that herd size may be an entry barrier to the modern private sector channel but not for cooperatives.

Furthermore, herd composition by species/breed also differs significantly between modern and traditional channel farmers. While about 75 per cent of traditional channel farmers' herds consist of buffaloes, modern channel farmers' herds consist of about 52 per cent. The share of crossbred cows is higher (31.2 per cent) for modern market channel farmers than the traditional channel (20.8 per cent). This difference in species composition is largely due to the outcome of a pricing mechanism, as the traditional channel pays higher prices for butterfat while in the organized sector pricing is two-dimensional based both on butterfat and solid-not-fat (SNF) content of milk.

Organized private dairy channel farmers have significantly higher number of crossbred cows compared with traditional and cooperative dairy farmers. Modern market channels are promoting high-yielding cow farms to reduce seasonal variations in milk production as buffalo milk production has greater seasonality.

The average milk production is highest in the modern private channel (49.4 litres/day), followed by the traditional channel farmer (46.5 litres/day) and cooperatives (29.8 litres/day). Average marketed surplus is also higher for modern private channel farmers followed by traditional and cooperatives. Nearly 80 per cent of milk produced on both modern and traditional channel farms is marketed, with

the remains retained by households for self-consumption as fluid milk and traditional milk products such as *curd* (yoghurt), *ghee* (clarified butter), *lassi* (butter milk), butter, etc.

The operational area of land of producers selling to the modern channel is also statistically significantly higher than traditional channel farmers.

Distance to the milk collection centre was found to be significantly different between the two farmer types (modern and traditional). The average distance to milk collection centres was highest (2.8 km) for the traditional channel, followed by cooperatives (1.4 km) and the lowest (1.0 km) in the case of modern private channels. The distance to the main market is highest (6.2 km) for traditional channel farmers.

The range of prices received by producers as an indicator of relative performance of the market intermediaries includes absolute price levels and price stability. Due to a lack of time, series data on producer prices (for analyzing price variation over time) and average milk prices received by producers from the alternative marketing channels were used in the analysis.

Table 4.3 shows that the highest price (Rs. 14.11/litre for cow milk and Rs. 16.28/litre for buffalo milk) was received by producers who sold their milk through traditional channels, followed by modern private channels (Rs. 13.78/litre for cow milk and Rs. 15.85/litre for buffalo milk) and the lowest price (Rs. 12.80/litre for cow milk and Rs. 14.16 litre for buffalo milk) was received by producers who sold their milk through cooperatives.

The price offered by cooperatives becomes a benchmark price for traditional as well as organized private sector players. Prices offered by modern channels vary according to the butterfat and SNF content of milk delivered by the producer. The average price for buffalo milk was higher than cow milk in both channels. The prices received from milk traders/vendors were different between the lean season (April to June) and the flush season (October to December). The prices are higher in the lean than the flush season because of relatively low milk supply during the lean season.

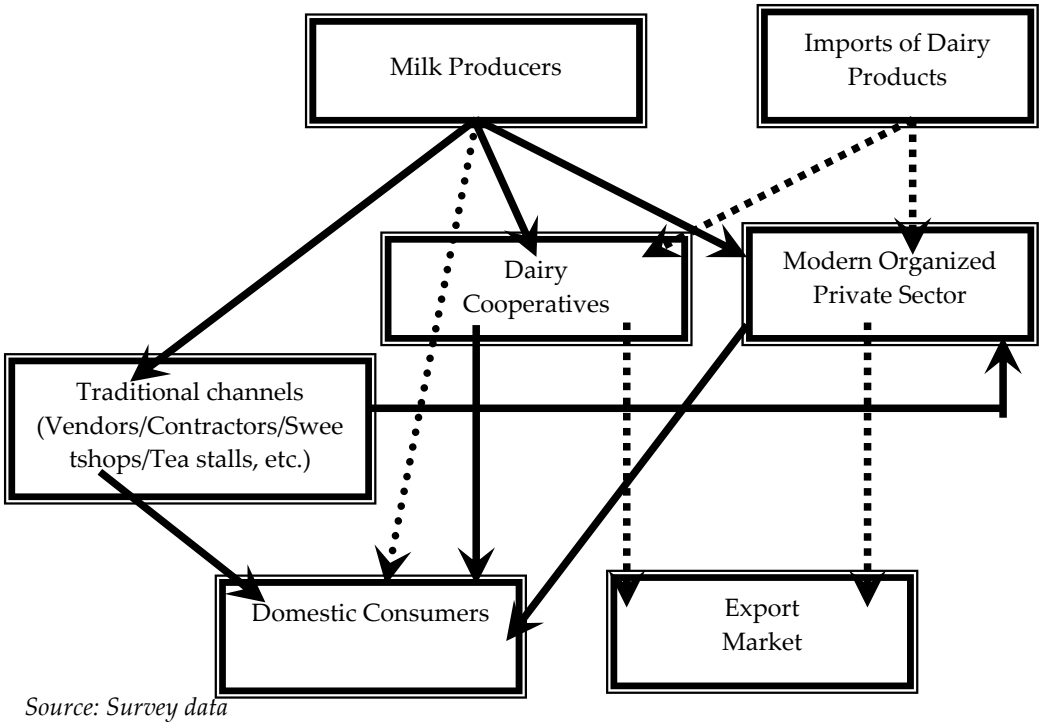
However, these fluctuations are less in modern channels. Moreover, the price paid by cooperatives does not include the bonus (price difference) that member-producers receive at the end of the year. The amount of bonus depends on the operating expenses of the cooperative, and normally covers utilities, lease and loan payments, salary to milk collection centre staff, etc. There was no significant difference in the butterfat and SNF content of milk procured by the traditional and modern market channels.

4.3 Milk marketing channels

This section briefly discusses the milk marketing system and channels in the study area. The modern/organized sector (cooperatives and private dairy plants) and the traditional/unorganized sector, involved in the marketing of liquid milk and traditional products such as locally manufactured *ghee* (butter oil), *paneer* (cottage cheese) and indigenous products such as sweets coexist in India. As per the National Dairy Plan 2021 to 2022, in 2004 to 2005, roughly 40 million tonnes (48 per cent of total production) of the total milk production of about 84 million tonnes in rural India is retained in the villages itself. The remaining 44 million tones (52 per cent) in sold in urban areas. Out of the 44 million tonnes of marketed surplus, the share of the organized sector (cooperatives and private sector) is small (30 per cent) and a large proportion (about 70 per cent) of milk continues to be marketed through traditional channels.

Depending on the involvement of the market intermediaries in the marketing of milk from producer to consumer, major marketing channels observed in the study area are given in Figure 4.1.

Figure 4.1: Predominant milk marketing pathways from the farmer to the consumer



Source: Survey data

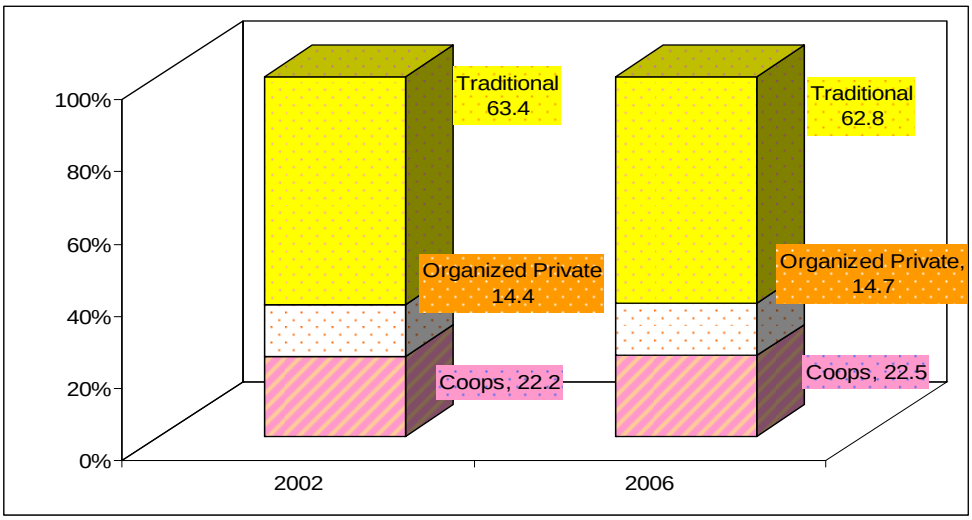
The most predominant traditional marketing channel from sample households was from producer to milk vendor/trader to consumer. However, some farmers also sell

milk directly to the consumer in the village itself or nearby villages. Milk marketing cooperatives and non-profit organizations, who market the milk and dairy products produced by the members of cooperatives, are other marketing outlets available to member-producers. Cooperatives are owned by the members - milk producers who participate in the cooperatives with the principle of 'one member, one vote', independent of the level of their investment, ownership of shares, volume of milk supplied.

Cooperatives transfer their entire income to farmers, after removing operating expenses. Farmers are given a minimum procurement price for milk on a butterfat and SNF basis. In the case of traditional channels, milk vendors pay for the milk mostly on a butterfat basis (in many cases a flat rate irrespective of fat content), with little or no consideration for the SNF content of milk. The organized private sector also procures milk directly from farmers. The share of the private organized sector is small compared with cooperatives/traditional sector but is increasing due to the liberalization of the Indian dairy sector.

Despite restructuring in the milk processing sector, the downstream restructure has not penetrated into farm procurement. Farmers' milk marketing channels in the study area are still dominated by the unorganized sector. Nearly two-thirds of milk is marketed through traditional supply channels, while modern channels, which include cooperatives and private companies, account for about 36 per cent of milk supplies (Figure 4.2).

Figure 4.2: Shifts in the share of major milk marketing channels in the study area: 2002 and 2006



Source: Survey data

The share of the cooperative sector has increased marginally from 22.2 per cent to 22.6 per cent between 2002 and 2006, while the share of the organized private sector has increased marginally from 14.4 per cent to 14.7 per cent. As the traditional sector handles the largest share of unprocessed milk marketed in India, the entities that process and sell fluid milk to consumers in each region/state varies. For example, most of milk produced in the Northern region flows from dairy farms through to traditional channels. In Western regions, dairy cooperatives procure and process most of the milk and distribute to consumers through retail outlets. The share of cooperatives in selected states varies from less than five per cent in Haryana and Uttar Pradesh to as high as 72 per cent in Gujarat. The share of the traditional sector varies from nearly ten per cent in Gujarat to over 90 per cent in Uttar Pradesh. That of the organized private sector is highest in Punjab and lowest in Gujarat. The results of the micro household study on milk marketing channels support the findings of the meso-level analysis (Sharma and Singh, 2007).

Of the traditional market share, milk vendors/traders handle the largest volume, implying that small-scale milk traders are more effective in procuring and marketing milk from smallholder dairy producers. However, despite public health risks associated with the consumption of unhygienic unprocessed milk and dairy products marketed through traditional channels, the traditional sector is still predominant in India. The number of intermediaries involved impacts both producer and consumer milk prices. It is expected that the shorter the channel, the more likely consumer prices will be lower and the producer will get a higher return.

However, milk producers may not necessarily benefit from a short marketing chain i.e. modern channels may be paying farmers almost the same price as traditional channels. Farmers sometimes prefer selling milk to milk vendors because other factors such as advance prompt payments and/or inaccessibility to formal market outlets such as producer cooperatives or organized private milk processing factories. The biggest disadvantage of direct milk sales to consumers through traditional channels/milk vendors is the lack of quality control and the frequent mixing of milk with water and other chemicals. There is growing consumer awareness of food safety and quality issues.

The demand for milk and dairy products is also increasing in the country due to an increase per capita income, changing dietary pattern and lifestyle and other demographic changes. This explains why, following the liberalization of the dairy industry, the share of modern channels (cooperatives and private) has been on the increase.

4.4 Channel participation and growth for smallholder producers

	Organized Coop. Channel farmer			Organized Pvt. Channel farmer			Traditional Channel farmer		
	2002	**2007**	**Growth**	**2002**	**2007**	**Growth**	**2002**	**2007**	**Growth**
Herd size	4.3	6.4	48.8	8.4	11.2	33.3	5.3	7.2	35.8
Crossbred Cow	17.8	28.1	10.3	38.6	39.3	0.7	15.6	20.8	5.3
Output Volume (lit./day)	23.6	29.8	26.3	37.3	49.4	32.4	31.7	46.5	46.7
Price (Rs./lit)									
Cow Milk	10.95	12.80	16.9	11.02	13.78	25.0	10.96	14.11	28.7
Buffalo Milk	13.53	14.16	4.7	14.36	15.85	10.4	14.54	16.28	12.0
Milk yield									
Cow	4.3	4. 5	4.6	4. 5	4.7	4.4	4.3	4.5	4.6
Buffalo	5.2	5. 3	1.9	5.0	5.4	8.0	5. 3	5.6	5.7

In order to analyze the effects of participation in modern dairy channels on the growth of the smallholder farmers, the study analyzed changes in herd size and breed upgradation over the period 2002 to 2006. As indicated earlier, this is the period during which all restrictions on the entry of the private sector in milk processing, including milkshed area, were abolished. The study included two size dimensions; the number of dairy animals and the milk output volume, plus one upgrading dimension; the share of improved breeds and milk yield. Table 4.4 provides summary statistics of growth indicators and upgradation over the period 2002-2006.

Table 4.4: Growth and upgradation by dairy farmer type between 2002 and 2007

	Organized Coop. Channel farmer			Organized Pvt. Channel farmer			Traditional Channel farmer		
	2002	**2007**	**Growth**	**2002**	**2007**	**Growth**	**2002**	**2007**	**Growth**
Herd size	4.3	6.4	48.8	8.4	11.2	33.3	5.3	7.2	35.8
Crossbred Cow	17.8	28.1	10.3	38.6	39.3	0.7	15.6	20.8	5.3
Output Volume (lit./day)	23.6	29.8	26.3	37.3	49.4	32.4	31.7	46.5	46.7
Price (Rs./lit)									
Cow Milk	10.95	12.80	16.9	11.02	13.78	25.0	10.96	14.11	28.7
Buffalo Milk	13.53	14.16	4.7	14.36	15.85	10.4	14.54	16.28	12.0
Milk yield									
Cow	4.3	4. 5	4.6	4. 5	4.7	4.4	4.3	4.5	4.6
Buffalo	5.2	5. 3	1.9	5.0	5.4	8.0	5. 3	5.6	5.7

Source: Survey data

The figures in table 4.4 show that for both channels (modern and traditional) there is a shift towards larger herds with a higher percentage of more productive crossbred cows. The average herd size is the highest (11.2 animals) in modern private channel farms, followed by traditional channel participants (7.2) and the lowest (6.4) in the case of cooperatives. The share of improved crossbred cows has increased on all channel farms but the increase is highest in the case of cooperative channel farmers. The average productivity per animal has increased by about five per cent on all three types of farms, while the buffaloes' yield increase was higher within the modern private and traditional channel. The overall increase in productivity was higher using cows compared to buffaloes. This implies that farmers have started replacing low-producing traditional breeds with high-yielding crossbred animals due to the availability of breeding services.

Milk output volume has increased for all farm types. It increased more for dairy farmers in traditional channels, followed by the organized private channel and finally cooperatives. Although the average marketed surplus increased for all farmer types, it increased more for dairy farmers in cooperative channels, followed by the traditional and modern private channel.

The cost of cow milk has increased by 28.7 per cent in the case of traditional channel farmers while buffalo milk cost has increased by about 12 per cent. There has been a moderate increase in milk prices for modern channel farmers but prices in the private sector were higher than the cooperatives.

5 Factors affecting market channel choice

Milk producers use different market outlets for their output. They sell their produce;
- at the farm gate to traditional channels such as milk vendors/traders;
- at sweetshops;
- directly to consumers;
- at the village dairy cooperative society milk collection centre; and
- at the milk collection centre of organized private sector dairy plants.

The largest share of milk is sold to traditional channels comprising mainly of milk vendors, while sale to modern chains (cooperatives and private) is low but increasing. Farmers may use more than one market outlet, but in different degrees, and perhaps for different purposes.

Market access is not uniform across different categories of households because households may face different;
- transaction costs to market participation (distance to roads, markets, towns, transport facilities, etc.);
- risks associated with prices and contract arrangements;
- human capital (age, education, gender, extension, training);
- physical capital (number of dairy animals, farm size, farm assets); and
- financial capital (income from crop and off-farm income).

Geographical markets may also be integrated differently into the local/national/global economy because of spatial differences in the costs of commerce and in the degree of competition among market channels or both. In general the farmer first decides to participate in the market when it is profitable to do so, and then decides on how much to sell and to which channel. The above factors affect profitability as they affect marketing costs. Important factors affecting market channel choice are discussed in the following section.

5.1 Transaction costs

In general, the study expects that farmers with lower transaction costs are more likely to participate in modern channels and sell higher quantities. Thus we expect farmers with easy access to milk collection centres, who live near to roads, markets and/or towns, and who have better transportation facilities, to participate in modern markets. However smallholder producers face high transaction costs, therefore reducing the opportunity to participate in modern markets.

Given the transaction costs encountered when using the input and output markets, a solution for the individual farmer would be to cooperate with respect to the various

farm activities. Indeed the advantages of organizing farmers into groups are widely acknowledged in the literature. The advantages comprise the reduction of transaction costs in accessing input and output markets and the strengthening of farmers' negotiation power.

5.2 Human capital

The study expects age to be negatively associated with modern market participation, as older households tend to have greater subsistence production activities and are risk averse. Education levels and extension is expected to have a positive impact upon market participation as they enhance the skills and ability needed to meet food safety and quality requirements of modern channels. They also utilize market information more effectively, which may reduce marketing costs and make it more profitable to participate in modern market channels.

5.3 Physical capital

The study expects that the larger the farm, the greater the probability that the grower will be in the modern channel. Physical assets such as land, herd size and farm assets may have an indirect positive impact. They may enable farmers to overcome credit constraints, where land can be used as collateral for obtaining institutional credit, and allow them to adopt improved technologies that increase productivity and profitability.

5.4 Financial capital

This is expected to have mixed impacts. For example credit for dairy activities is expected to have a positive impact, while those given credit for crop farming and other activities may raise the opportunity cost of dairy production, hence reducing participation in modern markets. Other assets that the study expects to be important in modern market channel participation include sources of off-farm income to serve as a risk management mechanism to offset the initial risk of selling to a traditional channel. Off-farm income will also provide finance for working and investment capital.

6 Econometric model and estimation

It is known that the decisions of farmers to supply one market or another are categorized as a function of the set of incentives and capacity variables that allow the fulfillment of technological requirements. This section discusses the econometric model used to test the hypothesis of exclusion and/or inclusion of dairy farmers from market restructuring and the impacts of farmers' marketing choices upon income, employment and technology.

Given that the study formulated the channel selection as a three-alternative choice (cooperatives, private and traditional); it has applied a multi-nominal logic model estimating marketing channel choice problems with mixed continuous and discrete dependent variables. The econometric approach used is a two-step procedure with channel choice first. The correlate behaviours are then modeled with endogenous stratification of the sample into the channel strata, controlling the conditional probability of inclusion in a given channel. According to the rational choice theory, the study assumes individuals rank mutually exclusive alternative marketing channels in order of utility, and will choose the channel with the maximum expected utility given their socio-economic and demographic characteristics, and relevant resource constraints.

The producer's market channel choice can be conceptualized using a random utility model (RUM). The RUM is particularly appropriate for modeling discrete choice decisions such as market channel choices. It is an indirect utility function where an individual with specific characteristics associates an average utility level with each alternative market channel in a choice set. In this study's sample, a member of the cooperative dairy society did not sell to other channels; a member of the private dairy company did not sell to cooperatives or the traditional channel and a producer for the traditional channel did not sell to cooperatives or to private dairy plants. There were few producers in this sample who sold their produce to multiple channels and these were dropped from the analysis. Producers are mapped into three mutually exclusive channels, the cooperatives, private dairy plants and the traditional channel.

6.1 Random utility model

Let decision-maker I choose from a set of mutually exclusive alternatives, j = 1, 2, …., J. The decision-maker obtains a certain level of utility U_{ij} from each alternative. The discrete choice model is based on the principle that the decision-maker chooses the outcome that maximizes the utility. The producer makes a marginal benefit-marginal cost calculation based on the utility achieved by selling to one market channel. We do not observe his/her utility, but observe some attributes of the alternatives as faced

by the decision-maker. Hence, the utility is mapped into deterministic (V_{ij}) and random (ε_{ij}) part;

$U_{ij} = V_{ij} + \varepsilon_{ij}$ $\varepsilon_{ij} \sim N$

Since ε_{ij} is not observed, the decision-maker's choice cannot be predicted exactly. Instead, the probability of any particular outcome is derived. We can not observe the utilities directly (or the difference between benefit and cost) but the choice made by the producer reveals which one provides the greater utility (Greene, 2000).

A producer selects market channel j=1 if;

$U_{ik} > U_{ij} \forall j \neq k$

where U_{ik} denotes a random utility associated with the market channel j=k, and V_{ij} is an index function denoting the producer' average utility associated with this alternative. The second term ε_{ij} denotes a random error that is specific to a producer's utility preference (McFadden, 1976).

Now, in this implementation model, market channel choice is modeled as:

$M_{ij} = \beta_j X_{ij} + \varepsilon_{ij}$

where M_{ij} is a vector of the marketing choices (j = 1 for cooperatives; 2 for private and 0 for traditional channel) of i^{th} farmer, β_j is a vector of channel-specific parameters. ε_{ij} is the error term assumed to have a distribution with mean 0 and variance 1.

X_{ij} is a vector of producer characteristics that together reflect the incentive, risks, capacity variables and other variables influencing the producer's indirect utility, hence his/her market channel decision. It includes the following variables (Table 6.1 for variable description):

- 'Age' is the age of the head of household. The study expects that the age of household head will be negatively related to the modern market channel choice and income, which means that the older the household head is, the less likely he is to participate in the modern channel and therefore the less income he will have. Younger farmers tend to be more enterprising, faster decision makers with the capacity to adopt new managerial systems and technologies.
- 'Education' refers to the number of years of schooling of the household head. The study expects a higher education to favour entry into the modern market channels as it would facilitate the adoption of new technologies and management practices. Education and age are also indicators of management capabilities.
- 'Membership' is proxy for social capital. This study expects there to be a positive relationship between membership of an association/cooperative/organization and of participation in modern markets. Collective action allows small-scale farmers to aggregate their inputs/outputs to achieve economies of scale that enables them to access inputs and services and negotiate for better prices for their outputs.
- 'Herd size' represents the overall herd size of dairy animals in 2002 to avoid any endogenous problems. It can be considered a proxy for financial capability and production capacity of the farmer. The study expects a positive effect of this

variable, as it is linked to marketable volume considered desirable (by the buyer) because it reduces transaction costs.

- 'Risk' is measured as a coefficient of variation (CV) of milk prices received by farmers. A price risk is likely to be negatively related to market choices, which means the higher the risks, the more likely a farmer is to participate in the modern market channel.
- 'Road' is the distance to a paved road measured in kilometres and it is expected (as a measure of transaction costs facing the producer as well as infrastructure) to negatively affect the choice of the modern channel.
- The study has tried measuring the household's distance from the nearest market 'market', the establishment of new milk collection/chilling centres post-2002 'collection centre' and the distance from the milk collection centre as instrumental variables in the farmers' marketing channel choices. The study assumes that these variables do not have any direct impacts upon farmers' milk production but they may have indirect impacts upon marketing channel choices.
- 'Market' is the distance to a market measured in kilometres (as a measure of transaction costs facing the producer). A longer distance to the market is expected to have a positive effect on modern market channel participation.
- 'New collection centres' is the number of new processing facilities/milk collection centres set up in the village in the post liberalization period (after 2002). The establishment of new facilities is expected to have a positive effect on the choice of modern channel.
- 'Distance from market' is proxy for access to alternative markets. The study expects to have a negative association with modern market channel participation.

The study used multinomial logic regression using the weights discussed earlier to estimate the determinants of market channel choice equation. This is because this model fits the multiple discrete choice variables. The multinomial logic model results will then be used to construct the selection-correction term (Inverse Mill's ratio (IMR)) for individuals selecting into each channel (Green 2003). In the second stage the IMR will be included in the impact regression estimation to control for selection bias.

Table 6.1: Variables for the marketing channel choice model

Variable	*Unit*	*Type of variable*
Marketing Channel Choice	Cooperatives, organized private, traditional channel	Multinomial (1,2,3)
Age of Head of Household	Number of years	Continuous
Educational Level of Head of Household	Number of years	Continuous
Membership	Membership to a Farmers' Association/Cooperatives	Binary (0,1)
Distance to Metalled Road	Km	Continuous
Herd Size in 2002	Number of dairy animals	Continuous
Provision of Veterinary Services	Yes/No	Binary (0,1)
Price Risk (%)	Coefficient of Variation (%)	Continuous
Distance to Milk Collection Centre	Km	Continuous
Distance to Main Market (km)	Km	Continuous
Milk Collection Centres set up in post-2002 period	Yes/No	Binary (0,1)

Source: Survey data

6.2 Effects of market channel choices upon income, employment and technology

The farmer's market channel choices are expected to have significant or non significant impacts upon various technological and economic parameters, such as income, productivity, employment and technology (breed composition). Here the study estimates income, employment and technology functions, again endogenously stratifying for the three market channels. Since the separation of producers by market channel introduces a bias derived from an endogenous stratification upon market channel, this bias need to be corrected. The regression equations are estimated for the group accessing modern channels and for those accessing traditional channels. The estimators in this production function use IMR as a regressor calculated from multi-nominal logic function for the market choice presented before.

For the second set of research questions related to the impacts of farmers' marketing choices, M_i, and their impacts on farmers' income, employment, and technology (Y_{ij}), we have the following specifications;

$Y_{ij} = \beta_0 + \beta_1$ AGE $+ \beta_2$ EDUCATION $+ \beta_3$ MEMBERSHIP $+ \beta_4$ ROAD $+ \beta_5$ PRICERISK $+ \beta_6$ VETSERVICES $+ \beta_7$ HERD $+ \beta_7$ IMR $+ u_{ij}$

Y_{ij} is a set of variables that are expected to be affected by the farmer's marketing choices (M_{ij}). In the study, the following impact variables are identified;

- dairy income (Rs./dairy animal/household/day);

- milk yield (litres/day);
- employment (hours/litre of milk);
- technology (percentage of crossbred cows in dairy herd).

β_i are the estimation parameters.
The study estimates the system for each market channel independently using a Zellner's seemingly unrelated regression (SUR) model to exploit any potential correlation across errors in four impact equations.

7 Economometric analysis results

7.1 Determinants of market channel choice – multinomial logit estimates

This section examines the determinants of the marketing decisions of milk producers. Estimates of the first-stage channel selection results of the Heckman procedure (multinomial logit coefficients and marginal effects of market channel choice) are presented in Table 7.1. Three instrumental variables are included in the first-stage estimation that are not part of second-stage estimation for identification (Hamilton and Nickerson, 2003). The first variable (new milk collection centres set up in the post 2002 regime) measures the impact of abolishment of milkshed area requirements under the MMPO. The second instrumental variable is the distance from the market, which captures the marketing opportunities available to the milk producer. The third instrumental variable is the distance from the new milk collection centre that has facilitated access to new market opportunities.

While these factors/developments have facilitated access to markets, their effects are similar among different types of milk producers/market players. These factors have not directly affected milk production because no *a priori* advantages have emerged for any of the producers. Instruments are appropriate because they represent industry level developments over time that all producers/industry players face.

Table 7.1: Multinomial logic estimates of the milk marketing channel choice equation

Independent Variables	*Mlogit Coefficient Estimates*		*Marginal Effects*		
	Cooperatives	*Private*	*Cooperatives*	*Private*	*Traditional*
Constant	-6.7403*** (1.8332)	-4.7790*** (1.938)	-	-	-
Age (years)	-0.0312 (0.0308)	-0.1021*** (0.0380)	-0.0007	-0.0021	0.0028
Education (years)	0.283*** (0.0900)	0.2356*** (0.0840)	0.0063	0.0047	-0.0110
Membership (yes =1; no = 0)	3.1138** (1.5321)	2.9361* (1.7831)	0.0761	0.0588	-0.1349
Distance from Road (km)	0.6378*** (0.1800)	0.8134*** (0.1809)	0.0155	0.0164	-0.0319
Herd Size (number)	-0.1091* (0.0564)	0.0205 (0.0534)	-0.0027	0.0005	0.0022
Veterinary Services (yes =1; no = 0)	6.0371*** (0.8636)	2.4850** (1.0174)	0.1492	0.0479	-0.1972
Price Risk (%)	1.1056*** (0.2404)	1.0184*** (0.2636)	0.0270	0.0204	-0.0474
Distance from Milk Collection Centre (km)	-0.2963*** (0.0868)	-0.6503*** (0.1483)	-0.0070	-0.0132	0.0202
Distance from Market (Km)	-0.1093* (0.0550)	-0.1114* (0.0657)	-0.0028	-0.0023	0.0004
Post-2002 Milk Collection Centre (yes =1; no = 0)	1.9279 (3.1378)	3.2080* (1.7977)	0.0463	0.0651	-0.1114
Number of observations		374			
Log likelihood function		-93.3967			
Restricted Log likelihood		-315.1223			
Chi^2		443.4512			

a. Notes: Figures in parentheses show standard errors; ***p <0.01, **p <0.05, *p <0.10.

b. The dependent variable is market channel choice: $M_k = 1$ for cooperatives, $M_k = 2$ for organized private and $M_k = 0$ for traditional channel. Traditional channel is used as base category

The tradional market channel is chosen as the base category and all coefficients in traditional channelS are set to zero. The marginal effects are evaluated using the sample means of all variables. An important feature is that the sum of the marginal effects of any variable on all the three channels should be zero by definition. The parameters of this model can be interpreted as the effects of a minute change on the probability of selecting cooperatives/modern private channels in each independent continuous variable and the discrete change in the probability for dummy variables. As shown in Table 7.2 the model is highly significant and correctly predicts about 80 per cent of the observed outcomes. Almost all the parameters have the expected sign, with varying degree of significance.

Table 7.2: Frequencies of actual and predicted outcomes – multinomial logic model results

Actual	*Predicted*			
	0	1	2	*Total*
0	89	12	5	*106*
1	29	148	21	*198*
2	25	30	15	*70*
Total	*143 (74.1%)*	*190 (95.%)*	*41 (58.6%)*	*374*

The multinomial logit analysis shows very interesting results. The most important finding of the market channel participation results is that herd size is a significantly important determinant of market channel participation in modern market channels but has different impacts. For example, in the case of the organized private dairy market channel, there is a positive impact of herd size upon market participation, i.e. as herd size increases, farmers shift supplies to the organized private dairy channel.

In contrast, in the case of cooperatives, this relationship is negative, therefore indicating that as herd size increases, farmers shift away from cooperatives to other channels. The possible explanation for this behaviour could be that farmers receive the same price in cooperatives irrespective of the quantity of milk supplied, while in the case of private dairies, and even traditional market channels, large producers obtain price incentives or higher prices because of the greater bargaining power, as well as lower transcation costs for buyers. The results clearly show that modern private dairy plants and traditional channels prefer supplies from large farmers who can supply more quantities of quality milk, and smallholder milk producers are excluded from these channels.

As expected, the age of the head of household is negatively related to the participation of smallholder dairy farmers in modern channels and is statistically significant in private dairy channels. A one year increase in age is predicted to raise the probability of

being in a traditional channel but reduces the chances of being in the other two channels. In the case of education levels, the results show a statistically significant postive impact for both cooperatives and private dairy chains.

Membership of a farmers' group/association/cooperative significantly determines smallholder dairy producers' participation within modern markets. Membership is positively related to market choice. This means that if a farmer is a member of a farmers' group/association/cooperative, he/she is more likely to participate in modern markets. The relationship is much stronger for cooperatives, which shows the strength of dairy cooperatives in India. It is also known that collective action enables small-scale farmers to attain greater bargaining power, greater economies of scale as well as reducing transcation costs. The results show that the majority of farmers in the cooperative market channel generate their produce individually (as the economies of scale in milk production are almost absent) but market collectively (as the economies of scale in marketing and processing of milk are very significant).

Interestingly, selling to modern marketing channels is positively correlated with the distance from a paved road, which indicates that those milk producers located in areas with less road connectivity may still be part of modern marketing channels. From qualitative discussions with traditional marketing channel operators, many organized dairy plants (cooperatives as well as private) have set up milk collection centres mainly in rural areas while traditional channel operators procure milk from areas near to urban centres to reduce transportation costs and exploit market opportunities in big cities.

Price risk is another important impediment to market entry, as well as the adoption of improved technologies and investment in productive assets, therefore reducing the market participation effects. Lower prices, greater price risk, or both will typically discourage smallholder market participation. Price risk has a significant effect upon modern market channel participation. Reported figures indicate that price risks appear to positively affect farmers entering the modern channel i.e. as price risk increases, farmers tend to shift to modern channels due to the transparent and stable pricing policies adopted by both cooperatives and organized private dairies. Traditional channel players pay marginally higher prices to milk producers during lean seasons but inter-seasonal price fluctuations are high and sometimes they disappear from the market during periods of high-production (flush season).

As expected, the provision of veterinary services is predicted to raise the probability of cooperative membership and/or the organized private marketing channel.

Milk collection centres set up during the post-liberalization period (post 2002) turned out to be a significant determinant of market channel participation. The coefficient was positive and statistically significant in the case of organized private dairy farmers but non-significant for cooperatives. The possible explanation for this pattern could be that many private companies set up milk processing plants during the post-liberalization era, when the milk-shed area requirement was abolished. This attracted dairy farmers from traditional channels as well as from cooperatives towards private sector plants.

The distance to milk collection centres is negatively correlated with modern market channel participation, which indicates that as the distance of milk collection centres increases, farmers tend to sell their output to traditional marketing channels as most of the traditional channel players collect milk from farmers' doorsteps.

The probability of selecting modern channels rises with an increase in distance from the market. However its influence is insignificant for cooperatives but statistically significant in the private sector channel. This significant positive impact may be explained by the fact that there has been an increasing trend of private dairies procuring milk directly from farmers through milk collection centres or through agents.

The study generated the IMR of this multinomial logic model and included it as an explanatory variable in the estimation of impact regressions.

8 Impacts of market channel choice on income, employment and technology

Table 8.1 provides the second-stage impact results using gross dairy income, milk yield, employment and share of crossbred animals as dependent variables. Ideally, dependent variables should be net dairy income. Unfortunately, accurate data on the value of some inputs are difficult to obtain. This is particularly true of inputs for which markets are not well developed, such as labour, home grown feeds and fodder. In some cases costs data are missing. As a consequence we use gross dairy income per animal per household as a dependent variable in the second stage of heckman model.

Table 8.1: Impact of milk market channel choice on gross dairy income, employment, milk yield and share of improved breeds, 2006

	Income			*Employment*		
Variable	*Cooperatives*	*Private*	*Trad.*	*Cooperatives*	*Private*	*Trad.*
Constant	88.5739 (11.6835)	52.501 (13.9558)	86.859 (21.894)	0.5064 (0.0953)	0.1713 (0.1782)	0.6152 (0.0988)
Age	-0.2961*** (01570)	-0.1477** (0.0992)	0.5398 (0.3438)	0.0022*** (0.0012)	0.0206* (0.0038)	0.00205 (0.0015)
Education	0.1030 (0.3324)	0.9400 (0.7541)	-0.5017 (0.884)	0.0115* (0.0027)	-0.0024 (0.0096)	0.0018 (0.0039)
Membership	16.8618* (4.827)	-1.2633 (11.1385)	-33.1126 (29.2065)	-0.1694* (0.0394)	-0.3731* (0.1422)	-0.2866** (0.1318)
Distance from Road	-1.2063 (1.0376)	-0.8109 (0.9121)	-0.8446 (1.5082)	0.0125 (0.0084)	-0.0031 (0.0116)	-0.0047 (0.0060)
Price Risk	-0.9054 (0.7694)	3.6395* (1.2663)	-9.0901** (4.093)	0.0295* (0.0062)	-0.0786* (0.0161)	-0.041** (0.0184)
Veterinary & Feed Service	11.2941* (3.9958)	1.4543 (3.6369)	0.9201 (17.821)	-0.1609* (0.0326)	-0.1253* (0.0464)	-0.2068** (0.0804)
Herd Size	-2.7676* (0.6256)	-0.1050 (0.1781)	2.305** (1.1101)	-0.0366* (0.0051)	-0.0071* (0.0022)	-0.0373* (0.005)
IMR	15.6060* (2.6012)	3.6501* (1.8929)	8.869 (12.2952)	-0.0588* (0.0212)	-0.2553* (0.0497)	-0.035 (0.0554)
Number of observations	198	70	106	198	70	106
R^2	0.38	0.41	0.34	0.31	0.61	0.65
	Yield			*Crossbred Cows*		
	Cooperatives	*Private*	*Trad.*	*Cooperatives*	*Private*	*Trad.*
Constant	6.0587 (0.8503)	2.9946 (0.928)	5.2401 (1.3791)	-15.8075 (7.7654)	20.959 (13.4828)	3.5896 (7.2020)
Age	-0.0231** (0.0114)	0.0076 (0.0198)	0.0356 (0.0216)	0.1064 (0.1044)	-0.5425** (0.289)	-0.0028 (0.1131)

Education	0.0239 (0.0241)	0.09581*** (0.0515)	-0.0212 (0.0556)	0.1636 (0.2209)	-0.1632 (0.7286)	0.3499 (0.2907)
Membership	1.1923* (0.3513)	-0.0771 (0.7406)	-1.9274 (1.8397)	9.5875* (3.2082)	22.1604** (10.761)	-0.5047 (9.6070)
Distance from Road	-0.0669 (0.0755)	-0.0608 (0.0665)	-0.0373 (0.095)	0.2248 (0.6896)	-0.7305 (0.8812)	-1.7627* (0.4961)
Price Risk	0.0226 (0.0560)	0.2588* (0.0842)	-0.5608** (0.2578)	0.6129 (0.5114)	2.5892** (1.2234)	1.3415 (1.3463)
Veterinary & Feed Service	-0.9991* (0.2908)	0.1546 (0.2418)	0.1079 (1.1225)	9.7613* (2.6558)	2.2575 (3.5136)	5.5041 (5.862)
Herd Size	-0.2106* (0.0455)	-0.9992 (0.0118)	0.1601** (0.0699)	2.7758* (0.4158)	0.619* (0.172)	0.8391** (0.3651)
IMR	1.189* (0.1893)	0.2628 (0.2588)	0.5431 (0.7744)	-2.422 (1.7289)	8.8087** (3.761)	-9.0078** (4.0443)
Number of observations	198	70	106	198	70	106
R^2	0.42	0.47	0.58	0.43	0.48	0.70

c. Notes: Notes: Figures in parentheses show standard errors; ***p <0.01, **p <0.05, *p <0.10.

The IMR corrects the error terms in the impact equations to achieve consistent and unbiased estimates. Justification for the Heckman procedure is found in the table as the IMR's coefficients are significantly positive for modern channels, indicating a positive selection into modern marketing channels. It is also interpreted as unobserved characteristic of one marketing channel influencing income relative to the other channels. The Heckman results suggest that the overall influence of marketing channel choice upon income is driven, in part, by an endogenous selection process.

The coefficient estimates in Table 8.1 are used to determine whether, and how, household characteristics, incentives, farm size and other factors affect farm income. The results of table 8.1 indicate that age is not statistically significant for the traditional marketing channel, but is negative and significant for modern channels ($p<0.1$). The results also indicate that education levels have a positive performance effect for modern channels (cooperatives and private), which supports the study's hypothesis.

Modern channels demand minimum quality standards from the producers.Tradtional channels are not so strict about food safety and quality issues. Educated producers are more capable of meeting the quality standards. Cooperative membership has significant positive impact upon income but is not statistically significant for modern private and traditional channels. As expected, the distance from the road has a negative effect upon income for all channels but is statistically non-significant.

Herd size has a negative effect upon income for cooperatives, indicating an inverse relationship between farm size and income. The possible explanation for this inverse relationship could be that the managerial efficiency of small-scale farms has been able to offset scale efficiencies, if any. The provision of veterinary services has a positive effect upon income for all marketing channels but is significant for cooperatives only, as cooperatives have strong backward links with producers and provide breeding, animal health care facilities and extension services to their producer members.

Price risk has a negative effect upon farm income for cooperatives and traditional channels but a positive and significant effect for the organized private channel. The Heckman results suggest that overall, the influence of marketing channel choice upon income is driven, in part, by an endogenous selection process.

The results of the impact of milk market channel choice upon human labour employment, milk yield and share of crossbred dairy animals are discussed below.

Herd size has a statistically significant negative effect upon employment in all channels, indicating that an increase in herd size replaces labour with machinery. Membership does have a significantly negative effect upon employment. The age of the head of household has a positive effect upon employment for both modern and traditional channel farmers but is statistically significant for the modern channel farmers. Price risk has a negative impact upon the employment generation in the dairy sector.

Age has a statistically significant negative effect upon the proportion of crossbred dairy animals for modern private sector channel farmers indicating that young farmers adopt modern technologies more compared with older farmers. Membership has a positive effect on the adoption of crossbreeding technology for modern market channel farmers. The provision of veterinary services also has a positive impact upon crossbreeding technology for both market channel farmers, but is statistically significant for cooperatives and organized private channel farmers.

Education levels and group membership have positive impacts upon milk productivity while age has a negative or non-significant impact upon productivity. Herd size has an inverse relationship with milk productivity for modern channel farmers. Price risk also has a negative impact upon productivity.

9 Conclusions

In response to the structural transformations taking place in the Indian dairy sector (mainly in the processing segment) the present paper aims to analyze determinants of market channel choices of milk producers, based upon a farm household survey. It also attempts to investigate what impacts these market channel choices may have upon farmers' income and technology adoption. Major findings related to a set of research questions in this study are summarized below.

9.1 Dairy market restructurings

There have been emerging modern marketing channels but the traditional sector is still dominant. Farmers sell nearly 85 per cent of their milk to traditional channels. The share of the modern organized sector is growing but at a slow pace.

Consistent with the findings of a local meso study, the rapid restructuring of downstream dairy processing and, to some extent, wholesale and retail markets has not penetrated into farm procurement. Overall, farmers selling their milk directly to the modern channel account for less than 15 per cent of the marketed surplus.

The dominant share of the traditional channel is an indication of a highly competitive and cost-effective market in linking producers and consumers. There may be high transaction costs in the modern channels with millions of small-scale producers. However, the issue of hygiene and the quality of milk being sold through traditional channel requires attention.

In terms of growth, the study found that there was no significant difference between the modern dairy channel and the traditional dairy channel in terms of herd size, milk output volume and price. There was also no significant difference with respect to improved breeds and productivity. However, the study found that relative growth regarding output volume outstripped relative growth in upgradation. This indicates that farmers have been able to make efficient and effective use of new technologies and management practices as well as upscaling herd size.

9.2 Determinants of farmers' marketing choices

Small-scale dairy farmers and the poor are not excluded from cooperatives but are excluded from the modern private sector channel. There is evidence of the size of herd affecting the farmer's choices of selling their produce to modern channels. In the case of

cooperatives, large-scale farmers are opting to move either to the modern private sector or to the traditional sector, as they receive price incentives for large milk volumes. Large-scale farmers have a better opportunity to participate within modern private sector channels.

Age and education levels are also important determinants of marketing channel choice in the modern private sector. Young and more educated farmers have a better chance of inclusion within the modern private sector channel.

Market infrastructure such as roads, provision of veterinary services, distance from milk collection centres, markets, milk collection centres, price risks, etc. are found to have significant effects upon farmers' marketing choices.

9.3 Impacts of marketing restructurings and marker channel choices on farmers

The second stage results of the Heckman model show that education levels, membership of producers' groups/association/cooperatives, provision of veterinary services, and herd size have significant impacts upon cooperative marketing channel farmers' income. Education and price risk have a significant impact upon income in the modern private sector. For the traditional market channel farmers, dairy income is significantly determined by price risk, and herd size. The modern market channel farmers have higher dairy incomes than traditional channel farmers, which is explained by higher yields obtained by modern channel farmers. However they receive lower prices than traditional market channel farmers.

10 Appendix

Household Code: _____

	**Indian Institute of Management** **Ahmedabad 380 015**

Regoverning Markets project

Determinants, Costs, and Benefits of Small Dairy Farmer inclusion in Restructured Agrifood Chains in India

Household Questionnaire

I. GENERAL INFORMATION:

Name of head of family : _____

Name of the decision-maker) : _____
(If different from head of family

Sex (Male/Female) : _____

Age (years) : _____

Occupation[1]

Main : _____

Subsidiary : _____

Education (years of schooling) : _____

Caste : _____

Village : _____

Taluka : _____

District : _____

State : _____

When did you start dairy farming? Year: _____

Number of milch animals: _____

Did you expand your herd size during the last 5 years? Yes/No

If yes, when and how many animals added: Year _____ Animals: _____

[1] Crop Farming = 1, Dairy = 2, Service = 3, Farm labour = 4, Others (specify) = 5

Membership of organisations : Yes/No. If Yes,

Name(s) of organizations: (1) _____ (2) _____

(3) _____ (4) _____

Are you member of Dairy Coop. Society? Yes/No

Are you a member of Private Dairy Company? Yes/No

Do you have milk cooling tank at your farm? Yes/No, If Yes:

When was it installed (Year)? _____ Capacity (lit.) & Cost (Rs.): _____

Did you get any support for installation of cooling tank? Yes/No, If Yes,

From which agency: _____ Amount (Rs.): _____

	2006	2001
Do/did you have milk collection/sale point in the village? Which agency[2]? (Coops, Private, Vendor		
Distance to the nearest milk collection/selling point (km)		
Which is the nearest market for sale of milk & purchase of inputs How much is the distance (km)?		
Which is the nearest major (taluka/district-level) market? How much is the distance (km)?		
Distance to metalled road (km)		

[2] Coops = 1; Private dairy = 2; Vendor = 3; Direct consumer = 4; Sweet/tea shop = 5; Contractor = 6; Others = 7

II. HOUSEHOLD CHARACTERISTICS

2006-07					*2001-02*						
Sr. No.	**01** *Relation with HH Head*	**02** *Number*	**03** *Age*	**04** *Years of schooling*	*Sr. No.*	**05** *Changes in family members?*	**06** *Relation with HH Head*	**07** *Number*	**08** *Age*	**09** *Attended any course related to dairy farming?*	**10** *If yes, when?*

11 Population of your family in 2006-07 : _____

12 Population of your family in 2001 : _____

III. OPERATIONAL HOLDING

		2006-07					***2001-02***				
		Area			*Terms of lease*		*Area*			*Terms of lease*	
	Unit	*Irri.*	*Unirr.*	*Total*	*Cash*	*Kind*	*Irri.*	*Unirr.*	*Total*	*Cash*	*Kind*
1. Own Land											
2. Rented-in											
3. Rented-out											
Total operational holding (1+2-3)											
Land Revenue/unit											
Value of land/unit											
Rental value of land											

IV. NUMBER OF LIVESTOCK

	Buffalo		*Crossbred Cows*		*Local Cow*		*Total*	
	2006-07	2001	2006-07	2001	2006-07	2001	2006-07	2001
Total Adults								
In-Milk								
Dry								
Female Young stock								
Male Young stock								
Bullocks								

V. CROPPING PATTERN

Crop	*Unit*[3]	*2006-07*				*2001-02*			
		Irrigated		*Un-irrigated*		*Irrigated*		*Un-irrigated*	
		Area	*Yield/unit*	*Area*	*Yield/unit*	*Area*	*Yield/unit*	*Area*	*Yield/unit*
Kharif									
Paddy									
Maize									
Oilseeds									
Pulses									
Fruits									
Vegetables									
Fodder									
Rabi									
Wheat									
Oilseeds									
Pulses									
Fruits									
Vegetables									
Fodder									
Others									

[3] ***[3] Local acreage unit = acre/hectare ; [3] Unit of measurement (qt. /kg/others)***

VI. PRODUCTION AND UTILISATION OF FARM PRODUCE

		2006-07					*2001-02*				
Seasons/Crops	***Unit***	***Area***	***Production[4]***	***Home consump.***	***Qty. Sold***	***Sale Price (Rs./unit)***	***Area***	***Production***	***Home consump***	***Qty. Sold***	***Sale Price (Rs./unit)***
Kharif											

[4] ***Unit of measurement (qt. /kg/others)***

Rabi											

VII. MILK PRODUCTION AND CONSUMPTION AND MARKETED SURPLUS

Do you sell fresh milk? Yes/No If yes, indicate the quantity and types of buyer (pervious day):

	2006-07			***Flush Season***		***Lean Season***		***2001-02***		
	Cow	*Buff.*	*Total*	*Cow*	*Buff.*	*Cow*	*Buff.*	*Cow*	*Buff.*	*Total*
Quantity of milk produced per day *(lit.)*										
Morning										
Evening										
Milk retained for home consumption *(lit.)*										
Fluid milk										
Converted into milk products										
Milk sold per day (lit.)										

VIII. MARKETING CHANNELS FOR MILK AND DAIRY PRODUCTS

	2006-07			*Flush Season*		*Lean Season*		*2001-02*		
	Cow	*Buff.*	*Mix.*	*Cow*	*Buff.*	*Cow*	*Buff.*	*Cow*	*Buff.*	*Mix*
Agency to whom milk sold[5] *(Ist, 2nd and 3rd)*										
Direct consumer *Qty (lit)*										
Price (Rs./lit)										
Time[6] *and mode*[7] *of payment*										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Coops. *Qty (lit)*										
Price (Rs./lit)										
Time[8] *and mode*[9] *of payment*										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Private dairy *Qty (lit)*										
Price (Rs./lit)										
Time of payment (days)										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Vendors/Dudhia *Qty (lit)*										
Price (Rs./lit)										
Time of payment (days)										
Sale Location (km distance from home)										
Travel Time										

[5] Direct consumer = 1; Coops = 2; Private dairy = 3; Vendor/Dudhia = 4; Sweet shop = 5; Contractor = 6; Other (Specify)
[6] Daily =1; Weekly = 2; 10 days = 3; Fortnightly = 4; Monthly; Other = 5
[7] Cash = 1; Cheque = 2; Kind = 3; Other s - 4
[8] Daily =1; Weekly = 2; 10 days = 3; Fortnightly = 4; Monthly; Other = 5
[9] Cash = 1; Cheque = 2; Kind = 3; Other s - 4

Main transport Mean										
Sweet shop *Qty (lit)*										
Price (Rs./lit)										
Time[10] and mode[11] of payment										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Contractor *Qty (lit)*										
Price (Rs./lit)										
Time of payment (days)										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Others (specify) *Qty (lit)*										
Price (Rs./lit)										
Time of payment (days)										
Sale Location (km distance from home)										
Travel Time										
Main transport Mean										
Products sold per month										
(i)										
(ii)										
(iii)										

Do you get payments for milk on time? Yes/No

Is your milk being tested for Fat and Solid-not-Fat (SNF) content? Yes/No

Cow milk **Buffalo milk**

If yes, what was the (i) Fat percentage for: _____ _____

[10] Daily =1; Weekly = 2; 10 days = 3; Fortnightly = 4; Monthly; Other = 5

[11] Cash = 1; Cheque = 2; Kind = 3; Other s - 4

(ii) SNF percentage for: _____ _____

Have your milk ever got tested for microbiological counts? Yes/No

If yes, do you get incentive price? Yes/No If Yes, how much per litre (Rs.): _____

How much time is spent in sale of milk: Male : _____ minutes/day & % share _____

Female: _____ minutes/day& % share _____

Child : _____ minutes/day& % share _____

Whose containers are being used for collecting milk?

Do you ever have difficulties selling your milk? Yes/No If yes, in which season: Summer/Rainy/Winter

Did you change the buyers of milk? Yes/No If Yes, When (Year): _____

Why? (i) _____ (ii) _____

(iii) _____ (iv _____

Did you sell milk to more than one buyer? Yes/No, If Yes, Which buyers: _____

Why? (i) _____ (ii) _____

(iii) _____ (iv _____

If selling to a particular buyer, Reasons for Selling to a Particular Channel:

How long you have been selling milk to this agency? _____ Years

Indicate Reasons for Selling to this Agency and Rank 3 most important (1st, 2nd, 3rd) reasons:

Reasons	*Coop. Soc.*	*Private dairy*	*Vendor/Dudhia*	*Consumer*	*Sweet shop*	*Others (specify)*
Pays higher price						
More secure & regular access to market						
Pays on Fat & SNF basis						
Pays more for higher quality						
Correct measurement						
Timely & regular payment						
Provides technical assistance, veterinary & breeding services						
Provides credit						
Old contract with vendor/dudhia						
Collection from home						
Provides advance payments						
Personal dealings/Familiarity						
Others (Specify)						

Pattern of Shifts in Marketing Channels

What proportion (%) of milk is sold to different agencies during various seasons?

Season/ Type of milk	*2006-07*							*2001-06*						
	Coops	*Pvt. dairy*	*Direct to consumer*	*Contract or*	*Vendo r*	*Sweet shop*	*Other s*	*Coops*	*Pvt. dair y*	*Direct to consumer*	*Contracto r*	*Vendor*	*Sweet shop*	*Others*
Cow														
10.1.1.1.1														
Lean														
10.1.1.1.2														
10.1.1.1.3														

Lean														
10.1.1.1.4														
10.1.1.1.5														
Lean														

Do you know about entry of other players such as Reliance/Bharti/ITC, etc in dairy processing and retail sector?

Yes/No

What would be likely impacts of entry of these players on dairy sector:

(i) _____

(ii) _____

(iii) _____

IX. PHYSICAL CAPITAL/ASSETS

	Number	*When did you build/possess it?*	*How much did it costs?*	*Current Value*	*Value in 2001-02*	*Source of investment*
House (Thatched/Concrete)						
Cattle shed (Thatched/Concrete)						
Farm Machinery						
Tractor						
Tractor drawn implements						
Thresher						
Combine harvester						
Tube wells/Pump sets						
Chaff cutter (Manual/Motor driven)						
Milk cans						
Households items						
Car/Motorcycle						
Color TV						
Washing Machine						
Refrigerator						
Air conditioner						
Land line Phone						
Mobile phone						
Furniture						
Others (Specify)						

X. WHAT SERVICES BUYER (COOPS/PVT./VENDOR, etc) PROVIDE?

Service	Coops	Private	Vendor		
Milk collection					
Veterinary services					
AI services					
Cattle feed					
Fodder seeds					
Credit					
Insurance					
Information of AH & animal health care					
Others (specify)					

XI. HUMAN LABOUR EMPLOYMENT IN DAIRYING

(minutes/day)

Operations	Human Labour used per Household					
	Family labour			Hired labour		
	M	F	C	M	F	C
Bringing fodder from field/forests/common lands, chaff cutting of fodder, feeding						
Cattle shed cleaning, Animal cleaning and health care and other operations						
Animal grazing						
Milking						
Selling of milk						
Any other (Specify)						
Wage rate (Rs./day)						
Total						

M = Male F = Female C = Child

XV. FEEDS AND FODDERS PER MILCH ANIMAL PER DAY DURING DIFFERENT SEASONS

Feeds & Fodder	Source[12]	Winter			Summer			Rainy		
		CBC	Local cow	Buff.	CBC	Local cow	Buff.	CBC	Local cow	Buff.
Green Fodder										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Dry Fodder										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Concentrates										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Name _____ Qty. (unit) _____ Price/unit (Rs) _____										
Veterinary and AI expenses										

[12] Purchased = 1; Home produced = 2; Payment in kind = 3, Free = 4; Others = 5

XVI. DAIRY HEALTH, VETERINARY AND EXTENSION SERVICES

What was your total expenditure during last 12 months on AI services: _____Rs

What is the cost of one AI service (including transport cost)? _____ Rs

How many AIs need for successful conception: Cow: _____ Buffalo: _____

What is the market rate for one AI service? Rs. _____

What is the cost of one bull service? _____ Rs

What was total expenditure during the last 12 months on animal health services _____Rs Source: Government/Coops/SHGs/Private/NGOs/Others

Important Sources of Information for Dairy

Type of information	1st source	2nd source	3rd source
Price			
Market information			
Proper feeding and management practices			
Technology			
Regulation			
Credit			

Code: 1.Extension agent 2. Cooperatives 3. R&D Institution 4. Radio/TV 5. Private dairies 6. Intermediaries 7. Personal contact 8. Feed mills 9. Traders 8. NGO/SHG 9. Others

XVIII. CONSTRAINTS IN DAIRY FARMING

Particular	Response			
	Most important	Important	Not important	Can't say
Low productivity in Local cows and Buffaloes				
Poor quality of bull at village level				
Incidence of reproductive disorders in animals				
Repeat breeding in buffaloes & crossbred cows				
Lack of A.I. and veterinary facilities in villages				
Relatively low conception rate through A.I.				
Crossbred cow milk has less fat				
Non-availability of land for fodder cultivation				
Non-availability of green fodder round the year				
Low availability of dry fodder				
High cost of feeds and fodders				
Inadequate knowledge about balanced feeding				
Lack of veterinary facilities (vaccinations, etc.)				
Lack of breeding facilities				
Improper housing facilities leading to infection				
High mortality rate				
Problem in disposal of manure				
Lack of organised milk marketing facilities in village				
Low price for crossbred cow milk				
Lack of water/good quality water				

11 References

Balsevich, F., J. Berdegue and T. Reardon, (2006), *'Supermarkets, New-Generation Wholesalers, Tomato Farmers, and NGOs in Nicaragua*', Staff Paper, 2006(3).

Berdegué, J.A., F. Balsevich, L. Flores, and T. Reardon. (2005), 'Central American Supermarkets Private Standards of Quality and Safety in Procurement of Fresh Fruits and Vegetables', *Food Policy*, 30(3): 254-269.

Birthal, Pratap S., P.K. Joshi and Ashok Gulati (2007), *'Vertical Coordination in High-Value Food Commodities: Implications for Smallholders'* in 'Agricultural Diversification and Smallholders in South Asia (Ed.) P. K. Joshi, Ashok Gulati, and Ralph Cummings Jr., Academic foundation, New Delhi.

Dries L. and Swinnen J.F.M. (2004), 'Foreign Direct Investments, Vertical Integration and Local Suppliers: Evidence from the Polish Dairy Sector', *World Development*, 32 (9), pp. 1525-1544.

Greene, W.H. (2000), 'Econometric Analysis', New jersey: Prentice Hall.
Hamilton, B. H., J.A. Nickerson (2003), 'Correcting for Endogeneity in Strategic Management Research', *Strategic Organization*, 1(1), pp. 53-80.

Hu, D., T. Reardon, S. Rozelle, P. Timmer, and H. Wang, (2004), 'The Emergence of Supermarkets with Chinese Characteristics: Challenges and Opportunities for China's Agricultural Development', *Development Policy Review*, 22: 557-586

Joshi, P. K., Ashok Gulati, and Ralph Cummings Jr. (2007), *'Agricultural Diversification and Smallholders in South Asia'* Academic foundation, New Delhi.
McFadden, D. (1976), 'Quantal Choice Analysis: A Survey', *Annals of Economic and Social Measurement*, 5, pp. 363-390.

Ministry of Agriculture (MoA, 2006), *'Basic Animal Husbandry Statistics 2006'* Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India, New Delhi.

Ministry of Agriculture (MoA, 2007), *'National Dairy Plan 2007-08 to 2021-22'* Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India, New Delhi.

National Dairy Development Board (NDDB, 2007), *'National Dairy Development Board Annual Report 2006-07'*, National Dairy Development Board, Anand.

Reardon, T. and C. P. Timmer (2005), '*The Supermarket Revolution with Asian Characteristics.*' Paper Presented at The International Conference 'Agricultural and Rural Development in Asia', Philippines.

Reardon, T. and C.P. Timmer (2007), '*Transformation of Markets for Agricultural Output in Developing Countries Since 1950: How Has Thinking Changed?*' chapter 55 in R.E. Evenson, and P. Pingali. Handbook of Agricultural Economics, Agricultural Development: Farmers, Farm Production and Farm Markets. Amsterdam: Elsevier Press: 2808-2855

Schwentesius, R., and Manuel, A. G., (2002), 'Supermarkets in Mexico: Impacts on Horticulture Systems', *Development Policy Review*, 20(4): 487-502.

Sharma, Vijay Paul (2006), 'Trade Liberalization and Indian Dairy Industry', International Symposium on *'Institutional Structures for Sustaining Livelihoods through Dairying in a Competitive Environment'*, National Dairy Development Board, Nov. 15, 2006.

Sharma, Vijay Paul and Raj Vir Singh (2007), *'Regoverning Markets: India Meso-level Study'* Regoverning Markets Projects Report, Indian Institute of Management, Ahmedabad, India.

Sharma, Vijay Paul (2007), *'India's Agrarian Crisis and Smallholder Producers' Participation in New Farm Supply Chains Initiatives: A Case Study of Contract Farming'*, W.P. No 2007-08-01, Institute of Management, Ahmedabad, August 2007.

Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analysing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets. The programme is funded by the UK Department for International Development (DFID), the International Development Research Centre (IDRC), ICCO, Cordaid, the Canadian International Development Agency (CIDA), and the US Agency for International Development (USAID).

Agrifood Sector Studies

These studies look at specific agrifood sectors within a country or region. Research studies have been carried out in China, India, Indonesia, Mexico, South Africa, Turkey, Poland and Zambia covering the horticulture, dairy and meat sectors.
Part A describes the observed market restructuring along the chains.
Part B explores the determinants of small-scale farmer inclusion in emerging modern markets. Using quantitative survey techniques, they explore the impacts on marketing choices of farmers, and implications for rural development.

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