Training Manual on
Value Chain Analysis of Dryland Agricultural Commodities

(Prepared under the HOPE project)

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ICRISAT
Science with a human face

International Crops Research Institute
for the Semi-Arid Tropics

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The training manual is targeted at all stakeholders who are involved in alleviation of poverty among smallholder farmers in the semi-arid tropics who cultivate their lands under marginal environments. It provides the key concepts to understand the changing dynamics of value chains and case studies in the fast changing market scenario. The consumption pattern of most of the urban consumers is changing towards high-value commodities, ready-to-cook products; they can afford to buy value-added products even though at higher prices. However, the majority of the rural population is still price conscious; they prefer to buy un-processed grains at the cheapest price. Hence, value chain analysis should also look into cost cutting innovations along the value chain to benefit price conscious poor consumers besides focusing on value added products. Under the changing utilization patterns, there is a growing demand for feed and fodder as the demand for livestock products is increasing. Additionally, the non-traditional sources of demand such as brewery, starch and bio-fuel industry are other growth sectors that need to be met by innovative arrangements like bulk marketing of grain. For this training material, the concepts of value chains have been taken freely from various published sources with due acknowledgment. We have also included value chain case studies of sorghum, pearl millet, cotton and jatropha, which are major dryland crops, to give further insights to the readers. The training material also includes the recent concept 'Producer companies' evolved in India, to provide recent developments in innovative institutions. We are thankful to Praduman Kumar for allowing us to reproduce the paper on value chains on biofuels. The training material also includes a brief note on the 'Producer Companies', an emerging innovative institution for the primary producers in the country. We are also thankful to P Birthal from National Centre for Agricultural Economics and Policy Research (NCAP/New Delhi), GP Reddy from National Academy for Agricultural research and management (NAARM/Hyderabad) and Ch Radhika Rani from National Institute of Rural Development (NIRD/Hyderabad) for their comments and suggestions to improve this manual.

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Chapter 1

Objectives of the Manual

Semi-Arid Tropics

Poverty, food insecurity, rapid population growth and environmental degradation are problems seriously hounding the developing world today. These are most felt in the semi-arid tropics (SAT), home to one-sixth of the world's population. The SAT, which includes 48 developing countries in Asia and Africa, is characterized by extreme poverty, lingering drought, infertile soils, growing desertification and environmental degradation. Our geographic focus is on the semi-arid tropics of Africa and Asia, referred to for brevity in the rest of the Plan as 'the tropical drylands' or simply 'the drylands'. About 6.5 million square kilometers in over 55 countries is classified as dryland tropics. More than 2 billion people currently live in the drylands, with 600 million considered to be poor. Hence, strengthening value chains in SAT regions will help in reducing poverty through upgrading along the value chain shifts from inefficient to efficient value added products (ICRISAT strategic plan 2020). Mostly, dryland crops are grown in the semi-arid tropics, which include coarse cereals (such as sorghum, pearl millet and finger millet) and legumes (such as soybean, groundnuts, chickpea, pigeonpea and other pulse crops). The other main source of income is from livestock products such as meat and milk products. Keeping in mind the diverse product base of the SAT areas, this manual illustrates value chains for different products commonly produced in this region.

Participation of smallholder farmers in value chain of dryland crops

Small agricultural holdings constitute a vast majority of farms in many developing countries. The studies based on World Programme of Census of Agriculture (WCA) 2000 indicate that the Asia and Pacific region has the smallest size of holdings in the world. Against an average overall size of 5.5 hectare (ha) for 114 FAO member countries for which the data was made available to FAO, the average size of holding in Asia is only about 1 hectare. Interestingly, the average size of holding estimated in the Bangladesh agricultural survey of 2005 comes to only 0.3 hectare. In the Pacific Islands, the average size of the holding, excluding Australia and New Zealand, ranges from 0.6 ha in Cook Islands to about 3.6 ha in Samoa. Yet another feature of agricultural holdings in Asia is that these are often fragmented. Although there does not exist a commonly accepted definition of smallholder farmers, in some countries (or regions) of Asia the percentage of small holdings (below 2 ha) could be up to 90% of the total holdings in the country. The share of area operated by smallholders in the total agricultural area of the country varies from one country to another. But in most Asian countries, the total land cultivated by smallholders represents a sizable portion of agricultural land in the country. A study of 14 countries in Asia indicated that 57.9% agricultural holdings were below 1 ha and these accounted for 14.2% of the operated area. If we extend the limit to 2 ha, over 85% holdings accounting for nearly 31% agricultural land gets covered. In five Pacific countries, American Samoa, Cook Island, Guam, Marina Island (north) and Samoa, 36.3% holdings of 1 ha and below manage only 5.4% of total area. Holdings below 2 hectare account for 63.7% of total holdings and operate only 18.3% of land. In India, over 80% of holdings are under 2 ha and they account for nearly 40% of the area. Further, owing to fragmentation and sub-division, the operational holding size is likely to decrease further in future. The reduced operational holdings implies that the smallholder farmers should enhance their income from the small holdings both through increased farm productivity and also increased value from farm output to meet the growing cash needs (Table 1).

Table 1. Average size and fragmentation of agricultural holding during (1995-2005).

Countries by continent (Number of reporting countries is given in parenthesis)	Average area per holding (hectare)	Average number of parcels per holding
World total (114)	5.5	3.5
Africa (25)	11.5	3.0
America, North & Central (14)	117.8	1.2
America, South (8)	74.4	1.2
Europe (29)	12.4	5.9
Asia (29)	1.0	3.2

Source: APCAS (2010)

With the enhanced efficiency of value chains, farmers will benefit from better prices, higher and quality yield and assured markets, services and input supplies. If possible, it is important to see that the smallholder farmers are able to participate and move up in the value-chains, given the high returns at the higher end of the value chain for many agricultural produce. In the recent past there has been a growing demand for agricultural produce for non-traditional uses like poultry feed, cattle feed, breweries and other non-food uses. And more recently, some big retail chains are selling ready-to-cook products like dry flour, local cuisines, bread, confectionary products, and bakery products from dryland crops such as millets and maize at premium prices through their retail network. The manual also illustrates how smallholder farmers can benefit from the huge demand for these value-added products through transforming from subsistence farming to market oriented farming?

Need for integration of smallholder farmers into value chain

Due to income growth, urbanization and change in tastes and preferences, the demand for value-added commodities like ready-to-cook food items and agricultural commodities are growing fast. It is well known that smallholders have more easily available labor than capital, and value addition requires more labor. This, coupled with the rising demand for value-added food commodities, offers an opportunity for smallholders to intensify production of value-added agricultural commodities. Moreover, their production efficiency is higher compared to larger landholders. But there are apprehensions that smallholders may lose on the marketing front. Analysis of value chains for high value commodities are presently popular and some of the issues are to what extent smallholder farmers are benefiting from the growing demand for high value crops and what are the different institutional innovations evolving to link smallholder farmers to end-users along the chain. High value food commodities require cold storages, special packaging, branding and bulk marketing, and their local markets are thin. Marketable surplus of individual producers is too small to be traded remuneratively in distant markets due to lack of access to market information, transport network and cold storage facilities. The prices of value-added food commodities are volatile, and fall drastically even with small increases in their normal market arrival (Birthal et al. 2007). Even though farmers forge links with big retail chains in order to access markets, there are some difficulties in sustaining these linkages. Many unsustainable interventions (often by external actors), which are insufficiently linked to markets, have existed in the past. This has been due to the non-existence of the enabling environment in which value chains operate. The rural poor engage with value chains at a number of different nodes of the chain, as workers, consumers and also as producers. There is a possibility that all of them will benefit from different value chains.

There are many studies (Birthal et al. 2008, Birthal et al. 2005, Delgado et al. 1999) on agricultural value chains in India addressing fruits and vegetables, dairy products and other high value crops, but there is

no literature available on the smallholder farmer's participation in value chains of dryland crops with just a few exceptions (Dykes and Rooney 2006, Reddy and Bantilan 2012, Shiferaw et al. 2006) even though good scope exists for their value addition and marketing through streamlining value chains. Keeping this gap in literature in mind, this training manual pulls together existing theoretical and empirical literature on value chains and addresses the issue of smallholder farmers' participation in value chains for dryland crops in the semi-arid tropics. Specifically, while providing a conceptual clarity and framework for analysis of value chains, the manual aims to (i) understand different concepts of value chain (ii) understand different methods of assessment of value chains (iii) assess the effects of different types of value chain on production costs, transaction costs and farm profitability (iv) study policy implications for evolving institutional structures that strengthen the vertical linkages between the smallholders and food-retailers and (v) examine relevant case studies of value chains. Further, the manual would seek to understand the smallholder farmer's participation in the value chain with focus on (i) How the smallholder farmers can participate in the high-end of the value chain of dryland crops? (ii) How the smallholder farmers can increase their share in consumer's price? (iii) How the smallholder farmers can participate in fast growing demand segments such as feed sector, brewery industry, bakery products, and ready-to-cook food items? and (iv) How the policy environment can ensure that smallholders exploit these opportunities to their advantage? The training material is prepared for those working in the area of agricultural marketing and promoting value chains particularly for the poor in the semi-arid tropics. The generic principals of value chain and its analysis are drawn from the literature. Successful value chains, particularly for crops grown in the semi-arid tropics, namely (i) bulk marketing of sorghum grain, (ii) pearl millet grain and fodder value chains, (iii) commodity producer companies to market branded food products and (iv) value chain from *Jatropha* bio-fuel are taken as examples for explaining different aspects of value chains.

Chapter 2

Theoretical and Conceptual Framework of Value Chains

Value chain definition

A 'value chain' describes the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use (Kaplinsky and Morris 2000 p4). There's a temptation to use "value chain" and "supply chain" interchangeably, but there is a difference in the concepts that is significant. The supply chain model – which came first – focuses on activities that get raw materials and subassemblies into a manufacturing operation smoothly and economically. The value-chain notion has a different focus and a larger scope. A supply chain is simply a transfer of a commodity from one stakeholder to another in a chained manner. The value chain is the value addition at different stages of transfer. In different stages of value chain, different stakeholders add value to the product to increase the end product value. In other words, a value-chain analysis looks at every step from raw materials to the eventual end-user – right down to disposing of the packaging after use. The goal is to deliver maximum value to the end user for the least possible total cost. That makes supply-chain management a subset of the value-chain analysis (Figure 1). Researchers from various disciplines work in the field of value chain analysis. Hence, many methods for value chain analysis have evolved in recent years with different perspectives. They can be classified into two groups: The first group consists of methods with a more descriptive and qualitative emphasis and the second group refer to specialized tools with an analytical focus. The objective of this manual is to put together different concepts so that different stakeholders may understand value chain holistically.

Value chains play an important role in transforming agricultural commodities from raw material to end products demanded by the consumers. There are a number of stakeholders involved in the agricultural commodity value chains and the partitioning of gains among the stakeholders along the chain is often

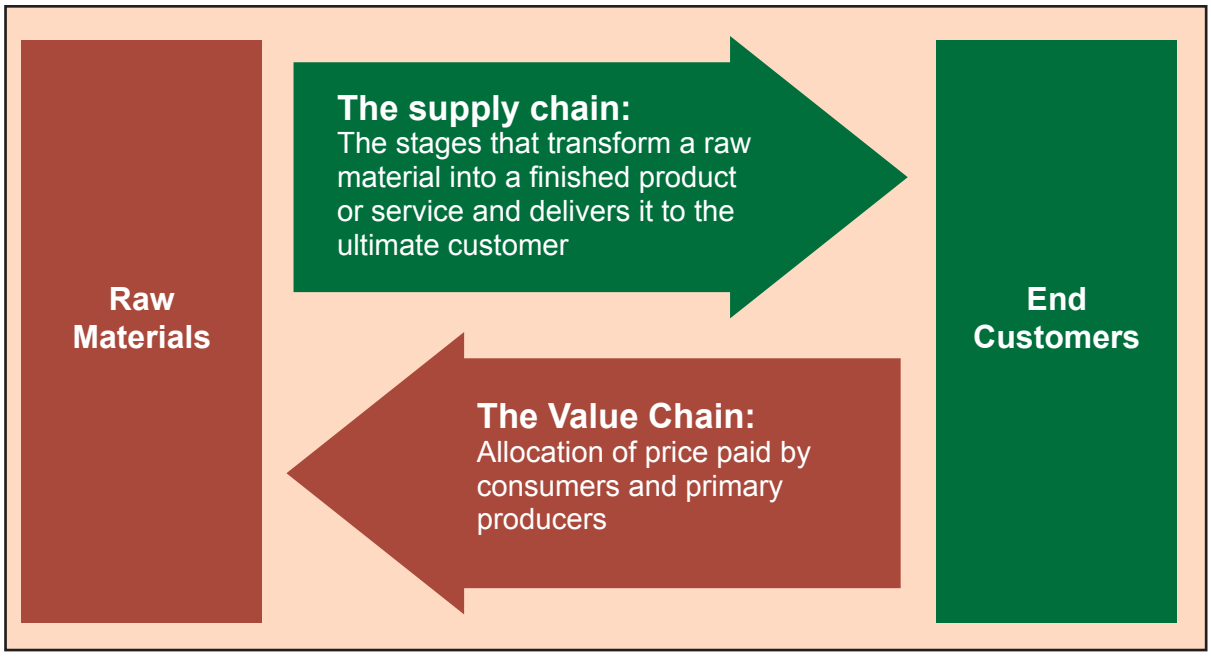


Figure 1. Supply chain and Value chain (adapted from Cox et al. 2002).

debated and analyzed. There is however, little understanding about the various concepts used in value chain analysis specifically addressed to developing countries like Asia and Africa and on how smallholder farmers can participate in the value chains. Farmers, traders, wholesalers, retailers, big retail chains and consumers are major actors in the value chain (Aksoy 2005). With the collective enlightenment of all stakeholders, proper enabling environment (institutions, infrastructure and policy) will be created in which various actors of value chain are functioning.

Value chain maps

The value addition in different phases of production can be mapped into a value chain map for easy understanding, which depicts interlinkages between successive stages in the value chain. A simplified value chain map (qualitative only) may be expressed as shown in Figure 2.

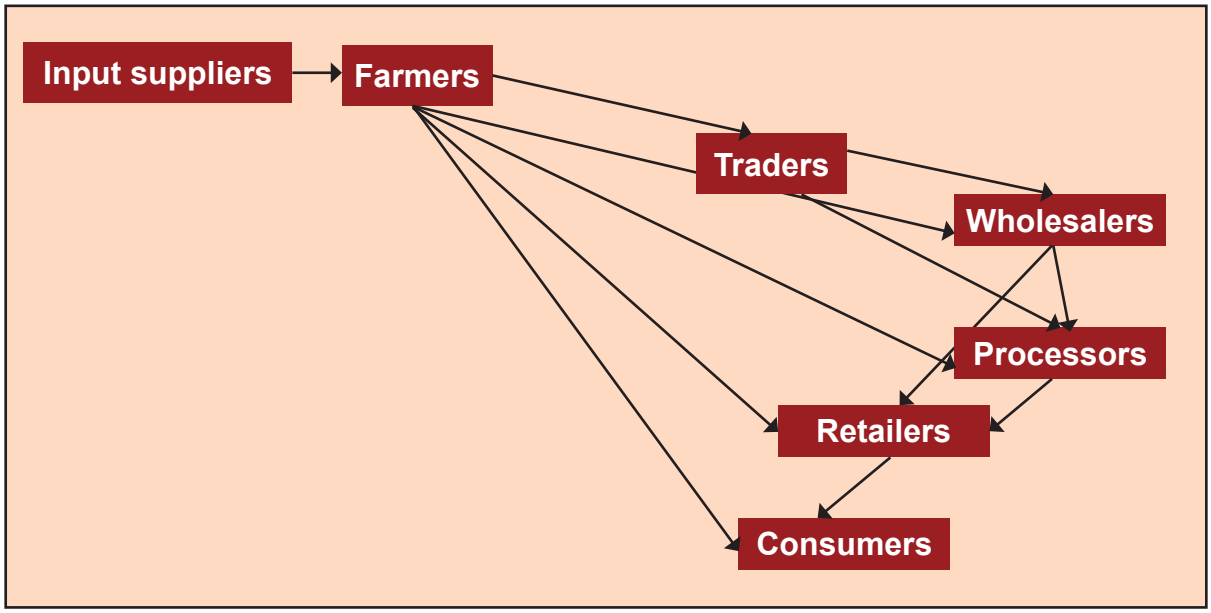


Figure 2. Value chain map and actors.

As markets develop, the value chains will become more complex with more competing channels both for inputs and outputs. A wide range of participants from smallholder farmers to transnational retailers with a wide range of technologies such as small-scale juice vendors to large sugar manufacturing plants will participate in value chains. Understanding the value chain is important as it explores why farmers choose a particular type of input like type of seeds they purchase given the institutional and market infrastructure and demand. The value chain maps are helpful in understanding these chain actions throughout the value chain. The market map is an analytical tool that helps in understanding policy issues that affect the functioning of the chain and also the institutions and organizations providing the services (eg, market information, quality standards) that the different chain actors need in order to make better informed decisions.

The Market Map is made up of three interlinked components:

1. Value chain actors (farmers, traders, consumers)
2. Enabling environment (infrastructure and policies, institutions and processes that shape the market environment)
3. Service providers (the business or extension services that support the value chains' operations).

Value coalitions

Often, a single work process can concurrently involve several units in the value chain and might be more accurately thought of as value coalitions. The value coalition model recognizes that value is often created by the simultaneous interaction of several stakeholders.

In Figure 3, R&D, Marketing, Production and Customers are all viewed as working together to add value. Problems arising in the value coalition model thus involve several units and require their simultaneous participation to find solutions. Our efforts at ICRISAT may be one of the examples for value coalition to meet the demand for high-starch content pearl millet grain by the brewery industry through value coalition among ICRISAT, national agricultural research system (NARS) and the local brewery industry.

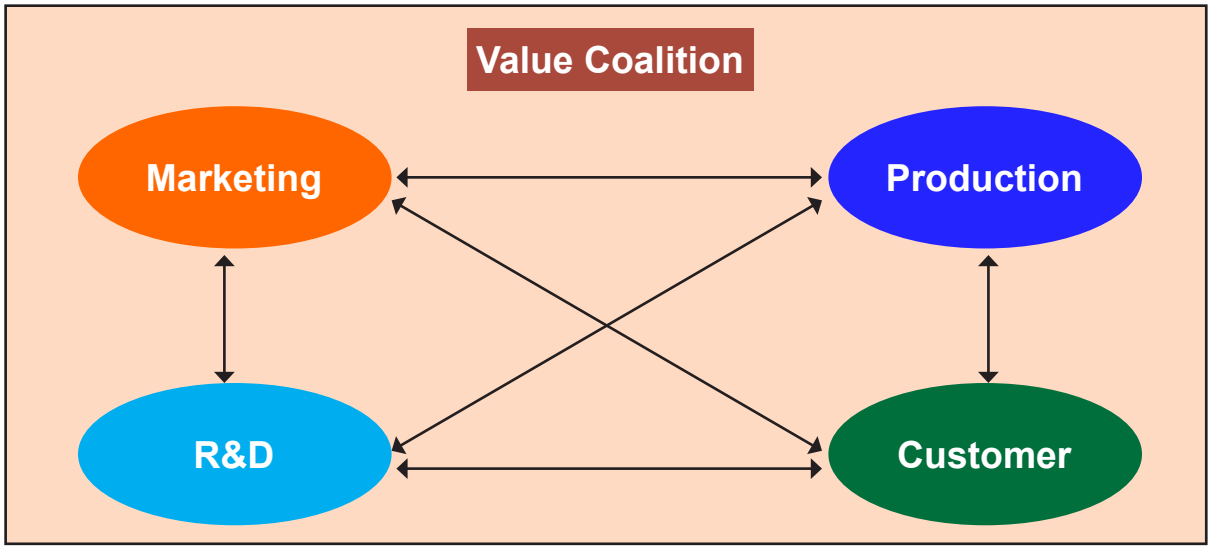


Figure 3. A Typical Value Coalition Model.

Source: Interoperability clearing house (2003).

How producers, contracting firms will benefit from efficient value chains

The concept of agricultural value chain includes the full range of activities and participants involved in moving agricultural products from input suppliers to farmers' fields, and ultimately, to consumers. Each stakeholder in the chain has a link to the next in order to form a viable chain. By understanding the complete production to consumption system of dryland crops, it is possible to determine how the marketing and value-addition activities take place and who shares how much benefit from such activities.

It has been argued that linking of farmers to the markets through efficient value chains would reduce the use of intermediaries in the chain, and strengthen the value-adding activities by better technology and inputs, upgraded infrastructure, processing and exports. This process can raise the income of farmers and will provide an incentive for improving their management practices towards higher farm productivity (Figure 4). The income of the farmers can be enhanced by increasing production, value addition, and better marketing options. The marketing factors are marketable surplus, marketing channels, numbers of players at each level, profit margin of respective players, cost reducing innovations along the value chain and value addition by different value chain players.

The strengthening of value chains by some sort of contract between producers and firms will benefit both producers and firms that are involved in input/technology supply and output marketing.

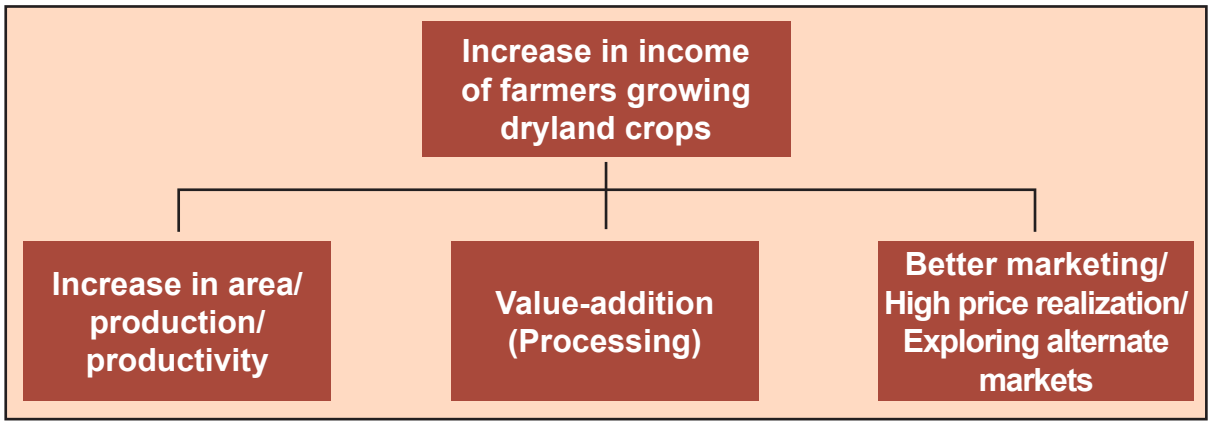


Figure 4. Alternative interventions to increase income from coarse cereal cultivation.

Transaction costs

All transactions involve some costs associated with it. Information is asymmetric, and the market relations are influenced by a number of extraneous factors. Trading partners incur costs in acquisition and processing of information, in negotiating the terms and conditions of the transaction, and on internalizing the externalities of exchange (monitoring and enforcement). These costs are termed as transaction costs. Institutional structures emerge to lower the transaction costs, and the institution that minimizes the sum of the production and transaction costs for a given activity will have a competitive edge over others and hence tend to dominate that activity (Birthal 2008). This is especially applicable to dryland areas and semi-arid tropics where poverty is higher and most of the consumers look for lower priced commodities. Williamson developed the transaction cost approach by combining the principles of bounded rationality and opportunism with the following components (i) the factors responsible for transaction costs, (ii) allocation of different types of transaction costs among the trading partners and (iii) the resultant governance structure to mediate the transaction (Williamson 1979, 1989). Bounded rationality means that there are information asymmetries on the behavior of economic agents, and the people have limited ability to predict their actions based on the information that one has. Economic agents are opportunistic and act in a self-interested manner with guile. Transaction costs include a number of activities. The transaction costs exist because of the following activities.

1. *Information search*: The costs of searching for information on the potential partners and the prices and quality of goods and services.
2. *Screening of information*: Costs associated with compilation and processing of the information.
3. *Bargaining with potential partners*: Costs of knowing the true position of buyers and sellers when prices are endogenous.
4. *Contract design:* Costs incurred towards drawing the contracts, including notary charges, legal fees, etc.
5. *Monitoring of contract*: Costs of monitoring the contract to see whether contractual parties abide by the forms of contract.
6. *Enforcement of contract*: Costs of ensuring that terms and conditions are met. These also include costs of default by the contractual parties.
7. *Protection of rights*: Costs of protecting the property rights against third party encroachment.
8. *Transfer of goods and services*: Costs of transport, storage, processing, retailing and wholesaling, and losses in movement of goods.

Some other studies classify transaction costs into information costs, negotiation costs and costs of monitoring and enforcement. *Information costs* are *ex ante* to a transaction and include costs of gathering and processing product and price information, costs of searching trade partners and information on their characteristics. *Negotiation costs* are the costs of physically carrying out the transaction and include costs of arriving at a decision, bargaining costs, costs of drawing formal contracts, commission charges, etc. *Monitoring and enforcement costs* are *ex post* to a transaction and include costs of monitoring of the contract, costs of protecting the property rights from third party encroachment, costs arising due to moral hazards, risk and defaults, and costs of dispute resolution. High transaction costs act as a barrier to upgradation in value chains of food commodities by smallholder farmers. The question is how to reduce transaction costs? This is a matter of developing appropriate infrastructure and institutions such as cooperatives, producers' associations and contract farming, which have the potential to reduce the transaction costs to smallholders through vertical coordination/integration. Nevertheless, rising per capita incomes, increased urbanization trends, and changing lifestyles particularly of the middle income class are fuelling growth in the demand for ready-to-cook, bakery and confectionary products made up of dryland cereals. The export demand too has been rising, which require more value added services along the value chain. These trends indicate a huge scope for value addition to agricultural products, and thus considerable opportunities for the food industry to evolve institutional mechanisms to integrate production, marketing, processing and distribution.

One of the benefits of understanding the entire value chain of dryland cereals is, it creates new demand for commodities through interventions by addressing all issues from farm production to consumption through innovative coalition building of all concerned stakeholders in the value-chain for higher incomes to smallholder farmers and greater value to the consumers. The dryland cereals especially millets are rich in nutrients and minerals and are known as nutritious cereals.

Producers

Improving access to markets

Markets for value added food commodities are thin. Marketed surplus of smallholders is small, and selling in distant markets increases transaction costs. This acts as a disincentive to smallholders to add value to agricultural commodities. Institutional arrangements with guaranteed off take of output through contract farming reduce market uncertainty, as well as the cost of information search.

Allocating production and price risks

Production and price risks are higher for smallholder farmers in market oriented economies. Institutional mechanisms to guard against such risks are rare in developing countries, and therefore farmers grow low risk-low profit crops. Empirical evidence indicates farmers are risk averse and are willing to pay a premium for stable incomes through guaranteed income schemes. The firms that insure farmers against price risk can earn a premium in terms of having an assured supply of raw material. Compared to individual farmers, the firm is in a better position to protect against income fluctuations by diversifying the production/supply sources geographically. The geographical dispersion of supply sources cancels the covariant variations in yields.

Supplying inputs and support services

The cost of information search and support services of value added product to an individual producer could be as high as to a single firm. The firm is in a superior position to acquire and disseminate

information among a large number of producers at a much lower cost. The firm can utilize the production contracts to transfer inputs and information in a cost-effective manner.

Improving access to credit

Value addition requires investment and financial resources. Smallholders are capital starved and need credit support. Credit markets are imperfect, fragmented and underdeveloped. Informal credit markets are exploitative, and institutional agencies are often biased against smallholder farmers. Also, the transaction costs of institutional credit for small loans are quite high. The firm, on the other hand, by simultaneously affecting the farming and credit contracts is in a position to lower the transaction costs to the producers. The firm too faces lower transaction cost in terms of lower administrative and other costs. The product marketing arrangements reduce the risk of default.

Improving access to new technologies

Efficient production of high value commodities requires a different set of inputs and technologies, which are not commonly available to a smallholder farmer. Transaction costs of acquisition of such technologies could be very high for an individual smallholder, while the firm has the advantage of economies of scale. The production of a commodity with a specific quality requires a specific set of agro-climatic conditions including soil quality. The firm can also take advantage of this by transferring specific technologies to the producers. There is, however, a possibility that the firm may acquire monopoly in specialized input markets by restricting their provision to the contract farmers.

Improving farming skills

The firm has a direct interest in quality control at the farm level, and it therefore provides improved technologies, technical assistance and information to the producers to improve the quality of the output. This is of considerable value to the producers, particularly to those who have no previous experience in undertaking production of the commodity in question. The producers would otherwise have to incur costs in acquisition of information and technologies and getting training.

Saving labor costs/Improving labor productivity

With the availability of input and output marketing facilities at their doorstep, producers save time and wages incurred in information search and sale/purchase of inputs and outputs. The time saved could be utilized in other productive activities.

Agro-industries engaged in value chains

Reducing supply and price uncertainty

For sustained supply of raw material, the firm has to produce either by itself (full vertical integration) or utilize contract farming. Self-production is not feasible in view of land ceiling restrictions, high wage rates and high costs of labor supervision. By exercising control over the production process through contractual arrangements, the firm can utilize its production capacity, control costs of production and respond to changing market needs. This helps the firm improve its competitive position in the market.

Improving quality

By exercising control over the production process, the firm is in a position to improve quality of raw material and thereby the quality of final product. In a competitive environment, the consumer is quality conscious, and better product quality helps the firm establish its competitive advantage and improve profitability.

Reducing cost of production and supervision

Smallholders are often labor surplus. Rural labor markets are imperfect, and opportunity cost of labor is low. Production of value added products is labor intensive, and the firm can take advantage of surplus and cheap labor by promoting value addition at a low cost. If the firm produces by itself, its dependence on hired labor increases the cost of production because of increase in the supervision cost of labor. By using the contract farming option, supervision costs become redundant for the firm as the family labor of the contract farmers does not require supervision.

Changing structure of demand for dryland cereals (coarse cereals)

As a case study, Table 1 presents expected changes in demand structure for dryland cereals based on the demand and supply estimates for the year 2011 and 2020 in western India. The estimates projected pearl millet grain demand and supply for 2020 based on the historical growth rates from 1996-2008, while food demand is projected based on population projections for 2020 and percapita consumption levels taken from NSSO pearl millet consumption data. The demand for feed is based on the derived demand from the historical growth rates of livestock population and feed ration based on Dikshit and Birthal (2010) and historical growth rates of livestock population.

Overall, 46% of production of pearl millet grain was used for food, 37.5% goes for cattle feed, 7.7% goes for poultry feed, 8.8% goes for alcohol industry and only 0.4% goes for seed purpose in 2011. The relative share of different uses by 2020 shows that the share of cattle feed will be increased to 38.6%, share of poultry feed will be increased to 9.4%, share of alcohol industry and other non-food uses will be increased to 11.7%, while food uses will be decreased to 40%. There is a deficit of about 7% in pearl millet grain production in western India to maintain the 2004/05 levels in food consumption and to meet the growing livestock demand in 2011 (Table 1). However, by 2020 it will become surplus to the extent of 5% due to productivity increase. However, Gujarat state will be deficit in grain even by 2020; however, increase in production in Rajasthan and Haryana will meet this demand. In the case of dry-fodder, deficit is higher at 18% in 2011; however, it is projected to reduce to 10% by 2020.

Meeting the niche of growing urban high value food demand

Urban consumers want food products that deliver convenience, taste, texture, color and shelf-stability at an economical cost. Upscaling dryland crops that meet these requirements is important to increase demand. Some excellent prototype products from sorghum and millet using grain with good processing quality are available. However, marketability is quite low. The major constraints in increasing marketability are discussed below.

Major constraints to sorghum and millet utilization

1. Lack of consistent, uniform quality of grain supplies
2. Logistics and marketing costs are high due to scattered production
3. Heavy subsidy to competing crops like paddy and wheat

4. Suitable processing technology unavailable
5. Lack of storability of flour made from grain
6. Poor image of sorghum and millets among consumers
7. Nutritional myths –high content of tannins, poor digestibility
8. Grain molds

Value added products from sorghum and pearl millet

The sorghum and millet grain can be processed into a wide variety of acceptable commercial food products. These grains can be used to produce a great array of snacks, ready-to-cook breakfast foods, instant porridges and other products. The flakes of a waxy sorghum obtained by dry heat processing can be used to produce granola products with excellent texture and taste. Tortilla chips have been produced from sorghum and pearl millet alone or with maize blends. The sorghum products have a bland flavor while pearl millet products have a unique strong flavor and color. The critical limitation is again cost efficiency, reliable supplies of grain with preferable taste and quality.

Neither sorghum nor millet has gluten proteins. Gluten is a protein that must be present in order for yeast to leaven bread dough, so to produce yeast-leavened breads; they are usually substituted for only a part of the wheat flour in the formulation. The level of substitution varies depending upon the quality of the wheat flour, the baking procedure, the quality of the sorghum or millet flour and the type of product desired. In biscuits, up to 100% sorghum or millet flour can be used. White sorghum has a definite advantage over maize and millet in composite flours because of its bland flavor and light color.

Functional advantages for sorghum include a white, light color and bland flavor that has excellent processing properties similar to rice for use in snacks, breakfast cereals and an array of flours, grits, meals and porridges. There are many different sorghum varieties that are used in various ways. However, the bland flavor and light color of food type sorghum is mostly preferred. It does not contain gluten and its slower hydrolysis makes it attractive to diabetics. In addition, it is an alternative to rice in extruded and processed foods because of its bland flavor, light color and good expansion. Pearl millet has a stronger flavor and dark color that is desired in millet consuming areas. Some white and yellow grain types would have functional advantages for processed foods. Many pilot studies in India have tested the profitability in selling pearl millet- and sorghum-based extruded snacks and the results are encouraging. Women self-help groups may be encouraged to prepare ready-to-cook products as the demand for these products are likely to increase in future.

Strategy for value-added products

i. Identify up-scalable products
ii. Identify niche markets for specified products
iii. Identify supermarkets through market surveys to showcase the products
iv. Develop value added products based on market surveys
v. Use low cost and appropriate technologies
vi. Stalk (preserve) grain to meet demand
vii. Specify variety of grain used on label
viii. Educate farmers and producers about markets, products and technology
ix. Share value-added processing profits with farmers' groups.

Value chain stakeholders

Excellent food products can be made from sorghum and millets; however, the lack of a consistent supply of good quality grain for processing usually precludes successful marketing of these products. The value-added supply chain includes:

i. Seed supplier (seed production) - quality and purity

ii. Grain producer

iii. Harvester

iv. Warehouse providers

v. Handling and transporting to processor

vi. Processing into products

vii. Marketing of products

The storability of grain and flour is a big problem for continuous supply of good quality grain in sufficient quantity for processors. Millets and sorghum grains in existing markets are extremely variable in kernel size, color and cleanliness. In addition, hybrids are not preferred; desi varieties with desirable taste and processing quality are preferred. Varieties with high storability are also preferred. More efficient machinery for threshing, cleaning and grading the grain to remove impurities are to be widely adopted at market yards and also in villages by farmers and traders. Most of the processors are willing to pay higher prices for clean and uniform grain. In addition, some varieties are available that will lead to significantly improved processing quality. Varieties that avoid head bug and molds, has demonstrated excellent processing properties and unique identity, stored, handled and processed into flour for composite flours is preferred. A successful value chain would allow for introduction of new varieties with better quality like high starch content for breweries and factories.

Quality control

Instruments to assess the quality are required to be put in local markets to facilitate quality control. A set of standards along with practical specifications for each important quality criteria is to be notified in markets. These specifications must be agreeable and practical both to producers and processors. The variety of grain to be included in the value chain can be determined by mutual agreement. Free information flow among all stakeholders (seed producers, scientists, farmers and processors) is required. Written or unwritten contracts, warehouses and warehouse receipts are required along with the credit systems to build grain storage facilities to hold grain throughout the year to assure a consistent supply of quality grain for the processors.

Profit for all is necessary for active involvement of stakeholders in the value chains. It is inherently difficult for producers and processors to understand each other's needs and problems without proper communications. A long-term relationship between producers and processors is required.

Drivers of change (adopted from Rural Industries Research and Development Corporation, 2001)

The main concern, however, is the difficulty in coordination from production through to consumer. Consumption patterns are changing dramatically all over the world. There are more double income families, they are working longer hours, have more disposable income and have an increased exposure to advertising (Table 2). Further, there are changes happening in the food value chain. A

Table 2. Share (%) of different uses of pearl millet grain in 2011 and 2020.

Year	Utilization	Gujarat	Haryana	Rajasthan	western India
2011	Food grain	58.3	10.8	46.8	46.0
	Cattle feed	33.5	39.2	39.3	37.5
	Poultry feed	5.4	34.1	3.5	7.7
	Brewery and other non-food uses	2.8	15.8	10.4	8.8
	Seed	0.2	0.3	0.5	0.4
	Total	100.0	100.0	100.0	100.0
2020	Food grain	52.5	8.3	41.3	40.0
	Cattle feed	36.5	35.8	40.2	38.6
	Poultry feed	7.0	37.0	4.3	9.4
	Brewery and other non-food uses	3.9	18.7	13.8	11.7
	Seed	0.1	0.2	0.4	0.3
	Total	100	100	100	100

Note: Similar trends are also observed for maize, finger millet and sorghum.

comparison of old and new food value chains is presented in Table 3. There is an increase in the number of hypermarkets (one stop shops for everything), convenience stores and the consumption of refrigerated/packaged goods. In addition:

i. There has been an increase in the globalization and concentration of the food supply chain in only a few large companies. Large retail chains such as Wal-Mart, Reliance and Bharati have outlets across the world and have a major share in retail marketing in many countries.

ii. The health-, the environment- and animal welfare-conscious consumers are increasing and many want to pay a premium for adhering to principles.

iii. The increasing awareness of consumers as to how and where our food is grown and treated.

iv. Food as a fashion item, rather than a subsistence item.

v. The impact of new technologies such as biotechnology and the internet on the traditional supply chain.

Table 3. Drivers of change.

Driver	Needs	Result
Double income families, longer working hours, more disposable income	Convenience becomes increasingly important	Increase in hypermarket (one stop shops for everything), convenience stores, consumption of refrigerated/packaged goods
Increased exposure to advertising	Quality becomes a key concern	High end stores for branded goods, market segmentation, range of goods available at the market

(Adopted from Rural Industries Research and Development Corporation, 2001)

Methods of integration

According to Williamson, there are three main factors that influence transaction costs and thus the type of governance structure or the type of coordinating mechanism. They are asset specificity, uncertainty and externality (Birthal 2008). Asset specificity refers to the lack of transferability of the asset from its intended use to alternative uses. As an asset becomes more specialized in a particular use, the cost of transferring it to the next best uses increases because of its technical characteristics, factor market imperfections and spatial dispersion of production. When the degree of specificity of an asset increases, its resale value will decline. When the asset specificity is high, transactions are likely to be less efficient in spot markets, and trading partners tend to reduce transaction costs by vertically integrating the activities through some institutional structures. Asset specificity is bilateral, and influences the bargaining power of the trading partners, and costs of the contract enforcement. For example, a breweries company having a contract with farmers to cultivate high starch content sorghum/pearl millet varieties that are not suitable for human consumption will have little market value if the breweries company infringes the contract. Higher the uncertainty surrounding a transaction, higher is the cost of renegotiating the contract, and greater is the potential for opportunism. This makes firms invest more in searching for honest and trustworthy partners and enforcing the contract. For example, the high quality perishable products need safe handling in the succeeding stages of the distribution system, and negligence in handling can degrade the firm's reputation. The intermediate institutional structure could be cooperatives, producers' associations, contract farming, etc, with a number of variants.

Spot/open market transactions: In spot markets, producers are free to sell any commodity, and sell as much quantity and of any quality to any number of buyers depending on the market price. Spot market transactions are common for staple foods.

Full vertical integration: In contrast to spot markets, full integration would prevail when there is very high degree of asset specificity. The firm has complete control over the processes of production, marketing, processing and distribution. The organic food brands of sorghum/pearl millet flour, bread, etc, need to follow international standards in tracking their products from farm gate to final consumption. If they don't follow standards, their brand value will reduce and prices will come down drastically. Hence, they prefer full integration of the entire value chain.

Cooperatives: Cooperatives are the structures owned and managed by the producers. They improve the bargaining power of the producers and inculcate fair practices in production and trade among its members. The problem of asymmetric information is low, and thus the cost of information search, monitoring and enforcement as they develop their own internal mechanisms for information dissemination regarding prices and quality standards. They are especially successful in the dairy sector, for example, AMUL. The Amul Model of dairy development is a three-tiered structure with the dairy cooperative societies at the village level federated under a milk union at the district level and a federation of member unions at the state level in India, founded by Verghese Kurien.

Contracting: It is an organizational arrangement in which a firm contracts a producer to produce a specific commodity. Through contract farming, the firm exerts considerable influence over producers' decision making without owning or operating the farms. The firm may provide inputs and technology, and share production and market risks. Contract farming is often prevalent in case of high value perishable commodities with uncertain supply behavior.

Types of contracts (adopted from Ayelech Tiruwha Melese 2010)

The institutional structures may use market specification contracts, resource-providing contracts, and production management contracts to get raw material supply.

Market specification contracts: These are pre-harvest contracts and specify price, quantity, quality and timing of delivery and payment. The firm has little control over farmers' management decisions. Some food retailers are following this practice especially in case of fruits and vegetables, for example, Reliance Fresh-a fruits and vegetable retail chain – sourcing fruits and vegetables in villages through this method. This model will give a lot of flexibility to both the firm and the farmers when compared to full integration.

Resource-providing contracts: They specify production inputs to be used, and timing and place of sale of product. The price is left to the market (spot price), and there is little price and income guarantee to the farmers. The firm usually provides inputs, technology, technical advice and credit to the farmers, and exercises rigorous control over the farmer's production process in respect of technology application and size of the operation so as to stabilize or increase market for its products. Most of the organic product marketers and big brands are into this type of contracts.

Production management contracts: These are a combination of market specification and resource providing contracts. The firm assumes substantial managerial responsibility of the farmers, but the farmers are bound to follow production methods as per the direction of the firm. In such contracts, market and price risk is transferred to the firm. Some of the high-end brands in coffee and tea plantations follow this type of contract.

Steps in value chain diagnosis

Diagnosing a value chain in a particular region and in a particular consumer/producer segment require systematic understanding of the different activities of the stakeholders at present and future planning to minimize the transaction costs and for recognizing each partners' competitive advantage. It also requires demand and supply estimates under alternate scenario with and without value chain intervention. We have to examine how participation of smallholder farmers can be increased and up-graded to enhance their incomes within the value chain keeping their resource constraints. We also need to identify intervention points within the value chain based on priorities set out through SWOT analysis. It will also be helpful in financial plans for each partner engaged in the value chain up-gradation and for attracting investments in the value chain. Table 4 depicts steps involved in the value chain diagnosis, while Table 5 depicts the process by which producers can be linked to the final consumers in actual conditions.

Table 4. Value chains: old and new methods.

Method	Product sourcing	Scale and marketing	Distribution	Retail
Old methods	Local production with little quality consciousness, high-end consumers met by imports	Dedicated players (Nestle, Uniliver) MNCs using distributors, local traders	Only a few dominant players develop scale & reach despite highly fragmented markets and poor infrastructure	Fragmented & unsophisticated players Mom & pop outlets
New paradigm	Focus on lowering cost and increasing quality, reducing transaction costs and increasing market access. Rising capability of local firms. Supply chain management a key competitive indicator	Increasing sophisticated sales & marketing approaches required to create differentiation	Just-In-Time (JIT) and world class inventory management	Professionalism, segmentation focus & concentration driven by international retailers

Rural Industries Research and Development Corporation (2001) Supply Chain Management: Building partnerships and alliances in international food and agribusiness Publication No. 01/31 http://www.fearp.usp.br/fava/pdf/pdf187.pdf

Table 5. Steps involved in value chain diagnosis (Oversees Development Institute, 2009).

Step	What to do?	Why?
	Phase 1: Diagnosis	
Step 1	Preparation	To define the destination, type of potential target group, and assessment of team/partners
Step 2	Map the big picture: enterprises and other actors in the agricultural sector, links between them, demand and supply data, and the pertinent context	To organize a chaotic reality, understand the overall system
Step 3	Map what the poor do and why they do not participate	To avoid erroneous assumptions about poor actors. To take account of the less visible suppliers
Step 4	Conduct fieldwork interviews in each node of the chain, with input suppliers and traders and processors, including current/ potential poor participants	To provide data and insights for Steps 5 to 8
Step 5	Track revenue flows and pro-poor income. Estimate how revenues flow through the chain and how much accrues to the poor. Consider their returns and factors that enable or inhibit earnings	To follow the costs/revenue through the chain down to the poor, and assess how returns can be increased
	Phase 2: Scope, priorities and opportunities	
Step 6	Identify where in the agricultural value chain to seek change: which node or nodes?	To select areas ripe for change, drawing on Steps 1 to 5. To ensure Steps 6 to 8 are focused on priority areas
Step 7	Analyze blockages, options and partners in the nodes selected, to generate a long list of possible interventions	To think laterally and rationally in generating the range of possible interventions
Step 8	Prioritize interventions on the basis of their impact and feasibility	To generate an intervention shortlist, comprising interventions most likely to deliver impact
	Phase 3: Feasibility and planning	
Step 9	Intervention feasibility and planning	Package selected interventions for funding and implementation

Note: These steps are iterative and cannot be entirely sequential, eg, some initial thinking from Step 6 (where to focus) will help in focusing resources within Step 5.

Upgrading in value chain

For sustainable income growth, farmers need to position themselves precisely in high-value added activities in the value chain. It requires grassroots level innovations and entrepreneurship skills to organize farmers in to self-help groups/ development of local clusters/commodity groups at higher level to market their products. Ultimately the successful entrepreneurship/innovation resulted in higher and sustained revenues to the entrepreneurs. Entrepreneurial surplus is the return to the innovation of a 'new product marketed' and arises when the price of the new product provides greater returns than are required to meet the cost of the innovation. These returns to innovation are a form of super-profit and act as an inducement to replication by other entrepreneurs (Kaplinsky and Morris 2001, Mitchell et al. 2009a).

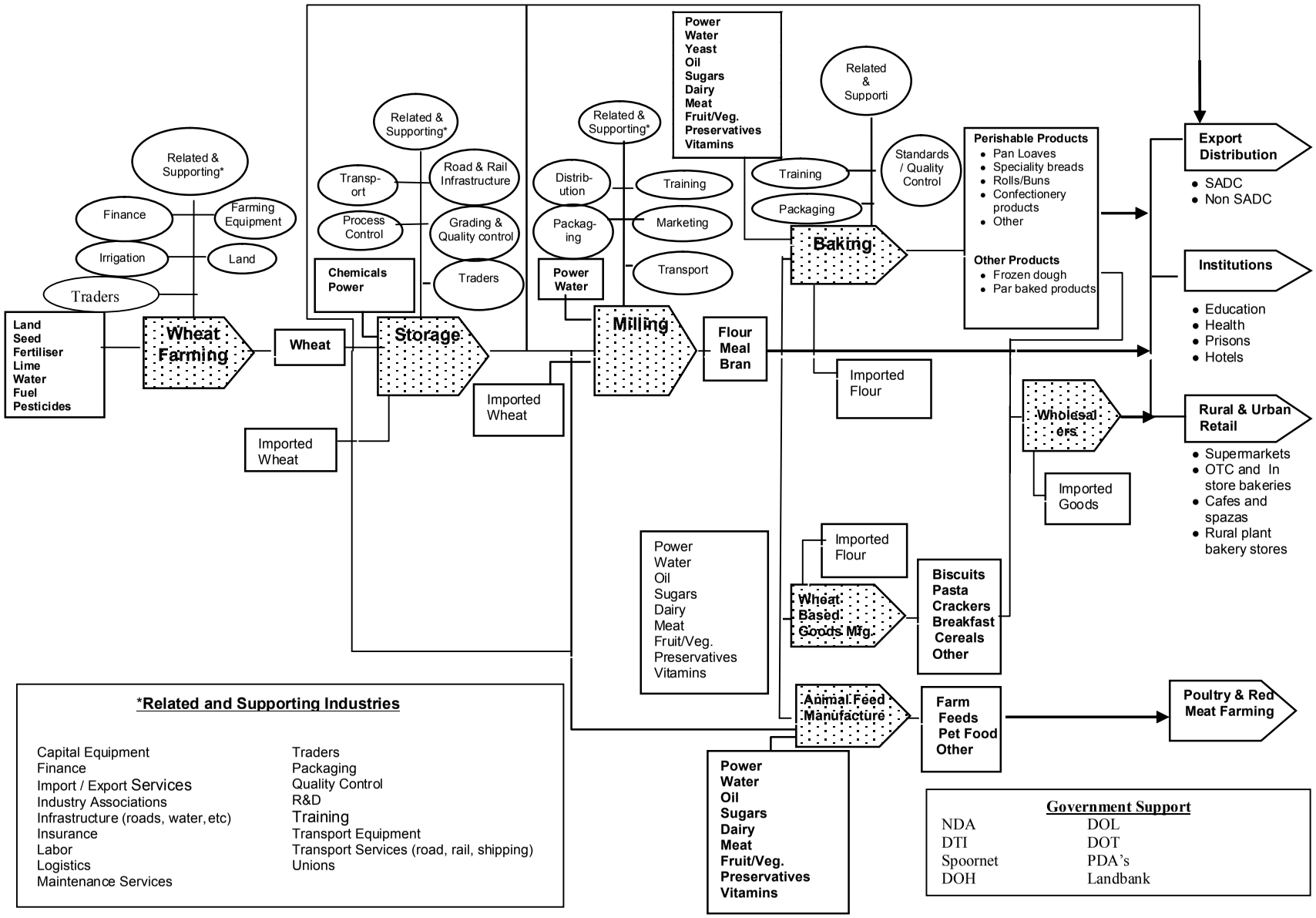


Figure 5. Typical Cereal Value Chain – Wheat, Milling and Baking.

Source: National Chamber of Milling (2003). Strategy document for the South African wheat to bread value chain compiled for The Wheat Steering Committee.

i. Economic rent arises in the case of differential productivity of factors (including entrepreneurship) and scarcity of entrepreneurial skills

ii. Economic rent may arise not just from natural bounty, but also as producer surplus that are created by purposive action. These augmented rents have become increasingly important since the rise of demand for value added and differentiated products and the growth of differentiated products since mid-1990s.

iii. Most economic rent is dynamic in nature, eroded by the forces of competition. Producer rent is then transferred into consumer surplus by the process of competition.

iv. The process of competition – the search for 'new products' to allow entrepreneurs to escape the tyranny of the normal rate of profit, and the subsequent bidding away of this economic rent by competitors – fuels the innovation process that drives entrepreneurial spirit.

Box 1: Benefits of value chain analysis (Mitchell et al. 2009b)

- Recognizes the lack of economic power of target beneficiaries compared with more powerful firms setting the 'rules of the game' in the value chain, and how this constrains their choices.
- Has economic viability and commercial sustainability at its core because of its market focus.
- Is a powerful diagnostic tool that can identify critical issues and blockages for specific target groups – and provides a framework for interventions to change the circumstances of the resource poor?
- Identifies the core rents and barriers to entry that determine who in the value chain benefits from production.
- Is inherently scalable: even if the initial focus of a value chain development exercise is a single producer group or firm, the same logic can be applied to a cluster of firms, a region or a whole country.
- Is relatively value free – beyond a concern with competitiveness and the efficiency of the chain – compared with the baggage and assumptions one has to accept when taking on some other theoretical stance.
- Can provide a policy and restructuring tool to counter both market and state failures.

Horizontal coordination is the process of greater intra-nodal organization, often in the production and processing nodes, in some form of collective structure. This form of upgrading is very important for poor people in rural areas because coordination with others allows producers to achieve economies of scale in supplies and to reduce transaction costs. Often, horizontal coordination is the first step in a sequence of interventions that ultimately result in access to the market, and is a prerequisite for other forms of upgrading. Critical to the success of horizontal coordination strategies are the entry rules to join the group and the quality of management of the group structure. Self-help groups are good examples of the horizontal coordination. Grape farmers' associations and poultry farmers' associations in many sub-urban areas also come under horizontal coordination, which increases economies of scale in production and marketing (Mitchell et al. 2009b).

Vertical coordination is the move away from one-off spot transactions towards longer-term inter-nodal relations, for instance, contract farming, whereby a processor or exporter will contract horticultural

farmers. This form of upgrading is important because it can result in greater certainty about future revenue flows for smallholder farmers. In practice, vertical coordination is often a slow and difficult process because it involves the building of trust relations between the buyer and the seller (to avoid the common scenario whereby producers break their contractual commitments and sell their produce on the spot market when prices are higher than specified in the contract).

Inter-linkages of horizontal (clusters) and vertical coordination (value chain)

Recently, development studies have witnessed a surge of interest in clustering of economic activities as a means for supporting, upgrading and thus generating economic growth in developing countries. As opposed to the traditional view of clusters as self-contained systems and the almost exclusive focus on local interactive learning, in recent years there is a renewed emphasis on linkages of local clusters with global value chains. In other words, it links the local production with external sources of knowledge/ markets especially to explain upgrading and the access to global markets of certain commodities in the agricultural sector. Clusters are considered to support upgrading in global value chains to the extent that they facilitate interactive learning both with local and external sources of knowledge and value-addition. In this context, upgrading is defined as the capacity of a cluster of farmers to innovate and increase the value addition in the products they have sold in the market. Furthermore, as farmers differ in their knowledge bases and learning mechanisms, the relationship between different forms of interaction and upgrading and innovation varies across regions and commodities.

The focus of this training material is on how farmers can move from being independent producers of commodities with little value-addition and competing at the lower-end of the market towards becoming active players in the value chain competing on the basis of the provision of value-added products. In other words, we are aiming to move from “low value products” to “high value products” with participation in upgraded value chains. Upgrading is defined as the ability to make better products, make them more efficiently or move to more skilled activities in the value chain. There are some fundamental differences between clusters and value chains at different stages; the same is presented in Table 6.

Upgrading in the value chain takes several forms and at different places within the value chain and outside the value chain to improve efficiency of the value chain. Different types of upgrading in value chain are given below. The types of upgrading and general practices and performance indicators are presented in Table 7 (Kaplinsky and Morris 2001).

Functional upgrading refers to changing the mix of functions performed by actors in the value chain – increasing (upgrading) or reducing (downgrading) the number of activities performed by individuals and firms. For instance, an agricultural producer starting to process some of their output to add value to it represents functional upgrading. Often, horizontally coordinated institutions are best able to provide these value-adding activities (such as grading and packaging of produce). Shortening the value chain can be achieved by excluding intermediaries and redistributing their functions among the partners of a newly formed vertical relationship. It is very rare for the smallholder farmers to functionally upgrade in the absence of other upgrading strategies.

Process upgrading involves improving value chain efficiency by increasing output volumes or reducing costs for a unit of output. Examples of this include improving agronomy to enhance yields that result in higher sales or own consumption, or both. This may be the result of improved planting techniques, planting materials or investments, such as irrigation infrastructure.

Product upgrading has become increasingly important as the developed countries have become more quality conscious as standards have risen. Some standards are driven by lead buyers (ie, supermarkets requiring traceability of food products), others by statutory hygiene standards in importing countries and others, increasingly, in response to fair trade and organic demands by final consumers. The

Table 6. Analyzing how farmers are connected to final markets (adopted from Kaplinsky and Morris 2001).

Issues in buying	Method of data collection	Data required
Identification of key buyers	Analysis of key market segments; ask suppliers for names of major buyers	Concentration ratios in market segments: names of key buying firms/individuals
Dynamics of the buying function	Analysis of key market segment; discussions with key buyers	Changing distribution of sales through different marketing channels
Low cost approaches to reach different buyers	Interviews with key respondents	Time trend of competitiveness of suppliers
Strategic judgments on sources of supply	Interviews with key respondents	Judgments of which supply sources are likely to be winners and why this might be the case.
Supply chain management policies	Interviews with key respondents, both amongst buyers and suppliers (to triangulate results)	Specific steps taken to upgrade (or prevent upgrading) by suppliers; size and budget of supply chain management function in buyers; frequency and nature of visits to and by suppliers, and who makes visits.

Note: Useful forms of concentration-ratio calculations are the proportion of purchases coming from the three largest, the five largest and the 10 largest suppliers (three-firm, five-firm and 10-firm concentration ratios). Another analytical technique is Pare-to-analysis, detailing the percentage of sales accounted for by the deciles of suppliers, which can then be charted on a graph. Open-book costing refers to a relationship whereby the suppliers open their costing procedures to buyers so that they can jointly act to reduce costs in the belief that the buyers will not use this information to squeeze profits out of production. Where this works, open-book costing requires high levels of trust and long-term relationships and frequently also involves some minor equity-holding.

Table 7. Clusters vs. value chains.

Indicators	Cluster	Value chain
Governance within the locality	Strong local governance characterized by close inter-firm co-operation and active private and public institutions. Risks attenuated by local mechanisms for risk sharing.	Not discussed. Local inter-firm co-operation and government policy largely ignored.
Relations within the external world	External relations not theorized, or assumed to be based on arm's length market transactions.	Strong governance within the chain. International trade increasingly managed through inter-firm networks based on quasi-hierarchical relations. Risks attenuated by relationships within the chain.
Upgrading	Emphasis on incremental upgrading (learning by doing) and the spread of innovations through interactions within the cluster. For continuous upgrading, local innovation centers play an important role	Incremental upgrading made possible through learning by doing and the allocation of new tasks by the chain's lead firm. Discontinuous upgrading made possible by organizational succession allowing entry into more complex value chains.
Key competitive challenge	Promoting collective efficiency through interactions within the cluster	Gaining access to chain and developing linkages with major customers.

Source: Humphrey and Schmitz (2001).

Table 8. Type of upgrading and practice and performance (Kaplinsky and Morris 2001).

Type of upgrading	Practices	Performance indicators
Improving process efficiency		
Within the chain link	R&D; changes in logistics and quality practices; introducing new machinery	Lower costs; enhanced quality and delivery performance; shorter time-to market; improved profitability
Between chain links	R&D; supply chain management procedures; e-business capabilities; facilitating supply chain learning	Lower final product costs; enhanced final product quality and shorter time-to-market; improved profitability throughout the value chain
Introducing new products or improving existing products		
Within the chain link	Expansion of design and marketing departments; establishment or strengthening of new product development cross functional teams;	% of sales coming from new products (eg, products introduced in past year, past 2 and past 3 years), % of sales coming from branded goods
Between chain links	Cooperating with suppliers and customers in new product development	Increase in unit product prices without sacrificing market share
Changing the mix of activities		
Within the chain link	New higher value added chain-specific functions absorbed from other links in the chain and/or low value added activities outsourced	Division of labor in the chain: key functions undertaken in individual links in the chain
Between chain links	Moving into new links in the chain and/or vacating existing links	Higher profitability; increase in skill and salary profile
Moving to a new value chain	Vacating production in a chain and moving to a new chain; adding activities in a new value chain	Higher profitability; proportion of sales coming from new and different product areas

challenge of standards lies in achieving them (to allow market access) without excluding the poor from the value chain. Process and product upgrading are closely related because improving product quality often involves improvements to the production process.

Inter-chain upgrading is the use of skills and experience developed in one value chain to productively engage with another – usually more profitable – value chain. Examples of this include the shift from growing traditional commodities to high-quality export horticulture. Inter-chain upgrading often has significant barriers to entry for the farmers to access the more lucrative value chain.

'Upgrading' of the enabling environment, although not an upgrading strategy in a strict sense, recognizes that the competitiveness of the enabling environment for value chains is a major contributing factor in the success of the operations of a value chain. Improvements to the support, services, institutional, legal and policy frameworks in which value chains operate are often a productive area in which development agencies can intervene to improve the functioning of a chain.

Examples of indicators of innovation and upgrading: practice and performance

Methodology for Estimation of Transaction Costs under HOPE Project

For measurement purpose, transaction costs are classified into tangible and intangible costs. Tangible costs include cost of personnel time, travel costs, communications costs, insurance costs, advertising and promotion costs, transport and storage costs, market research and consulting costs, arbitration, legal, and auditing costs, implicit and explicit costs of credit, product inspection services, costs of extension services, commission charges, costs incurred in safeguarding the property and in regulating trading practices, etc, and are amenable to quantification. Intangible costs are unobservable and difficult to quantify. These relate to level of information and trust between the economic agents, and risks and uncertainty in completing the transactions. We focus on quantification of tangible costs using transaction level information from the farm households for both input and output transactions. The tangible costs include both pecuniary costs (paid out expenses) and non-pecuniary costs (imputed costs). Their estimation procedure is given in Table 9.

Table 9. Estimation of transaction costs.

Cost item	Input market	Output market
Communication costs	Expenses on telephone calls for seeking information on prices, and ordering input delivery	Expenses on telephone calls for seeking information on prices, and requesting transportation of the produce
Travel costs	Travel and other travel related cash expenses in seeking information or acquisition of inputs	Travel and other travel related cash expenses in seeking information or disposal of output
Transportation costs	Transportation costs in delivery of inputs from market to farm gate	Transportation cost of output from farm gate to market
Cost of transport losses	Value of inputs lost in delivery of inputs, if any	Value of output lost in delivery of outputs to market, if any
Cost of personnel time	Value of time spent in acquisition of an input at existing wages	Value of time spent in marketing of output at existing wages
Cost of extension services	Payments made to extension personnel as fee for consultation or services	Not applicable
Market fees and commission charges	Not applicable	Market fee, market development charges, commission charges
Cost of credit	Interest on loans if taken from the firm	Not applicable
Cost of non-conformation with standards	Not applicable	Value of the output rejected due to lack of quality and non-conformation with standards
Legal costs	Cost of judicial paper and notary charges for writing the contract if borne wholly or partly by the producer	

Source: David et al. 2000.

Of the transaction costs listed in the table above, except for the imputed costs of family labor, all costs are pecuniary costs. Profitability analysis is done with and without transaction costs. Cost of production includes only the costs of variable inputs. Like transaction costs, production costs are also classified as pecuniary and non-pecuniary costs – the latter includes only the imputed cost of family labor. Profit is calculated as the difference between the product price and the unit cost of production with and without non-pecuniary costs.

Action points for value chain development in a cluster of villages (at local level)

This section gives some policy suggestions to assist the entry, participation and upgrading of the rural poor in value chains.

1. **Clarity on the purpose for the intervention:** Whether the primary aim of an intervention is to reduce poverty or to simulate growth in the local economy or both.
2. **Selecting an appropriate value chain:** The choice of value chain has important implications for the barriers to entry for the farmers and for the sustainability of the initiative. Most of the time, it is the commodity that most of the smallholder farmers are cultivating now, where the gains due to intervention are high. This is typically demand driven and sustainable over a period of time.
3. **Research and planning for intervention:** Value chain analysis and development requires robust evidence-based research of the current market system and a clear identification of bottlenecks and strategies/interventions to benefit smallholder farmers.
4. **Defining most important intervention:** It is important to prioritize interventions proposed for value chain development based on sound theoretical and practical knowledge.
5. **Identifying the key gains to poor producers to participate gainfully and sustainably:** The key goal is to identify how and from where smallholder farmers gain from development of value sustainably.
6. **Reducing barriers to entry:** All social and economic barriers to entry in to value chain needs to be thoroughly studied and eliminated for smallholder farmers and processors
7. **Avoiding obsessing about the production node in agricultural value chains:** Poor people engage with value chains at all nodes as producers, intermediaries, workers and consumers. It is not necessarily the case that the largest pro-poor impact should center on the production node.
8. **Providing the enabling environment:** After analysis of the operation of value chains, it is the duty of the local government, agricultural officers, and marketing officers to create an enabling environment for poor farmer participation in the value chain at various nodes.

Chapter 3

Mainstreaming Gender in Value Chain

Value chain and gender

As has been stated in the beginning of the manual, the goal of a value chain is to deliver maximum value to the end user for the least possible total cost. Value chains comprise the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation, inputs by various service providers, delivery to the final consumer, and final disposal after use (Kaplinsky and Morris 2002)). Thus, value chain analysis requires the examination of typologies and locations of all the actors in the chain, the linkages between them, the dynamics of inclusion and exclusion as well as understanding the structure of rewards in case of participation, the functional division of labor along the chain and its changing shape, the role of standards and labels in facilitating or hindering participation, and the distribution of value added along the chain (Bolwig et al. 2008). What needs to be understood is that women and men are not only likely to be involved at different stages of the chain, but the areas or tasks where women are involved are often less visible, even though these may constitute critical links at which change and/or upgrading should occur in order to bring about development of the chain. Addressing those stages in the chain is therefore indispensable in developing the chain. Thus, gender dimension in the chain forms a critical area to be examined, particularly as women in the drylands play a dominant and crucial role in the cultivation, processing and even marketing of the agricultural commodities. Furthermore, institutions of economies and labor markets in which value chains and employment/ participation within these are rooted in, are gendered, reflecting and reinforcing socially constructed gender divisions and inequalities (Barrientos et al. 2003, Tallontire et al. 2005). Roles and work in the value chain are gender segregated and there exists inequalities in these gender specific roles, leading to differences in the position of men and women in the value chain and in the upgrading option available to them. Consequently, value chain dynamics are critical to the differential way that men and women experience poverty. This goes on to show that gender inequality is often intricately linked with poverty, vulnerability and the mechanisms of inclusion, exclusion and changing terms of participation; at the same time there are issues specific to gender too (Bolwig et al. 2008).

Gendered nature of value chains

The gendered nature of value chains have been explained to some degree in the above section. This section[1] briefly outlines some of the prominent types of gender disparities/discriminations prevalent in the value chains.

1. Women's work is often arbitrarily assumed to be of lower value, and men typically occupy permanent and management positions. As a result, gender wage gaps are found in most of the value chains.
2. In smallholder farming, women are typically concentrated as producers at the bottom of the chain. They can find it difficult to take on more profitable roles as buyers, sellers and processers for a number of reasons - women's unpaid household roles and responsibilities consume much time, resulting in little time and scope for increasing the amount of labor time that they can put into production for crops sold into value chains; in some countries, socio-cultural norms may inhibit women's participation at higher levels.

1 Adapted from: Farnworth, Cathy Rozel. 2011. Gender-Aware Value Chain Development. Expert paper presented in the Expert Group Meeting Enabling rural women's economic empowerment: institutions, opportunities and participation organized by UN Women In cooperation with FAO, IFAD and WFP. Accra, Ghana 20-23 September 2011.

3. Women-owned off-farm businesses frequently face more constraints, including less capital and collateral, and receive fewer services and support, than businesses owned by men. On the other hand, men are generally much more able to engage in risk taking, and are able to grow their businesses, due to their superior position regarding ownership and deployment of productive assets, such as land and machinery, and their ability to make major expenditure decisions.
4. Women in many countries exhibit low levels of human capital. Their lack of literacy and numeracy skills can prevent them from developing effective negotiation skills with value chain actors, or using modern communication technologies to support decision-making.
5. Extension and business support systems continue to direct a greater proportion of technical assistance and extension services to men, even for tasks and crops that women manage, in the assumption that information will be shared. One reason for this is that men dominate as extension officers/agents who frequently disregard women in the delivery of services, and their specific needs, interests and problems are neither heard nor addressed.
6. Gender issues remain to be fully incorporated into technology development; it is often assumed by those involved in development and transfer of technology that the process is gender-neutral and benign. Yet this is often not the case, as often when the technology does not fit the physical and socio-cultural conditions of end-users, or when end-users face specific socio-economic constraints in applying the technology, the technology is not adopted (Muntemba and Blackden 2000).
7. In many smallholder farming systems, agricultural production and marketing is sex-sequential, with women and men taking on specific roles at particular points. The separation of tasks by gender may mean that neither men nor women possess a complete understanding of the whole value chain and of how the roles and responsibilities of different actors intersect and interact at different stages.
8. Household gender relations profoundly affect the intra-household distribution of income because households are not unitary with a single interest or equality, rather, households' and individual well-being are not necessarily the same, and individuals living in the same household may have very different control and power over the household income and assets (Sen 1990; Agrawal 1994; Kabeer 1997; Kelker, Nathan and Walter 2003; Rao 2006; Deere and Das 2006). In most cases, due to social norms that privilege men, men hold more power than women and thus wield more control over assets and expenditure.

Advantages and disadvantages of addressing gender in value chains

In general, addressing or mainstreaming gender in every value chain intervention area will lead to the inclusive and sustainable development of societies. Addressing gender in value chains can lead to increases in production and productivity, household incomes, accelerate the adoption of innovations, and bring about significant improvements to child health, nutrition and educational levels. Farnworth (2011. p. 2) has given an economic case and a social justice case for paying attention to gender in value chains: "The *economic case* for working towards gender equity in value chains lies in the understanding that the majority of agricultural production systems are structured by gender roles and responsibilities, and as a consequence, any attempt to intervene in value chains will affect gender relations in some way. This will inevitably have wider consequences for value chain effectiveness and efficiency. The *social justice case* for gender-sensitive value chain development is embedded in human rights discourses, and – critically – should be seen as complementary to the economic case". Addressing gender issues in value chain will help in understanding women's and men's roles and relationships in the chain, the gender differentials in access to, and control over key productive assets necessary for participation in the chain. Going further, it can help in analyzing how gender power relations affect economic transactions among actors throughout the chain. This would result in designing value chain

interventions that provide gender-sensitive and gender-differentiated opportunities to enable women and men to participate equitably in the chain as well as get the due benefits.

Gender inequality is often materialized in the 'weakest link' of the value chain and has a negative impact on the possibilities for upgrading quality, pushing production, good marketing and effective decision-making (Terrillon 2011). When value chain analysis and interventions do not address or capture gender issues, then gender disparities in workloads and incomes may increase with negative effects for human development indicators and, women may also be directly excluded from the benefits of development interventions. Thus, leading to a reverse effect on power relations and income distribution within the value chain between men and women; this will affect the economic growth on a national level too and hamper further development.

Gender-sensitive approach to value chain

A gender-sensitive approach to value chain analysis has three-fold goals: (i) to understand women's and men's roles and relationships in the chain (ii) to examine the gendered differences in access to, and control over, key productive assets necessary for participation in the chain, and (iii) to analyze how gender power relations affect economic transactions among actors throughout the chain. These analyses would then lead to the development of interventions that provide gender-differentiated opportunities to enable women and men to participate equitably in the chain. Since gender is intricately linked to poverty, vulnerability and inequality, incorporating gender awareness into value chain analysis entails a conceptual understanding of these three issues so as to capture the gender differences from all these aspects (Risgaard et al. 2008). The major gender dimensions in a value chain are:

- Incorporation of gender sensitivity into all elements of the value chain framework;
- The importance of gender differences for changes in value chain position and for impacts on poverty and the environment;
- An understanding of the economy to include both market-oriented activities and reproductive (unpaid) work that underpins productive work.
- Analysis of the terms under which women and men workers are integrated into value chains and how they are affected by changes in these, in terms of changes in income level, job security, personal health and social security protection (Bolwig et al. 2008).

Thus, to address gender issues in a value chain framework, the analysis should be systematic and encompass both the upgrading process as well as the implications of upgrading, which would involve addressing questions such as those given below in Box 2.

Systematically analyzing value chain with a gender perspective entails collection of sex-disaggregated quantitative and qualitative data at the macro, meso and micro levels using both a gender and a value chain development perspective (Box 3). The purpose is to identify gaps, discriminations and key gender issues, keeping in mind the multiple dimensions on which gender inequalities and opportunities operate: economic, psychological, social, political and at different levels – individual, household, community, market, institutional, national, international and so on (Terrillon 2011). Gender sensitive value chain analysis should start with drawing a preliminary map of the chain, while at the same time integrating gender issues. This process helps in identifying the relevant actors, partners and clients involved in the value chain facilitation process. The next step would then be to examine the gender issues and implications in each of these.

Box 4 gives the questions for analyzing the overall cultural setting, the values and norms and the institutional environment before heading towards a gendered value chain analysis on a macro level.

Box 2. Framework for gender analysis

- What kinds of value chains and forms of incorporation are likely to exacerbate gender inequalities and which ones provide the best options for reducing gender inequalities and gender related vulnerability?
- How might gender relations constrain access to, or rewards entailed by, value chain participation?
- Do women/men have the resources to participate in the value chain node or segment?
- Do gender inequalities in downstream nodes constrain participation by men/women in the targeted node?
- How might gender relations constrain participation in, or rewards entailed by, the upgrading strategies considered by the research?
- What strategies provide the best options for reducing gender inequalities and gender related vulnerability? Are there trade-offs between gender equity and other poverty reduction objectives (eg, increased household income)?

(Source: Bolwig et al. 2008).

Box 3. Questions to be addressed in the preliminary mapping

The preliminary mapping should shed light on the following aspects:

- For each level (macro, meso, micro), what are the institutions, organizations and individuals involved?
- What is their level of awareness of gender equality issues?
- Which ones are advocates of gender equality issues?
- What are the interactions between them and other organizations working in the sector?
- What actors have the potential to work towards the achievement of gender equality goals/ impacts in the value chain?
- What financial and technical partners have a strong commitment to and dedicate resources to gender equality issues?

Source: Terrillon 2011.

Box 4. Questions for analyzing the overall cultural setting

Regarding the overall cultural setting, values and norms, the following aspects should be looked at:

- What is the cultural, ethnic context in which we work? What religion or ideology is dominating the society?
- What are the norms and values regarding women's roles and responsibilities?
- What are the stereotypes, perceptions and values regarding women's economic contributions?
- How do they affect sexual division of labor?
- What is society's willingness to accept new gender roles/responsibilities?

Source: Terrillon 2011.

Box 5. Check list of questions under each level and each focus area (Terrillon 2011).

Macro Level

Focus areas	*Check list of questions*
Gender roles	• What is the proportion of men and women working in this specific sector/ value chain by activity (supply, production, processing, transportation, trade)? • Are they part of the formal or the informal economy? • What are the functional as well as sexual divisions of labor and roles within the different segments of the value chain (production, processing, trading and marketing, consumers, etc) according to gender roles? • Are there any segments where the presence of women is more important? Are women involved in stages where value addition is carried out ? Where is actual income earned? • What is the visibility and value granted to women's role? What are the perceptions by women themselves, men and the community? What is the nature of women's work? Is it a temporary/casual type of work? Are women only used as unpaid labor?
Gendered access to resources	• What are men's and women's entitlements? What are the characteristics and factors that mediate men's and women's access to and control over different types of resources (natural, productive and services)? • What is women's access to information on production, organizations and services available? Through what means of communication? Are these adapted? • What are their capabilities to use these resources? • Who owns the land/trees/harvest, etc? • Is information more difficult to obtain for women producers in "feminine" and mixed value chains? For women in other segments of the value chain? • If yes, why? What are the main constraints faced by women in different segments of the value chain? (women's lower level of instruction, more marginalized and lesser access to networks, project, programs, less visible within segments of the value chain, less control over information, etc) • Any specific information on market segments relevant for gender issues? (eg, increase product offer to low income consumers in order to improve quality of life such as nutrition) • How can poor groups and other stakeholders obtain information about services in the sector, or market information?
Gendered control over benefits	• Are there any uneven power relationships? Any gender-related discriminations/exclusions? • How is power distributed within production and exchange relationships across the value chain? • Are benefits distributed/concentrated in one segment of the chain? • Who decides? Who controls benefits? • What are the disempowering dynamics? • What are the entitlement capabilities of men and women throughout the value chain? Is there any uneven distribution of these capabilities?

Continued.

Box 5 *continued.*

Focus areas	*Check list of questions*
	• What choices/alternatives do women have regarding chain activities management? • What is the ability of producers (male/female) to influence the price? What are the opportunities for negotiation (voice, participation, inclusiveness, indebtedness, sub-optimal contracting)? Who signs the contract for the sale of the product? • Do women in different segments of the value chain earn more income following the intervention? • Are women's roles changing? Do they take leadership positions? Do they sign contracts? • What is women's own perception of change? Did they gain more self-confidence, credibility? • Can these changes be interpreted as empowerment?
Gendered influence on enabling factors	• What is women's ability to influence decisions/policies/programs at all levels? • Do they have access to specific spaces of power (invited or claimed spaces), and places of power (municipal council, parliament, etc)? Do they have the opportunity to speak? Are women's voices heard? Are they listened to? Which women's voices? • Are women in specific segments of this value chain/sector/activity organized? • Do they build strategic alliances with institutions working on gender issues such as women's rights organizations and platforms? • Are institutions working on women's and gender issues in this sector, as well as women producers' or farmers' associations involved in decision-making at national policy and planning levels?

Box 6. Check list of questions under each level and each focus area (Terrillon 2011).

Meso Level

Focus areas	*Check list of questions*
Gender roles	• What is women's role and positioning within these organizations? • Do they face specific constraints (representation in decision-making instances, power to influence decisions, etc)?
Gendered access to resources	• Access to land, water and technologies • Access to information and education • Access to and responsiveness of value chain development services: – What is women's access to business development services? – Do female producer groups have the same access to Business Development Services (BDS)? If not, why? – Are technological innovations and investments, for instance, specifically addressed at men, or also at women? Are they adapted to women's needs (physical strength and daily schedules)?

Continued.

Box 6 *continued.*

Focus areas	*Check list of questions*
	– Are women-specific BDS needed to support female producers? – Are BDS adapted to female producer's specific needs (daily schedules, lower educational levels, etc)? – Is childcare available? – Do service providers know how to perform gender mainstreaming to better analyze/understand and address these constraints? Are they attentive to delivering gender sensitive services? In their approach? – Do they apply institutional/organizational gender mainstreaming? – Employment in BDS: does it foster employment of women? Are employment opportunities equitable? How are the working conditions? • Access to and responsiveness of financial services: – Do women who concentrate in specific segments of value chains face particular constraints in accessing financial services? What are these constraints? – What are their specific needs? (investment and cash flow needs/social pressure to face school fees and food items) – Are financial services adapted to their needs? What are the most suitable financial products? – Are there any institutions (private or public sector) that specialize in facilitating women's access to financial services?
Gendered control over benefits	• Are women members of producer groups? • Do they take part in meetings? Do they have the right to voice their needs and vote? • Do they have the right to access social and financial benefits offered by the organization? • Do they have the opportunity to be elected to governing bodies and if so, are they elected and to what degree? • Are there any special measures in the Articles of Association such as quotas to guarantee their participation in decision making?
Gendered influence on enabling factors	• What are female leaders' capacities to influence collectively, decision making about sector services and value chain development? • How can those who do not have access to resources and services claim to be included? • In what "claimed or invited" spaces and places?

Box 7. Check list of questions under each level and each focus area (Terrillon 2011). Micro Level	
Focus areas	***Check list of questions***
Gender roles	• What is the sexual division of labor within the household (socially determined gender roles)? - What are men's and women's reproductive roles? - What tasks are performed by men and women? • How much *time and energy* are spent? • How does it relate to women and men's other roles (reproductive/ community)? • How does the work performed in the value chain add to their work burden?
Gendered access to resources	• What is women's and men's access to resources in order to perform tasks? • Are there any specific constraints faced by women in particular?
Gendered control over benefits	• Do women/men benefit equally at the household level? Who earns income? Who decides on the use of the income? Who decides on family budget allocation? What is women's decision-making power on spending of the household budget? • Are other types of benefits generated (financial, visibility, credibility, better access to information and social networks)?
Gendered influence on power dynamics within the household	• How is women's contribution perceived at household level? • Are gender roles changing? If yes, is women's changing role/increased income valued within the household? Within the community? Does it have an impact on her decision-making and negotiating power? • Do women attend/participate in more meetings at community level? Do they speak up? • For what purpose is additional income generated by the intervention spent? • What are the changes in men's behaviors/attitudes? Do men still take their responsibilities within the household? Do they get involved in household chores and childrearing to support their wives?

The section below is taken from Terrillon, Jacqueline (2011) on *gender mainstreaming in value chain development-practical guidelines and tools*. It outlines the gender sensitive analysis at the three levels – macro, meso and micro. The macro level is the entire value chain, the meso level is the organization level, ie, the particular organization in the value chain where the analysis is being done, and the micro level is the household level. The key areas of investigation and analyses under the macro and meso levels are Gender roles, Gendered access to resources, Gendered control over benefits, and Gendered influence on enabling factors; while in the micro level, the first three areas of focus are the same as in the macro and meso levels, but the fourth one in this level is Gendered influence on power dynamics within the household.

The *macro level* focuses on the overall institutional environment and interrelations between actors throughout the chain and analyses whether these are conducive to the development of pro-poor, gender equitable, inclusive and responsive value chains. Details of analysis of the key areas are:

Gender roles looks at sexual division of labor within the chain: where in the chain are women and men active (vertical integration)?

Gendered access to resources looks at how resources are shared/distributed according to laws/ regulations, norms and values.

Gendered control over benefits looks at women's and men's roles in the management of the chain (horizontal integration) and the power dynamics.

Gendered influence on enabling factors looks at how women/men leaders can influence policy-making and legislations to promote their economic rights and make the overall environment more conducive to gender equality.

The *meso level* focuses on institutions and organizations. Examining the delivery systems of these institutions and organizations, the objective is to investigate whether they reflect gender equality principles in their structure, culture, services they provide and in the way these services are provided. At all times, the key gender issues related to gender roles and the way they affect access for women and men to opportunities and resources, control over benefits and capacity to influence decisions, and the overall institutional/organizational environment have to be kept in mind. Details of analysis of the key areas are:

Gender roles analyzes women's positioning within organizations (producers, users, processors) of value chain (internal governance).

Gendered access to resources focuses on understanding women's specific needs in terms of access to resources.

Gendered control over benefits looks at power relations within groups/associations, whether they are inclusive and how costs and benefits are shared.

Gendered influence on enabling factors looks at the empowerment side of groups and associations in terms of access to arenas where decisions that affect their lives are made.

The ***micro level*** helps identify major constraints faced by women at the household level, which will have repercussions on the meso and macro levels. Details of analysis of the key areas are:

Gender roles analyzes the gender division of labor within the households.

Gendered access to resources looks at the gender differential access, opportunities and constrains to resources within the household.

Gendered control over benefits examines gendered nature of distribution of incomes.

Gendered influence on power dynamics within the household examines the changes occurring in the gender roles and relations at the household level.

The gender sensitive analysis of value chains at the three levels will guide in identifying windows of opportunity to empower women in value chains. It must be remembered that the three levels do not operate in isolation but in tandem and there exists interactions between all these levels. Therefore, changes at the micro level in favor of greater gender equality will have an impact on the meso and macro levels, as individuals will influence organizations and the delivery of gender sensitive services and the overall institutional and regulatory environment. Similarly, changes at the macro level will have an impact on institutions and organizations to make them more responsive, inclusive, equitable and accountable at all levels.

The envisioned ultimate impact of mainstreaming gender in a value chain is women's empowerment by providing them

- Equitable access to social, economic, material, human resources and opportunities within the household and throughout different segments of the value chain.

- Equitable control over benefits at household level and within value chains through raised productivity and wages or increased income, employment and production, and women's ability to benefit from and decide.
- Equitable and participative management of the value chain through improved voice and participation of actors and sharing of power.

The challenge here will be to conciliate economic and gender objectives, which can sometimes be in contradiction as it could mean profit and economic growth vs. equitable distribution of benefits and social cohesion. However, relations of inequality and exclusion do not contribute to sustainable value chains.

Chapter 4

Economic Appraisal of Value Chains with Case Studies

Basic objectives

After having developed the general conceptual background of the value chain, the next step is to analyze the chain's economic performance and competitiveness (including a review of external sources of competition). Production costs, margins, price markups, productive capacity and productivity are among the possible measures of chain performance. The calculation of these variables makes it possible to:

- Position the chain vis-à-vis alternatives or competitors – benchmarking;
- Identify strategic and non-strategic activities;
- Raise awareness among chain actors concerning cost drivers, margins for price negotiation, and possibilities for value addition;
- Recommend leverage points for action at policy and institutional levels as well as at enterprise level.

The measured economic and competitiveness variables can also be used as the baseline for monitoring the potential impact of upgrading interventions in the value chain – for instance, poverty reduction through increased margins/incomes for poor stakeholders; productivity gains through the introduction of more efficient technologies or processes; increased exports as a result of improvements in product design and quality; a friendlier business environment achieved by removing institutional bottlenecks. Most of these aspects of chain performance can be influenced by the collective action of enterprises and support services.

Analysis of external sources of competitiveness

The economic environment in which a value chain operates can have a positive or negative impact on its performance. Therefore, it is important to analyze the principal components of this environment and to identify its limitations and opportunities with respect to any value chain promotion project. The main elements of the methodology of evaluating economic performance of value chains are summarized in Figure 6.

a. Economic and social environment

The analysis of this environment provides a significant pointer to the origins of opportunities for upgrading the target value chain as well as to the sources of existing constraints. It may include:

- The trends in the basic economic data of a country, such as: (i) average per capita income, gross national product, consumption, investments, economic growth rate, exchange rate; (ii) exports and/or imports by the country, sector and industry, and of products manufactured by the value chain under consideration; (iii) economic policy: development objectives, economic orientation, programs and strategies of the country, sector and industry.
- The principal economic measures adopted by the state to promote and finance industry and associated services and to support the restructuring and upgrading of enterprises.
- The impact on the performance of industry of various economic and political variables, such as currency devaluation, increase in the cost of particular factor inputs, average cost of capital, labor and severance.

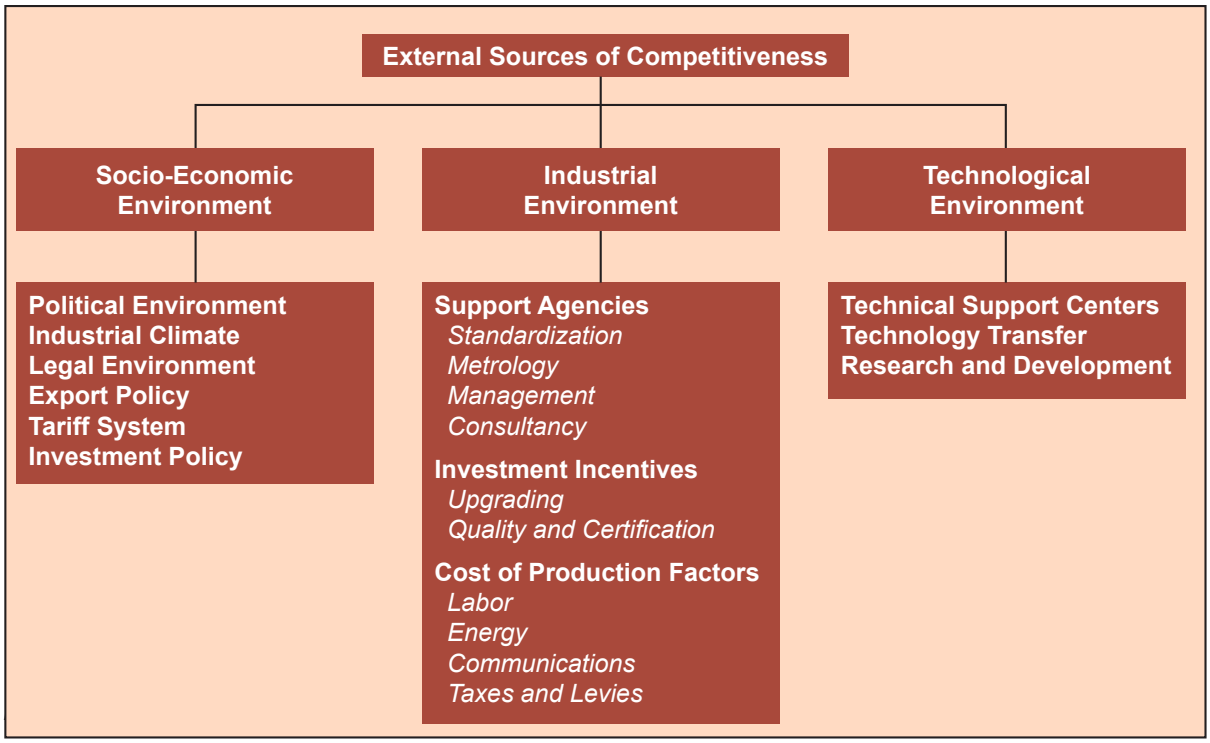


Figure 6. Main elements of competitiveness.

Source: UNIDO (2009)

b. Agro-industrial and food processing industry status

The agro-industrial and food processing industrial environment of a value chain is made up of all the actors (individuals, enterprises and organizations) and factors (economic and technical) that exert influence on its own results and also on those of its direct competitors. The assessment of this environment consists therefore of an analysis of the various institutional and support agencies (standardization, certification, accreditation, metrology, financing, management, maintenance and consultancy services) so as to identify the constraints and opportunities related to upgrading and developing the value chain in an open and competitive market.

c. Technological environment

This analysis investigates the technical support systems that enable the value chain operators to use and access technical information, to select and acquire technologies, equipment and manufacturing procedures, to adapt and control technology transfer, and, finally, to capitalize on technological know-how.

Case Study-I

Cotton value chain

The indicators of major interest for such an analysis are the production costs, value addition and productivity. Frequently, the calculation of these variables is complex due to the multifaceted elements of value chains. Various problems may be encountered in the analysis, particularly in small- and medium-size enterprises, regarding the reliability, availability, regularity and homogeneity of the accounting data and the conversion of the latter into required economic data. Thus, economic analyses of value chains often have to be based on cost estimates. Such estimates should however be carefully checked, for instance, against data of similar projects when available. When faced with questionable estimates, it may be necessary to verify such costs by using other data sources. In any case, the economic analysis should provide useful indications to guide choices and support decision making for future strategic chain upgrading interventions. Final investment decisions will have to be based on an in-depth and thorough analysis of technical and financial data.

a. Production costs

The production costs in value chains can be calculated by aggregating costs incurred by enterprises in each segment of the chain through a standard practice called The Analytic Analysis by Product Table (AAPT).

Table 10 can be used as a basis for the computation of these factors. The review of the AAPT data will help identify the operations that account for the largest shares of the overall production costs at enterprise level. A more detailed analysis of these operations may point to cost reduction prospects and/or upgrading strategies. Pre-tax profit can also be derived from the AAPT data.

A further step in calculating production costs relates to each function within the chain. As an example, in the case of the textile and apparel value chain, these costs will be broken down to account separately for all activities required to manufacture and market a product: (i) yarn – spinning; (ii) fabric – weaving, knitting and finishing; (iii) garment production – Designing, cutting, sewing, buttonholing and ironing; and (iv) marketing and distribution operations. Such information does not illustrate the enterprise accounting details, but rather the costs along the sequence of production and marketing operations within a value chain. The cost of each activity can be combined with the measurement of productivity and converted into a production cost per unit of output (ie, USD per kg of yarn or fabric). Here again, the unit costs that are high can be analyzed for potential reduction. Figure 7 below illustrates the case of men's T-shirt production in Bangladesh.

b. Value added

Value added ideally represents the value created during the manufacturing process conducted by each agricultural processing establishment. It is measured as the difference between the value of all goods and services produced and the value of those purchased non-labor inputs that have been used in the production process. This type of measure avoids double counting, since what each establishment has purchased from other establishments is deducted from the value of its own production. Inputs to be considered may include raw material (like cotton in textiles), fuel, electricity, contract work, repairs, maintenance and transportation as well as other support services like input supply and technical advice on farming practices to farmers. The value at which these inputs were purchased is deducted from total revenue from production in order to obtain the establishment's value addition. Revenue from production can be reported at basic or producer prices. The difference is that the latter includes indirect taxes and excludes subsidies.

Table 10. Analytic analysis by product.				
Designation	*Unit*	*Year (n-4)*	*Year (n-1)*	*Year (n)*
1. Production capacity	tons			
2. Actual production	tons			
3. Value of production sold		*Costs (%)*	*Costs (%)*	*Costs (%)*
4. Raw materials consumed at cost price (RM) RM1 RM2 RM3				
5. Consumable materials at cost price (CM) CM1 CM2 CM3				
6. Rent				
7. External work and services				
8. Other production costs				
9. Personnel costs				
10. Technical assistance				
11. Manufacturing cost (4+5+6+7+8+9+10)				
12. Packaging				
13. Distribution costs				
14. Cost of distribution (12+13)				
15. Production cost before amortization and financing costs (11+14)				
16. Amortization in financial year				
17. Financing costs				
18. Production cost before general costs (15+16+17)				
19. General costs				
20. Total production cost (18+19)				
21. Pre-tax profit (3-20)				
Source: UNIDO (2009).				

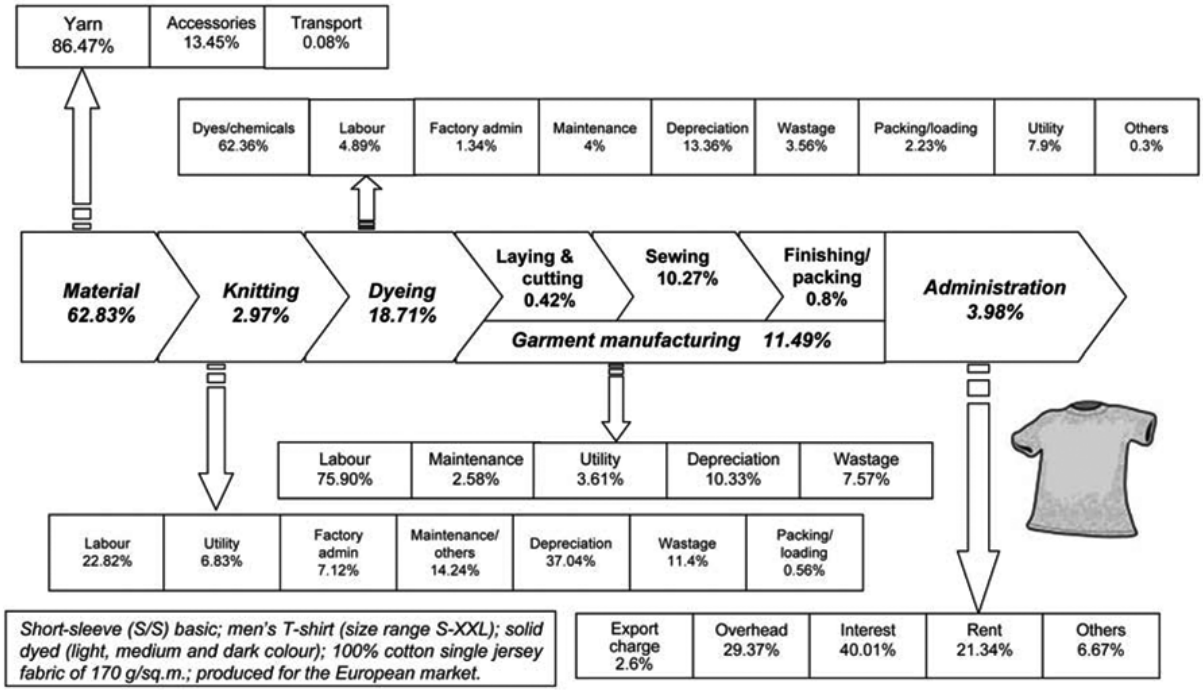


Figure 7. Production costs of men's cotton T-shirts in Bangladesh.

Source: UNIDO (2009).

The above principle is applied at each stage of the selected value chain. It is also important to distinguish, along these stages, those goods and services that are provided by the chain members from those provided by external entities. The measurement of value added throughout the chain provides a sound basis for formulating possible upgrading strategies by highlighting where value is added and by whom. Such an analysis has direct implications for pro-poor growth.

Figure 8 illustrates the distribution of value addition in the textile sector expressed by a Value Index. The latter shows the incremental increase in value addition for each stage along the textile chain (ie, the production sequence), from raw cotton to ready-made garments, for example, shirts and trousers. The cost of raw cotton is taken to have an index of 100; the increase to lint cotton stage is 15, and so on to reach a value of 900 (simple garments) to 1,300 (more sophisticated garments) for the finished product.

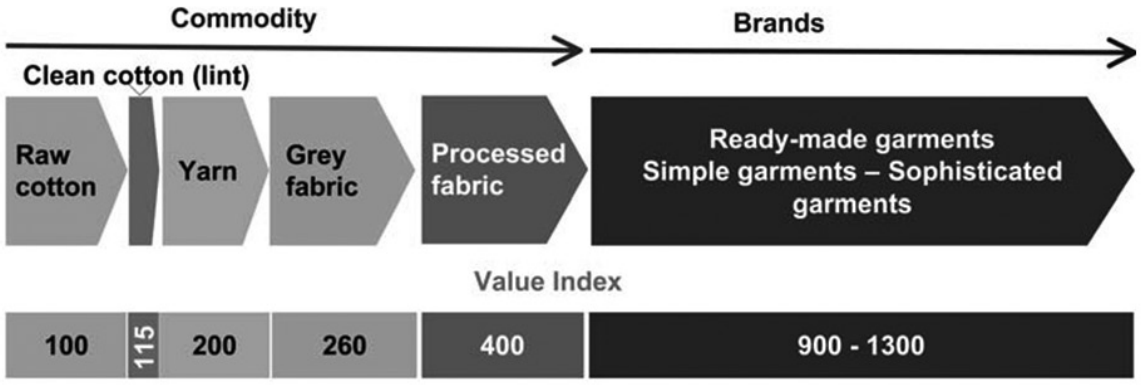


Figure 8. Value addition in the textile chain from cotton.

Source: UNIDO (2009).

c. Performance benchmarking

In today's rapidly evolving markets, benchmarking the performance of a value chain is important as it helps understand where the chain stands in relation to competitors or to a particular standard. This task involves comparing a number of key parameters along the value chain against those of a panel of countries (or other value chains). Such key parameters are the unit cost of production, labor productivity, the quality of a specific process, etc. The outcome is often a business case for making changes in order to make improvements.

Like the calculation of production costs, benchmarking a value chain is often complex. The required information may not be readily available and can be difficult to obtain. In general, one has to rely on inputs from industry experts or have to access specialized data banks. Also, depending on the type of value chain (or product) under investigation, the key indicators to be measured may vary.

A benchmarking exercise conducted by UNIDO in 2005 for the textile industry of a typical developing country was based on the following parameters:

- ✓ mill working hours per year;
- ✓ cost of wages per hour;
- ✓ cost of electrical power;
- ✓ cost of cotton per kg;
- ✓ cost of capital;
- ✓ freight costs;
- ✓ age structure of machinery.

Using these parameters, the benchmarking study compared Country X with a number of countries it competes with either directly or indirectly, and yielded the following main conclusions (Table 11):

Table 11. Benchmarking of the textile industry of a typical developing country.

Parameter	Conclusion
Mill working hours/year	The level of mill hours per year worked in Country X is quite low compared to those in the reference countries. The result is a low level of utilization of capital-intensive spinning, weaving and processing machines. Furthermore, additional investment is required to generate the same fixed product volume.
Cost of wages/hour – skilled workers	Country X has a comparative advantage in the average cost of workers hourly wages, including social charges. But the advantage is lost when the low labor productivity of the workers is built into the cost calculation. Higher labor productivity levels are essencial if Country X is to capitalize on this comparative advantage.
Cost of electrical power/kwh	Country X is not disadvantaged in the cost of power. However, nor does it have a comparative advantage
Cost of cotton/kg (staple length = 11/8")	Data suggest that the textile industry of Country X has an advantage in the price of domestic cotton.
Interest rates (average first quarter 2003)	Interest rates in country X are competitive. The private sector suffers, however, due to the absence of an adequate banking system.

Continued

Table 11. Benchmarking of the textile industry of a typical developing country *continued.*

Parameter	Conclusion
Freight rates	Freight rates and shipping times are important cost factors when calculating the comparative advantage of companies, especially in the garment industry. For example, the cost of shipping a 40-foot container from Egypt to Hamburg is about €500. A lorry carrying double that load from Turkey to Germany costs about €1500. It is presumed that Country X has about the same comparative advantage as Egypt.
Age structure of installed capacities: - Short-staple spinning machines - Open-end spinning machines - Weaving equipment	Country X should take full advantage of its modern spinning, weaving and processing capacities to boost exports: - It has the highest share of modern ring spindles compared to the reference countries. - Only Turkey and Italy have more modern installed OE-rotor capacities. - The shuttle-less looms in Country X are very modern, and only China and Turkey have higher modern shares.

Source: UNIDO, 2009.

Case Study-II

Bulk marketing: Sorghum for Poultry Feed[2]

Resource poor farmers in India mainly cultivate rainy-season sorghum to meet household requirements of food and fodder and have a small surplus for the market. During the last two decades, the food demand for rainy-season sorghum grain has declined in India due to faster growth in the production of fine cereals (primarily wheat and rice) and public policies (procurement and distribution) that make the subsidized grains accessible to the low-income consumers. At the same time, new alternative markets for sorghum grain uses are emerging, for example, as poultry and livestock feed, and in alcohol manufacturing. However, owing to scattered and small-scale production, farmers are unable to meet the requirements of the industry that need grain in bulk quantities. After harvest, the surplus sorghum grain is sold either in a regulated market through Commission Agents in the markets or through a broker (middleman) at the village (Figure 9). Despite several inefficiencies and exploitation by middlemen, Marshland and Parthasarathy Rao (1999) found that the marketing system per se does not constrain the utilization of the crop as food grain. At the same time the study concluded that the

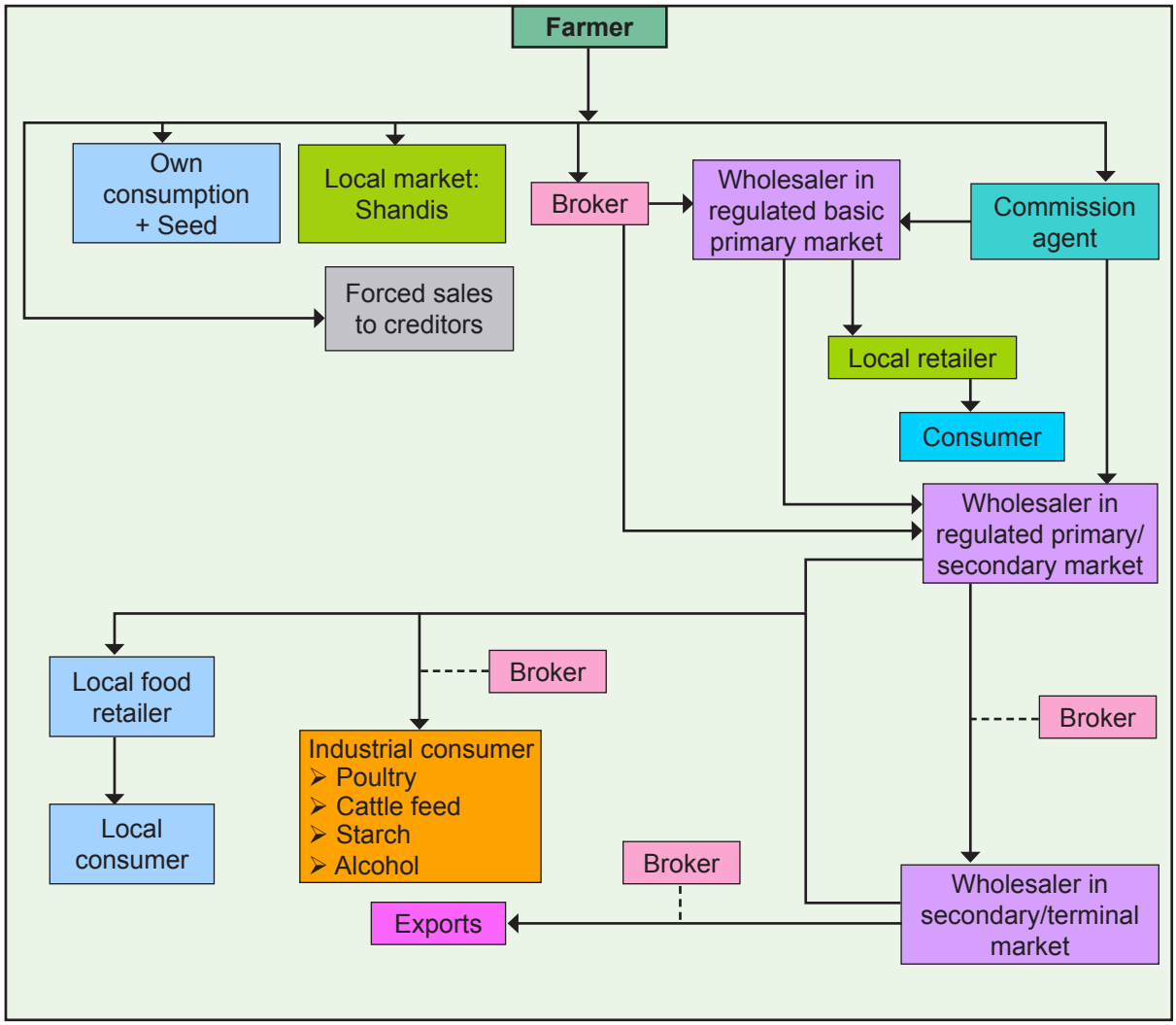


Figure 9. Flow chart of traditional marketing chain for sorghum grain in India.

Source: Rao et al. 2008.

2 This case study was adopted from Rao et al. 2008.

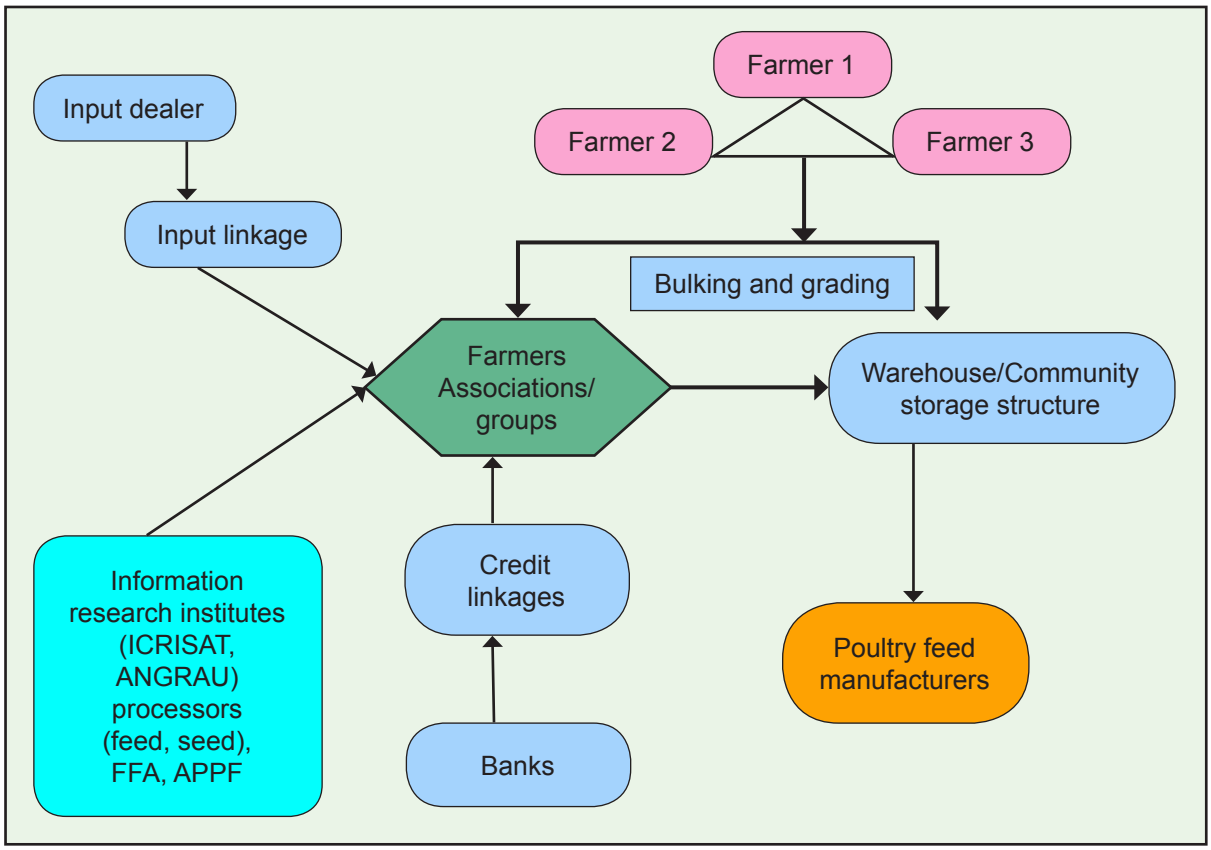


Figure 10. Innovation in supply chain.

Source: Rao et al. 2008.

existing marketing system is not optimal for industrial users, who would prefer to obtain sorghum through new institutional arrangements such as contract farming and bulk purchasing that compress the marketing chain and thus reduce transaction and marketing costs.

Establishing market linkages

In order to bridge this gap, a project was initiated on a pilot scale where the ultimate goal was to link small-scale sorghum producers with poultry feed manufacturers through informal institutional arrangements.

The rationale for the new marketing arrangement includes the following:

1. Potential demand for sorghum grain in poultry feed and other emerging alternative uses.
2. Non-availability of grain in bulk quantities due to scattered and variable surplus production over subsistence needs.
3. Need for assured supply of quality grains in bulk quantities.

In the process of linking sorghum producers and poultry feed manufacturers, many simultaneous activities were carried out. For instance, Poultry Feed Trials (PFT) to further corroborate the efficiency of sorghum in poultry rations, supply of improved sorghum seed and technology to farmers, formation of Farmers Associations, training in bulk storage and bulk marketing.

The process of linking farmers to industry included the following steps:

1. Formation of Farmers' Association: Farmers' Association was constituted in each project village consisting of farmers participating in the project.
2. Training on specific skills: Farmers' group trained on grading the sorghum grain as per grain mold severity, bulking the surplus and storing according to scientific principles.
3. Collective Sale: The surplus sorghum grain stored collectively by the farmers was sold to poultry feed manufacturers after careful negotiations between Farmers Association representatives and feed manufacturers at a mutually agreeable price.

There were a number of advantages to both the buyers and sellers due to bulk marketing as indicated below:

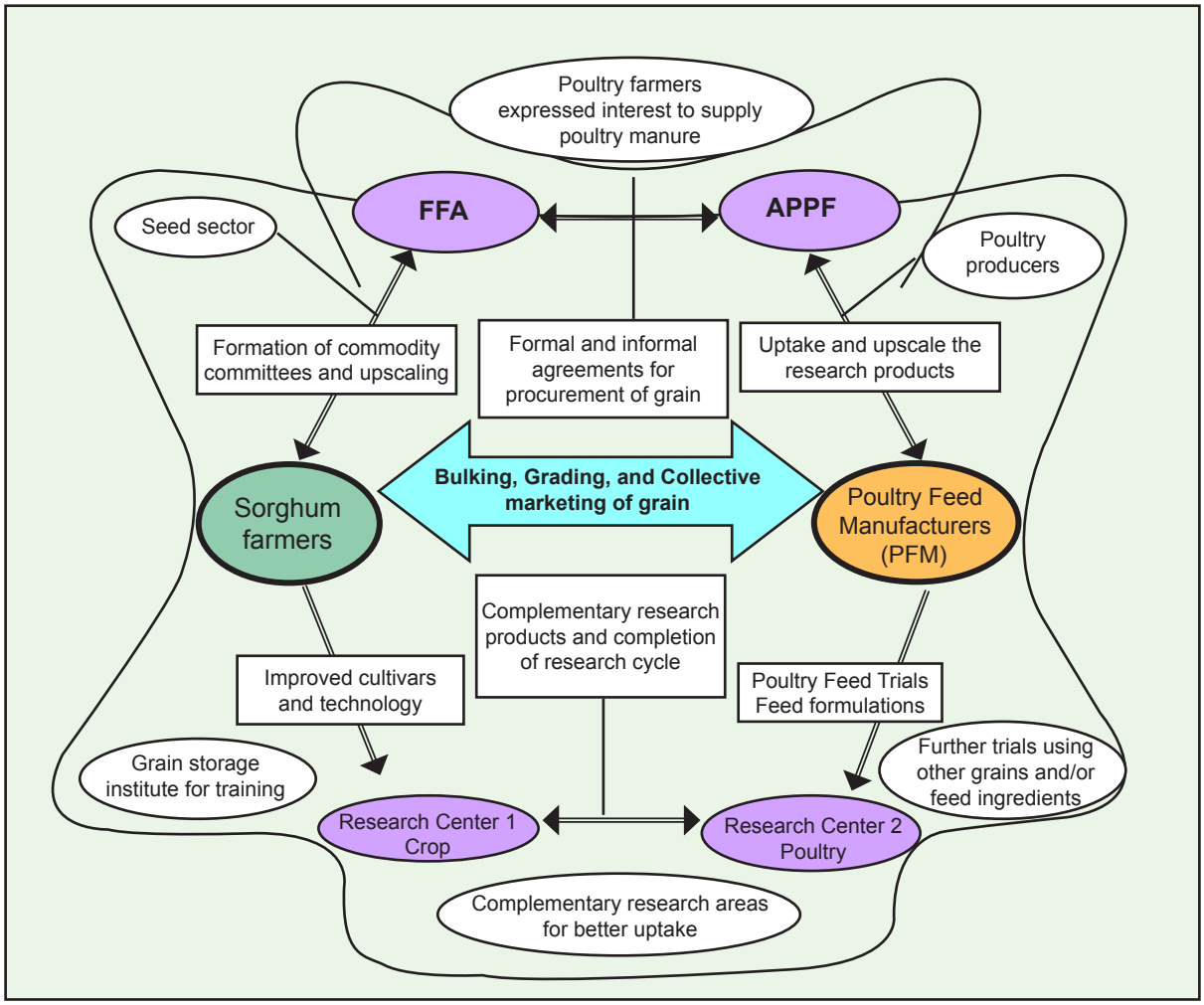


Figure 11. FFA – Federation of Farmers Association, APPF – Andhra Pradesh Poultry Federation. A coalition approach for promoting sorghum for poultry feed.

Source: Rao et al. 2008.

Advantages of bulk marketing

Farmers

1. Reduced input costs due to backward linkages with input dealers
2. Better price realization due to output linkages
3. Minimizes middlemen charges/transaction cost
4. Increase in bargaining capacity of the farmers
5. Increases the involvement of the farmers and makes them independent
6. Improves market intelligence
7. Market expansion

Buyers

1. Overcoming multiple transactions
2. Assured supply of produce
3. Overcoming seasonality in purchase to some extent (grain availability throughout the year)
4. Quality of the produce guaranteed
5. Origin ensured (from particular locality with specified qualities)

This model is now successfully operating in 5 clusters in the states of Maharashtra and Andhra Pradesh under a CFC funded project on "Enhanced utilization of sorghum and pearl millet in poultry feed industry" (Figure 11). For the success and sustainability of this model of bulk marketing through formation of farmers associations, it was felt that there was a need for credit from formal sources since the linkage between the credit and output market, ie, tied transactions, was one of the reasons for distress sales outside the Farmers' Association. There is also a need to explore informal / formal agreements through novel market linkage models for long-run sustainability of the market linkages between the farmer and the feed industry / processors. Although the transactions are based on mutual trust, a formal agreement would provide some kind of a cushion to both the parties. Finally, there is a need for a more critical examination of the roles and responsibilities of Farmers' Associations.

Case Study-III

Pearl millet value chain in western India

Grain markets

In continuation of bulk marketing of sorghum, this section describes the value chain of pearl millet in different uses (Figure 12a and Figure 12b). In pearl millet grain value chain, the importance of value addition is less as it is mostly used by poor consumers as food or cattle/poultry feed for livestock or as a source of starch for the breweries industry. In this scenario, reducing costs along the value chain should get higher priority than value addition. It has to compete with other grains like sorghum, broken rice and maize based on cost advantage. Hence, identification of value chain with lower costs and margins is the first step in the value chain analysis. As a case study, we have examined the different marketing channels in the regulated markets of western India. A schematic diagram of the value chain of pearl millet grain is presented representing a typical case. It shows how the grain is transported from Haryana to Gujarat, Rajasthan and Uttar Pradesh and for what purpose the grain is utilized and in what proportion. The most important marketing channels are given below.

- Producer-Commission agents-Wholesalers-Retailers-Consumers
- Producer-Village merchants-Commission agents-Wholesalers-Retailers-Consumers
- Producer-Wholesalers-Retailers-Consumers
- Producer-Commission agents-Wholesalers-Exporters
- Producers-Retailers-Consumers
- Producers-Consumers

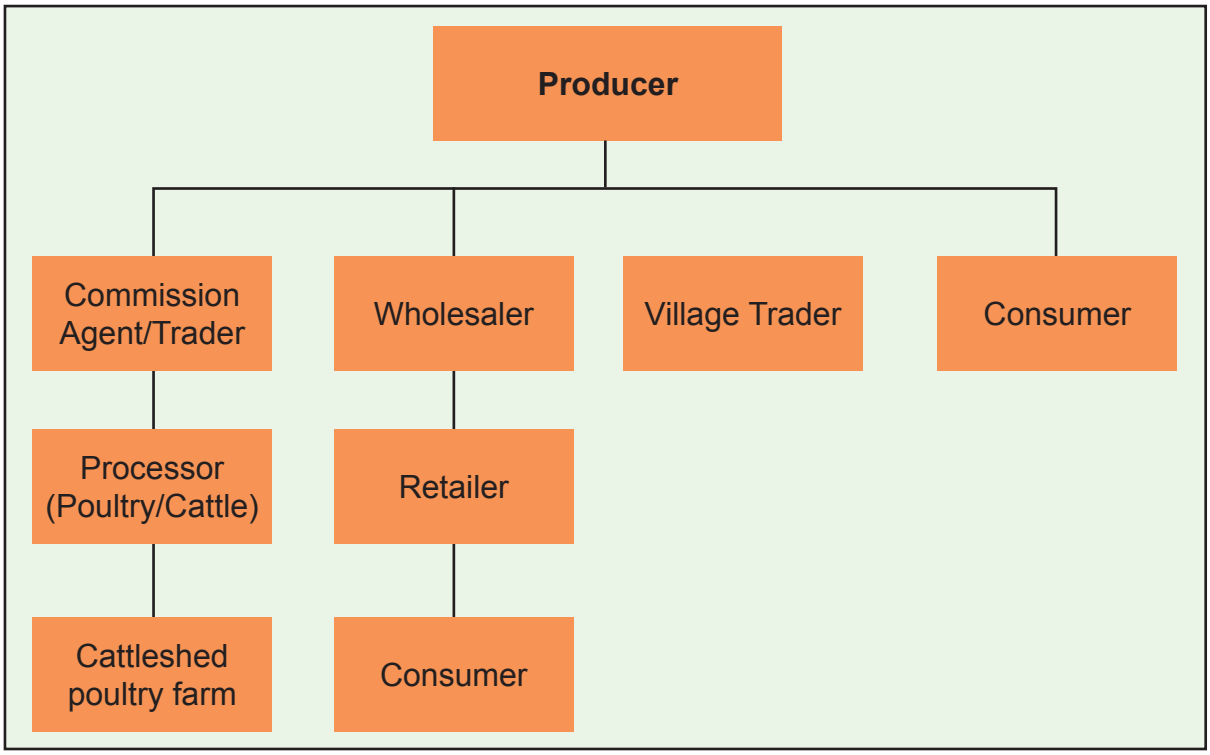


Figure 12a. Value chain of pearl millet

Source: Field Survey, HOPE project (2011).

Table 12 presented the costs and margins of three value chains namely channel-I (traditional), channel-II (direct farmer-to-consumer) and channel-III (contract farming; farmer-firm-retailer-consumer). We have identified Channel-I as the most prevalent value chain – producer-commission agent-wholesaler-retailer-consumer. Transaction costs and marketing margins at each transaction were estimated for different value chains for pearl millet. Farmers sell their produce at ₹ 10110/t to the commission agent, in turn the commission agents sell either to the wholesaler or the retailer at ₹ 11000/t; the marketing costs incurred by traders is ₹ 470/t, while ₹ 410/t is profit margin to traders in channel-I. The farmer's share in the consumer's price is 87.6%. The consumer's price is ₹ 11300/t. The details of trader's margin, wholesalers' and retailers' margins as percent of consumers' price is calculated and presented in the table for all three channels. Efficient value chains increase the producer's share in consumer's price (channel-III is more efficient than channel-I). However, it is interesting to note that in channel-II, consumer price is quite low (₹ 950/q) compared to channel-III (₹ 10530/t) and channel-I (₹ 11300/t). There is also a significant inter-state trade in western India, which is shown in the chart below (Figure 12b).

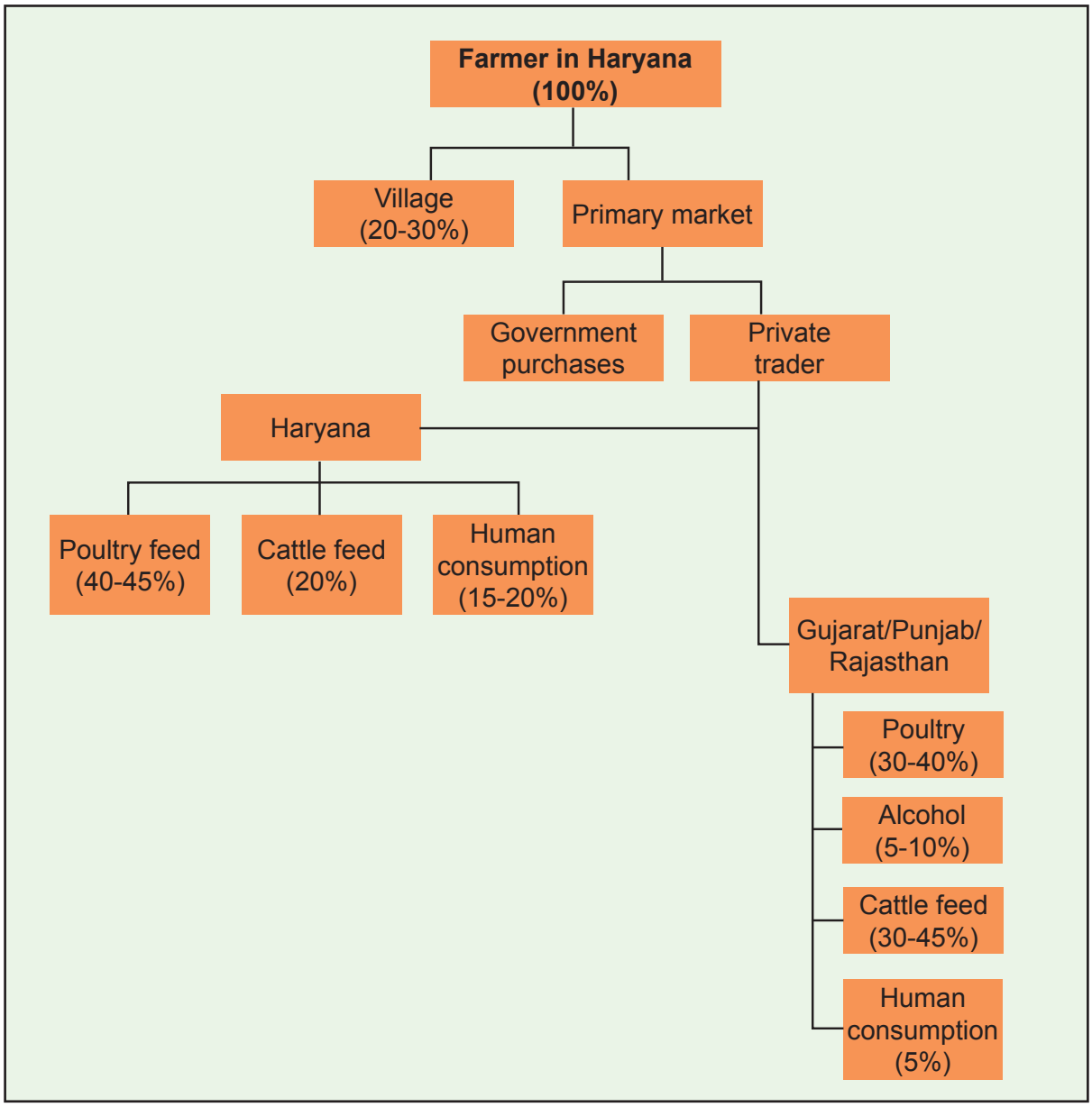


Figure 12b. Schematic diagram of value chain of pearl millet grain in western India.

Source: Field Survey, HOPE project 2011.

Table 12. Margins of different stakeholders in value chain of pearl millet in 2009-10.

	% of consumer price			₹/ton		
	Channel-I (traditional)	Channel-II (direct farmer-consumer)	Channel-III (contract farming, farmer-firm-retailer-consumer)	Channel-I (traditional)	Channel-II (direct farmer-consumer)	Channel-III (contract farming, farmer-firm-retailer-consumer)
Farmer						
Human labor	15.7	18.7	16.8	1770	1780	1770
Bullock labor	2.5	3.0	2.7	280	290	280
Seeds	2.8	3.3	3.8	320	310	400
Manures	2.3	2.7	2.5	260	260	260
Chemical fertilizers	4.3	5.1	4.6	490	480	480
Irrigation	15.2	18.1	16.3	1720	1720	1720
Insecticides/pesticides	0.3	0.4	0.3	30	40	30
Other costs	25.9	30.8	27.8	2930	2930	2930
Total cost	69	82.1	74.8	7800	7800	7880
Farmers profit	18.6	17.9	20.1	2100	1700	2120
Farmer sale & commission agent/ contract firm purchase price	87.6	100.0	95.0	9900	9500	10000
Bagging charges	0.5		0.5	60		50
Unloading charges at market	0.1		0.1	10		10
Weighing charges	0.2		0.2	20		20
Depreciation value of bag	0.8		0.9	90		90
Commission agent charges (1.25%)	1.1			120		
Market fee (0.53%)	0.5			60		
Transportation charges to ware-house	0.3		0.3	30		30
Loading charges when produce sent to secondary market/local wholesaler	0.2			20		

Continued

Table 12. Margins of different stakeholders in value chain of pearl millet in year 2009-10 *continued.*

	% of consumer price			₹/ton		
	Channel-I (traditional)	Channel-II (direct farmer-consumer)	Channel-III (contract farming, farmer-firm-retailer-consumer)	Channel-I (traditional)	Channel-II (direct farmer-consumer)	Channel-III (contract farming, farmer-firm-retailer-consumer)
Transportation charges to railway station	0.6			70		
Marketing costs	4.2			470		
Commission agent/trader margin	3.7			420		
Commission agent selling price/ wholesaler purchase price	95.5			10790		
Wholesaler logistic and storage cost	0.9		1.0	100		110
Wholesaler margin	1.8			200		
Wholesaler selling price/retailer purchase price	98.2			11100		
Retailer costs	0.5		0.5	60		50
Retailer margin	1.4		1.5	160		160
Consumer price	100.0	100.0	100.0	11300	9500	10530
Consumer price (₹/ton)	11300	9500	10530			

Note: Channel-III is hypothetical example with contract farming.

Source: Field survey, HOPE project, 2011.

Human consumption

Unlike demand from feed and breweries industries, demand for food varies significantly with grain attributes. Consumer preference (ranking) for different attributes of pearl millet grain is presented in Table 13. Higher keeping quality and ease of preparation are some of the desirable characteristics of the flour and grain. Consumers were also willing to pay premium for grain size (₹ 580/t), color (₹ 520/t) and aroma (₹ 520/t). Higher market prices compared to subsidized rice and wheat, bitter taste of hybrids are some constraints in popularization of pearl millet grain for food purposes. However, in the recent years, the increased number of diabetic patients and the obese population has increased health consciousness among the majority of high-end consumers. The potential of pearl millet in addressing the diabetic and obese populations is still unexploited; some studies have documented that it is good for heart patients. To meet these higher-end consumers, value addition in terms of reducing fat content and enriching with minerals like zinc and iron, increasing palatability and making ready-to-eat foods is becoming an opportunity to be met either through cultivation of new varieties or post harvest processing.

Table 13. Ranking of attributes of pearl millet grain by consumers in Rajasthan (%).

Attribute	1st rank	2nd rank	3rd rank	Not responded	All
Color	53	22	17	9	100
Bigger grain size	17	5	3	75	100
Smaller grain size	15	34	18	34	100
Cleanliness	12	29	37	22	100
Aroma/smell	2	8	11	80	100
Texture of the flour	1	1	13	90	100
Invisible attributes					
Grain keeping quality	63	14	20	4	100
Ease of preparation	26	52	17	6	100
Elasticity of dough	8	9	10	74	100
Better taste	4	26	54	17	100

Source: Field survey, HOPE projects, 2011.

Demand from cattle/poultry feed industry

Cattle feed industry is composed of both small and large plants, some large feed manufacturers have a capacity of 600 t/day with annual capacity of 120,000 t/annum; however, they mostly use maize and sorghum as feed ingredients. Because of the small size of the pearl millet grain, grinding is difficult and it adversely affects the palatability and digestibility of feed. In addition, pearl millet grain is palatable to cattle only if it is pre-boiled, which is not a general practice and not inbuilt in the feed manufacturing plants. However, the demand for feed is growing from dairy farms due to increasing demand for milk animals and many feed mills have increased their capacities significantly. For example, Banas Dairy maintained by Banaskantha district cooperative (in Gujarat) increased its size from 100t/day in 1980 to 600t/day in 2009. Some small-scale plants are engaged by the Banas Dairy for manufacture of feed on contract basis with specific quality parameters that specify the proportion of different ingredients. Cost composition and profit margins of a typical small-scale plant is given in Table 14. Banas Dairy produces several different branded feed products with different composition of ingredients. The proportion of feed ingredients and the prices for a typical feed pellet are given in Table 15.

Table 14. Production and marketing costs of cattle feed concentrate.

Item	Cost (₹/t)	% of retail price
Raw material cost	7247	72.47
Processing cost	753	7.53
Total cost of production	8000	80
Margin for feed factory	500	5
Ex-factory price to *Banas* Dairy	8500	85
Transport, packing, etc	1000	10
Margin for *Banas* Dairy	500	5
Retail price	10000	100

Source: Field Survey, HOPE project, 2011; Note: feed manufacturing is contracted out to small-scale units by Banas Dairy, but packing, branding and marketing is done under Banas Dairy brand.

Table 15. Local medium-scale cattle feed manufacturing plant (cost of raw material).

Raw material/ Ingredients	Price (₹/t)	%
Rice bran (DRB)	780	40
Cluster bean meal	14000	8
Cluster bean (broken grain)	14000	6
Rapeseed cake (local)	1000	5
Maize (local)	1000	10
Salt	1000	2
Calcite powder	10000	2
Rice polish (16% oil)	500	14
Bubble (broken grain)	5000	3
Molasses	6000	10
Total		100

Source: Field Survey: HOPE project, 2011.

Although pearl millet, sorghum and maize grains are transported over long distances for feed uses (eg, from Haryana to Rajasthan, Gujarat and Uttar Pradesh and vice-versa), it is unlikely that the large feed processors include pearl millet as preferable ingredient. Many processors would not prefer pearl millet over other inferior grains such as broken wheat or ragi, maize and sorghum. The survey revealed a range of negative perceptions of feed millers to using pearl millet in the cattle feed industry. Overall, the survey revealed that pearl millet is currently the last choice as feed ingredient for cattle feed. In the case of cattle feed, many co-operative feed mills have used pearl millet as ingredient in the past, when there is non-availability of maize, sorghum for a limited period of one or two months per annum. Even in this case, in general, relatively less grain (about 5-10% depending on the feed type) is used in cattle feed formulations. However, it is estimated that in 2010, a few feed millers (5-10%) used pearl millet as an ingredient for commercial cattle feed at an inclusion rate of up to 5-10%. According to feed millers, pearl millet is included in feed rations mainly due to its low cost compared to maize and sorghum. Among many reasons, low storability of pearl millet grain is one of the reasons for non-inclusion by large millers; storing is a major problem particularly in the rainy season.

Poultry feed industry in Haryana

There are many poultry feed manufacturers in western India, which are mostly located in Haryana. All are using pearl millet as one of the ingredients. We have taken Mahadev poultry feed manufacturing unit for our case study. It is a small-scale poultry feed manufacturer with a capacity of 5t/day. The ingredients of feed concentrate for broiler-poultry comprises maize (60%), soya (30%) and rice bran (10%), while ingredients of feed concentrate for layers includes pearl millet (40%), maize (20%), soya (25%) and rice bran (15%). The price of maize is ₹ 11/kg, which is more than the price of pearl millet at ₹ 8/kg. The feed concentrate price is ₹ 16/kg. Farmers mix pearl millet with feed concentrate in a 2:1 ratio to prepare feed ration before feeding in the poultry sheds.

Breweries units

The breweries industry prefers varieties with a higher starch content and less protein. Distilleries purchase pearl millet from traders and brokers in the main producing centers and also from the secondary market, whenever prices are significantly lower than competing crops like maize, sorghum and broken rice. Many times, they also call for tenders and select the lowest bidder for supply of required grain. In Haryana, there are eight brewery units, which were started in early 1990s. The study team visited a large distillery named Associate Distilleries in Haryana. This distillery prefers broken rice over pearl millet as the former contains more starch (66-70%) than the latter (55-60%), if the price differences are not too high. However, whenever the prices are low for pearl millet, ie, below ₹ 800/q compared to ₹ 1000/q for broken rice, they use pearl millet (Table 16). Sorghum, barley and potato are used in beer making, while pearl millet and broken rice are used in whisky preparation. Distilleries prefer any material that contains high starch for making alcohol. Now increasingly many distilleries are shifting from sugarcane molasses to pearl millet as ingredient. Distilleries are willing to pay a premium and willing to undertake contract farming with farmers in Haryana if they grow varieties with high starch (>65%) content. However, only assured irrigated regions are suitable for contract farming as it reduces supply uncertainty to both farmers and distilleries. The summer pearl millet is more suitable for contract farming as during this season productivity is high as it is grown in high-input-high-output conditions with irrigation, which is congenial to contract farming.

Table 16. Cost-benefit analysis of alcohol production with pearl millet.

Item	Pearl millet	Broken rice
Cost of raw material (₹/t)	8000	10000
Concentrates production (96% Alcohol) (liter/t)	380	433
Concentrate value (@₹32/liter) price varies between ₹ 30-₹ 35/liter	12160	13856
Profit (₹/t)	4160	3856
By-product solid content (used as cattle feed)	₹ 2/kg	₹ 2/kg
Processing cost (₹/liter)	5	5

Source: Field Survey, HOPE project, 2011.

Starch industries

Some of the country's main starch manufacturers, who are primarily based in Ahmedabad, have used pearl millet for a few months in a year, whenever there is a shortage of maize and sorghum in the markets. Starch manufacturers are mostly not in favor of pearl millet as ingredient for starch making, as the starch content is low and crude protein content is high. The pearl millet grain contains 11.5%

crude protein and 2900 kcal metabolizable energy (ME) as against 9% crude protein and 3330 kcal ME in maize. Hence, the quality of the end product will be affected. Most of the breweries and starch industrial units require pearl millet grain in bulk; hence, generally, they call for tenders and select the lowest bidder.

Grain market arrivals and price trends

Pearl millet consumption as food is decreasing year-after-year. However, the majority of the poor in both rural and urban areas still consume it as chapati in the winter season. Pearl millet chapati can also be consumed in combination with butter milk, jaggery (is a traditional unrefined, uncentrifuged whole cane sugar consumed in Asia), ghee (clarified butter), kadi (churn of the curd along with gram flour and water) and curd in addition to vegetables. Consumption of pearl millet is also decreasing since eating pearl millet chapati (Indian flatbread) is considered low status in society. The study team surveyed a few selected markets in western India to get first-hand information about pearl millet grain and fodder markets. The share of pearl millet grain in total turnover of the markets ranges from 5 to 10%. In most of the markets, market arrivals increased by 5 to 10% even though there is a reduction in area due to increased marketed surplus. Most of the market yards do not have cleaning facilities. In the secondary market, prices are quoted as FOR (free-on-road). The utilization pattern of pearl millet by farmers in western India is given in Table 17, which shows that about 70% of production is sold as grain and the remaining is used for own consumption, as seed, etc. Most of the farmers keep a larger share of the local variety grain for own consumption (26%) compared to 9.9% of public sector variety (HHB-67) and 6.2% of private sector variety (Table 17).

Table 17. Pattern of end-use of pearl millet grain production by seed source.

	Source of seed		
Grain output & utilization	Local	Public Sector	Private Sector
Grain output (kg)	1684	3190	2087
Per unit market price (₹/kg)	9.3	7.0	7.2
Own consumption (% of production)	26.2	9.9	7.6
Other uses (kind wages, gifts and feed to cattle) (%)	9.3	3.7	6.2
Own seed (%)	2.1	0.4	0.5
Sold as grain (%)	61.5	85.4	85.1
Sold as seed (%)	1.0	0.6	0.6
Seed sale price (₹/kg)	11.0	16.0	15.0

Source: Field Survey, Hope Project, 2011.

The peak market arrivals of grain are in June (summer harvest) mostly characterized by shining bright grain, but with low keeping quality (high insect damage) due to onset of monsoons in June/July, while peak market arrivals of *kharif* season starts in October, characterized by superior quality, shining, bright, bold, with no-black colored/damaged seed, and good keeping quality. High quality grain is available in November (Table 18).

It is also to be noted from Table 19 that price premium exists for grain size, disease free, clean and uniform grain. Pearl millet from Uttar Pradesh and Maharashtra also comes to western India (Gujarat, Haryana and Rajasthan) based on the seasonal demand supply gaps. About 70% is utilized for local uses. Most of the traders do not prefer to trade in pearl millet compared to high value crops like jeera

(cumin seeds) and cotton due to less marketing margin per quintal. Further, there is no procurement of pearl millet in the market by government agencies under the price support system. Marketing margins of local traders is given in Table 19, which shows that the profit margin of local traders is about ₹ 470/t, with annual turnover of 8613.5 tons.

Summer pearl millet grown in a few packets of Gujarat and the surplus produce will move from Gujarat to Rajasthan, while the *kharif* harvest moves from Rajasthan to Gujarat to meet local food and fodder demand depending on the prices of competing grains like maize and sorghum. If prices of sorghum/

Table 18. Grain quality traits and price differentials.

Grade	Quality	Price (₹/t) APMC	Utilization
Summer	Yellow green, white, bold, cleaned	12500-13000	Export to Gulf for poultry/ cattle feed
Summer	White, bold, un-cleaned	12000	Local sale for human consumption
Rajasthan (kharif)	Sweet, bold, yellow green, white, no black spots, not quality sensitive	10200	Human consumption
Sourashtra	Greenish yellow, bold	10000	Human consumption
A	Bold/medium size, greenish yellow	9500	Human consumption
B	Small, white	9000	Human consumption
C	Small, red	8500	Cattle/poultry feed
	Damaged, black colored, unclean, broken	7500 (Oct-Dec)	Cattle feed
Cattle feed quality	Very low quality	1000-6000	

Source: Field Survey, HOPE project, 2011.

Table 19. Market margin and turnover of sample traders.

Item	Mean
Average no. of villages covered under market	51.1
Annual turnover (t/year)	8613.5
Share of pearl millet (31%)	31
Large grain premium (₹/t)	510
Small grain premium (₹/t)	500
Pest & disease free premium (₹/t)	230
Cleanliness premium (₹/t)	410
Uniformity premium (₹/t)	540
Purchase cost (₹/t)	10110
Average selling price (₹/t)	11000
Marketing expenses (₹/t)	470
Profit margin (₹/t) to traders	410

Source: Field Survey, HOPE project, 2011.

maize in local markets go above ₹ 8000 to 9000 per ton, most of the pearl millet market arrivals will be purchased by feed manufacturers or large dairy farm holders. But, if prices of sorghum and maize are similar or on-par with that of pearl millet, most of the feed manufacturers and large dairy farmers prefer to purchase sorghum/maize due to their superior feed quality. In case of deficit in the Rajasthan market, the price quotation in Rajasthan market is generally 10% higher than in Gujarat markets due to the 5% market expenses (including trader's profit) plus 5% transport charges.

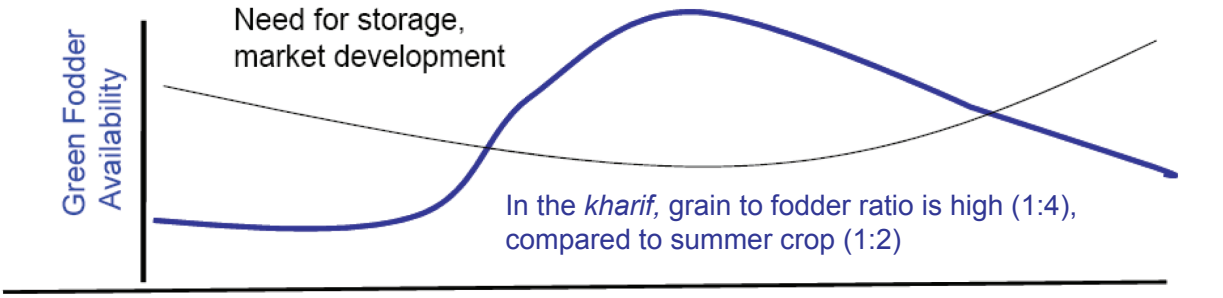
Value chains in pearl millet stover

Most of the fodder produced is traded within boundaries of adjoining villages among farmers and the leftover about 10-20% is traded in informal markets within 30 km distance from the villages. The widely used marketing channel for fodder is farmer-trader-commission agent-cattle shed owner. Even though growth in cattle population is slow, the buffalo population is increasing rapidly, which increased the demand for both fodder and feed. As a result of decline in area under permanent pastures and grazing land and also stagnation in area under food grains, which are major sources of green and dry fodder, there is a justification for increasing the area under dual purpose crops like pearl millet.

Being in harsh and dry climate, fodder availability is less in western India. Fodder availability in western India is about 30 kg/animal/day compared to the all-India average of 44 kg/animal/day. There will be a huge gap between demand and supply for fodder by 2020. Local prices of green fodder hovering around ₹ 1500/t to ₹ 2000/t, while dry fodder is about ₹ 2000 to 4000/t depending upon the seasonality.

Table 20. Crop growing seasons and fodder availability.

Crop	June	July	Aug.	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May
Wheat						→	→	→	→	→	→	
Rice	→	→	→	→	→							
Maize	→	→	→									→
Sorghum	→	→	→	→	→	→	→					
Pearl millet		→	→	→	→					→	→	→
Cotton	→	→	→	→	→	→	→	→	→	→	→	
Peanut	→	→	→	→								→
Pigeonpea	→	→	→	→	→							
Chickpea					→	→	→	→	→	→	→	
Castor		→	→	→	→	→	→	→	→	→		
Mustard					→	→	→	→	→			



Source: Field Survey, HOPE project, 2011.

Local commission agents facilitate fodder trading with a commission of ₹ 100-200/truck load of fodder ranging from 7 to 15 tons each. This effectively translates into 0.5 to 1% commission on trade value of fodder. The logistics cost of transporting green fodder is about ₹ 500/100km/1 t. On average, one animal consumes 4-5 kg green fodder and 4-5 kg dry fodder for normal activity. The milking cattle take an additional 0.5 kg concentrate per every liter of milk. Color, size, moisture, softness, purity, cleanliness and variety are some of the parameters that are taken into account during negotiation and price determination of fodder. Fodder having uniform color, thin stalk and bright luster is preferred. More fodder quantity with leaves, storability of fodder and palatability (quality/taste) are important factors in determining the price of fodder. In *kharif,* grain to fodder ratio is high (1:4) compared to the summer crop (1:2). Trends of seasonality of market arrivals of fodder is given in Table 20, which shows that market arrivals peak in the months of October, November, May and June. The price premium is given in Table 21 and Table 22. The productivity of fodder crops is in general 300 t/ha. 3 crops will be taken up for cultivation per annum.

Table 21. Grade (quality) of green fodder and price differentials.

Grade	Quality	Price (₹/ton)	Remarks
Chopped	White/red colored stalk, thin	6000	Informal market facilitated by commission agent
A	White/red colored stalk, thin	5000	
B	White/red colored stalk	4000	
C	Not red/white	3500	
	Non-descript	2800 to 4000	Farmer-to-farmer

Source: Field Survey, HOPE project, 2011.

Table 22. Market price of different fodder.

Crop	Quality	Price (₹/ton)	Remarks
Sorghum	Chopped	4500	Less price compared to pearl millet
Tur fodder	Chopped	3000-6000	
Sugarcane top		1750	From Anand
Pearl millet		4000	Milk yield reduce by 10%, produces heat in the body
Sorghum	Dry fodder	3500-5000	In quality terms solapur (white and sweet) is preferred over desijowar followed by sorghum jowar and fetches higher price
Maize	Dry fodder	4000	
Pearl millet	Dry fodder	4000	

Source: Field Survey, HOPE project, 2011.

Conclusion

There is growing scope for alternative uses of pearl millet grain in the coming years, and most of the growth will come from cattle and poultry feed industry, alcohol industry and starch industry. Even though there will be a slight increase from the quality conscious urban consuming sector who will prefer healthy, tasty, hygienic, branded, packed and ready-made easy to cook value added products from pearl millet, pearl millet consumers will be more concentrated in rural areas, and they will purchase unbranded pearl millet from local markets with preferred grain traits like good grain color, size and taste and cleaned grain. To meet their requirements, infrastructure at markets, traders and farmers with grain cleaning and grading facilities are required. On the other hand, the feed industry is more price conscious; they give little or no preference for quality aspects, if the price is low, while the alcohol and starch industries prefer grain with good starch content with low protein.

Case Study-IV

Primary Producers Companies – Emerging Innovative Institutions[3]

Smallholders occupy a dominant position in the agrarian economy of many developing countries. The country is second largest after China in terms of small holding positions with 92 million small holdings or nearly 21 percent of the world's small holdings of 450 million (Nagayets 2005). Ensuring the productivity of small holdings and integrating them with the value chain is always a challenge being faced by the policy makers. Many institutions have emerged to include them in mainstream models but the most common institution is producer cooperatives.

The Cooperatives enables farmers to organize and manage themselves. They move up the value chain by ownership and operation of their own processing units and sometimes extend the chain up to the retail level. India has a large number of cooperative institutions in a vast range of enterprise sectors, but many of them are not successful. The experiences of cooperatives in our country have never been reassuring except in a few cases as they have largely been state promoted with focus on welfare rather than growth. Even the cooperatives such as National Dairy Development Board (NDDB) are known for their administrative difficulties. The cooperative institutions are controlled by the state through the Registrar of Cooperative Societies. The overriding powers of registrars in controlling the cooperatives and the intrusion of the political system into the day to day operations of cooperatives have rendered them uneconomical and inefficient, thereby effecting their growth. The majority of the cooperative institutions are currently facing severe financial crises and heavily relying on the state's subsidy for existence. The Mutually Aided Cooperative Societies Act (MACS) was introduced to overcome some of these limitations of the cooperatives; however, not many states have adopted the MACS. The reasons are many and have been analyzed at length by several expert committees from time to time.

After realizing the needs of the farmers, given the challenges of the world market and the un competitiveness of existing cooperative acts and institutions, the Government of India set up a committee under the Chairmanship of noted economist YK Alagh in 1998. The objectives of the committee were a) to frame a legislation that would enable incorporation of cooperatives as companies and conversion of existing cooperatives into companies and b) to ensure that the proposed legislation accommodated the unique elements of cooperative business with a regulatory framework similar to that of companies while ensuring the unique elements of cooperative business. Thus, in the Companies (Amendment) Act 2002, 1 of 2003, a separate category came into force and producer companies found a place in the Act. For this, a new part IXA, divided into 12 chapters, has been included in the Companies Act, 1956.

The cooperatives are registered with the Registrar of Cooperative Societies. Whereas, the producer companies (pc) are incorporated with the Registrar of Company (RoC). The producer companies have inherent advantages over the cooperatives in many areas, specifically in the areas of government control. Table 23 provides some differences between producer companies and Cooperatives.

Salient provisions of Companies Act relating to producer companies

In a `Producer Company', only persons engaged in an activity connected with, or related to, primary produce can participate in the ownership. The members have necessarily to be `primary producers. 'Primary produce has been defined as a produce of farmers arising from agriculture including animal husbandry, horticulture, floriculture, forestry, forest products, bee raising and farming plantation

3 This chapter is written by Ch Radhika Rani, Faculty member, National Institute for Rural Development (NIRD), Hyderabad

Table 23. Cooperative and Producer Company – Key Variances.

Features	Producer Cooperative	Producer Company
Registration	Cooperative Societies Act	Companies Act
Objectives	Single Object	Multi Object
Membership	Open only to individuals and cooperatives	Only those who participate in the activity
Relationship with other corporate/ business houses/NGOs	Transaction based	Producers and corporate entity can together float a producer company
Shares	Not tradable	Not tradable but transferable limited to members on par value
Voting rights	One person, one vote, but Government and RCS holds veto powers	One person one vote. Those not having transactions with company can't vote
Reserves	Created if there are profits	Mandatory to create every year
Role of registering authority	Significant	Minimal
Administrative control	Overbearing	None
Borrowing power	Restricted	More freedom and alternatives
Dispute settlement	Through cooperative mechanism	By arbitration

products: produce of persons engaged in handloom, handicraft and other cottage industries: by-products of such products; and products arising out of ancillary industries.

Incorporation

Any ten or more individuals, each of them being a producer, that is, any person engaged in any activity connected with primary produce, any two or more producer institutions, that is, producer companies or any other institution having only producers or producer companies as its members or a combination of ten or more individuals and producer institutions, can get incorporated as a producer company.

The companies shall be termed as limited and the liability of the members will be limited to the amount, if any, unpaid on the shares. On registration, the producer company shall become as if it is a private limited company with the difference that a minimum of two persons cannot get them registered, the provision relating to a minimum paid-up capital of ₹ 1 lakh will not apply and the maximum number of members can also exceed 50. Members' equity cannot be publicly traded but only transferred.

Salient features

The salient features of producer companies shall include one or more of the eleven items specified in the Act, the more important of these being:

i. Production, harvesting, procurement, grading, pooling, handling, marketing, selling, export of primary produce of members or import of goods or services for their benefit;

ii. Processing including preserving, drying, distilling, brewing, venting, canning and packaging of produce of its members; and

iii. Manufacture, sale or supply of machinery, equipment or consumables mainly to its members.

The other features include rendering technical or consultancy services, insurance, generation, transmission and distribution of power and revitalization of land and water resources; promoting techniques of mutuality and mutual assistance; welfare measures and providing education on mutual assistance principles.

Management

Every producer company is to have at least five and not more than 15 directors. A full time chief executive is to be appointed by the board. He shall be an ex-officio director and will not be liable to retire by rotation and shall be entrusted with substantial powers of management as the board may determine.

Members' benefit

Members will initially receive only such value for the produce or products pooled and supplied as the directors may determine. The withheld amount may be disbursed later either in cash or in kind or by allotment of equity shares. Members will be eligible to receive bonus shares.

There is a provision for the distribution of dividend in the form of patronage bonus, after the annual accounts are approved — patronage bonus means payment out of surplus income to members in proportion to their respective patronage (not shareholding). Patronage, in turn, is defined as the use of services offered by producer companies to their members by participation in their business activities.

Reserves

Every producer company has to maintain a general reserve in every financial year and in case there are not sufficient funds in any year for such transfer, the shortfall has to be made up by members' contribution in proportion to their patronage in the business.

Dispute resolution

Dispute relating to producers companies are to be settled by conciliation or arbitration under the Arbitration and Conciliation Act, 1996 as if the parties to the dispute have consented in writing to such procedure.

Inter-state cooperative societies

Inter-State Cooperative Societies not confined to one state can also make an application to the Registrar for recognition as producer companies. The statute also provides for re-conversion of such producer companies to their former status as inter-State cooperative societies subject to the approval of the High Court.

Further, "all the limitations, restrictions and provision of the Act, (other than those specified in Part IXA), applicable to a private limited company, shall apply to a producer company, as if it is a private limited company.

In other words, a producer company is a hybrid between a private limited company and a cooperative society. It combines the goodness of a cooperative enterprise and the vibrancy and efficiency of a company. It accommodates the unique elements of cooperative business with a regulatory framework similar to that of a private limited company.

Key learnings and observations through some cases[4]

- The Primary Producers' Companies (PPC) are being registered either through the active initiation of local NGOs or through the support of the state. For example, in Kerala during late 90s, the increase in cost of production, decline in profitability and the subsequent agrarian distress has triggered farmers' suicides. In order to make agriculture more sustainable and to provide remunerative prices to farmers, five NGOs have joined together and started Indian Organic Producers Company Limited (IOPCL), the first PPC in the country. The initial capital support required to run the company was made by the farmer partners themselves. Whereas, in the case of Madhya Pradesh, the Primary Producers Companies were initiated under a World Bank funded poverty alleviation program. The hand holding support for grassroots initiation, to organize the farmers and to provide the technical assistance was imparted by an NGO 'Action for Social Development' (ASA) to these PPCs.
- Mobilizing the initial working capital has become a challenge to the PPCs. From the point of view of the financial institutions, a PPC is a commercial entity and therefore they need to contribute the collateral securities and also margin money to get loans from banks, which is a concern. The PPCs are also required to provide collateral for the loan. The IOPCL was promoted by organic farmers to aggregate their produce and enter into niche markets. The farmers have been following all the quality standards prescribed by INDOCERT, an international certification body, to get the organic certification and also obtained the fair trade certification necessary to enter into the European market. However, the company could not procure the entire product of the farmer shareholders mainly due to working capital constraint. As a result of this, the farmers have been selling the remaining part of their produce in the open market with a price on par with that of inorganic produce.
- The role of state in the promotion of producer companies seems to be not much, except in case of PPCs initiated by the Madhya Pradesh (MP) Government through Madhya Pradesh District Poverty Initiatives Project (MPDPIP) project. In MP, the efforts of ASA and DPIP have brought in several policy changes in favor of producers' organizations. The Government of Madhya Pradesh has agreed to provide initial support for a period of three years and a one time working capital support of ₹ 25 lakhs to the PPCs.
- Provision of infrastructural facilities to PPCs such as primary processing facilities and warehouses is essential so that they can either pre-process or process the product and supply the material. For example, some of the products that the IOPCL handles needs simple processes such as shade drying, grading, etc, before supplying. At present the IOPCL is hiring the processing facilities.
- Coverage or access to the subsidy based schemes/programs of the government to all the farmer shareholders is very minimal. For example, 50% of the cost of organic certification of the farmers was borne under NHM in Kerala. Except this, no other major support seems to have been provided to the PPCs by the government. The Spices Board has a scheme for the promotion of pepper cultivation. However, this scheme, which was to encourage new pepper plantations, was not useful to the existing farmer shareholders of PPC, who have their pepper plantations already under mixed cropping systems.
- The transfer of technology or extension services by the state in the area of operations of PPC seems to be very minimal. For example, around 32 percent of the farmer shareholders in Wayanad district of Kerala have access to the technology through Organic Wayanad, one of the partner organizations of IOPCL. Another 32 percent of the farmers do not have any access and only 13 percent of the farmers have access through the agriculture department.

4 NAIP Research Study on "Public Private Partnership in Agriculture based Livelihoods" conducted by author.

Policy implications

1. Provision of performance linked support to the PPCs in the form of working capital.
2. Provision of one time grant to the PPCs to enable them to enter into the value chain through processing facilities.
3. A minimum social security support for the member shareholders in the form of pension and health support must be provided.
4. Extension of Institutional Credit and Insurance coverage to all the members.
5. Partnering of agricultural universities or ICAR institutes with PPCs, which enables them to transfer their technology to the field or to identify the research needs.

Case Study-V

Jatropha-based Biodiesel Value Chain in India[5]

Introduction

With fast depletion of fossil fuels, increasing focus is being given to the development of bio energy as a potential future source of energy and this has brought jatropha, a tree-borne oil seed crop into the limelight. The plant jatropha *(Jatrophacurcas)* is widely known for its ability to yield biodiesel upon processing of its seeds. World over, considerable investments are being made on the jatropha-based biodiesel development projects. A survey conducted by Global Exchange for Social Investment has identified 242 jatropha projects in different parts of the world and a majority of them are located in Asia. India is currently the leading cultivator of jatropha with more than 0.4 million hectares (M ha) of area under this crop. In India, it is the Planning Commission report on development of bio fuel that has officially endorsed the suitability of jatropha as a prominent feedstock for biodiesel production. Even though various other oilseeds also qualify as feed stocks for biodiesel, jatropha has been specifically chosen, it being a non-edible oilseed crop that does not impinge on the food security of the nation even if promoted commercially. Also, jatropha is a drought-tolerant and hardy crop that can be grown in relatively less fertile and marginal lands with minimal inputs and management. The scope of earning 'carbon credits' from jatropha cultivated lands is considered as an added advantage. Several studies at the global level too favors the cultivation of jatropha in marginal or less productive lands. The Government of India has introduced a myriad of programs and policies to encourage the upcoming of the bio fuel sector in the country. As a part of this, the National Bio fuel Mission (NBM) was launched in the year 2003, of which Biodiesel Blending Program (BDBP) and Ethanol Blended Petrol Program (EBPP) are the integral components. The BDBP mandates blending of biodiesel in high speed diesel (HSD) with a target of effecting 5% blending by the year 2012, 10% by 2017, and 20% after 2017. As substantial area is to be brought under bio-fuel plantations to meet the mandated blending target, the government policy is to utilize the wastelands available across the country to grow non-food bio fuel crops. In its 2003 report, the Planning Commission has mentioned that there is an estimated area of around 13.4 M ha that is suitable to plant jatropha. To ensure fair price to the farmers growing jatropha, various state governments have announced Minimum Support Price (MSP) for jatropha seeds. The Minimum Purchase Price (MPP) offered by the oil marketing companies acts as a guarantee to the bio fuel (both bio ethanol and biodiesel) manufacturers against price troughs. Various subsidy programs and tax concessions/exemptions are also part of the government's effort to speed up the partial transition from fossil fuels to bio fuels. For instance, National Oilseeds and Vegetable Oils Development Board (NOVOD) under the Ministry of Agriculture, Government of India, are providing a back ended subsidy of 30% for the promotion of tree-borne oilseeds like jatropha and pongamia. Along with the government, other non-state actors like non-governmental organizations (NGOs), self-help groups (SHG), co-operative societies, private entrepreneurs and corporate bodies, are also involved at various levels in the jatropha based biodiesel value chain.

In spite of all these efforts, the progress of the jatropha-based biodiesel production program is not up to the expectations. The program lags behind in terms of coverage of jatropha cultivated area, yield potential of the plants, number of biodiesel production units, establishment of seed collection and delivery channels, biodiesel distribution channels, etc. In addition, the progress has been found to be highly varied across the states due to various underlying reasons. Though slow, all these promotional efforts are being carried out under the assumption of environmental benefits, benefits of creating

5 This section is a reproduction of a paper that appeared in Agricultural Economics Research Review, written by P Shinoj, SS Raju, Praduman Kumar, SiwaMsangi, PawanYadav, Vishal Shankar Thorat and KR Chaudhary.

income and employment opportunities for local populations as brought out by some studies. However, in a divergent line of thinking, a few studies have pointed at the negative socio-economic consequences of jatropha cultivation on the impoverished farmers, which in a sense are questioning the basic legitimacy of the program itself. Under this backdrop, the paper attempts to make an economic assessment along the jatropha based biodiesel value chain in major jatropha producing states of India.

Methodology

The study used both primary and secondary data, but is predominantly based on the survey data collected from three major jatropha cultivating states, namely Rajasthan, Chhattisgarh and Uttarakhand using pretested questionnaires. The primary data pertains to the cost of cultivation, yields, input sources, marketing practices and other economic and livelihood aspects regarding jatropha cultivation. From each state, one district each (Sikar district in Rajasthan, Bilaspur district in Chhattisgarh and Dehradun district in Uttarakhand) and then two blocks within it were selected purposively based on the prominence of jatropha plantations. Three villages from each block, ie, six villages from each district were selected and finally ten jatropha growing farmers from each village were chosen randomly as respondents for conducting personal interviews. In all, 60 sets of jatropha plots were sampled from each state. The study team also visited two biodiesel manufacturing units, one each in Rajasthan and Chhattisgarh to obtain detailed information on jatropha processing aspects. In addition, information collected through personal meetings and discussions with various state department officials, *panchayat* committee members, faculty of agricultural universities, market intermediaries and corporate officials was also used. Various secondary sources like published reports and websites were also relied upon, in the process of writing the paper. Tabular and graphical methods have been used to present the results.

The jatropha value chain consists of various activities starting from raising nursery to distribution of biodiesel to end users. Broadly, the activities can be classified into four categories, – farm production of seeds, seed marketing, biodiesel production and biodiesel distribution. A typical jatropha value chain has been depicted in Figure 13.

Farm production of *jatropha* seeds

1. Farming Models

Farm production of jatropha seeds is the first major activity in this value chain. Different models of jatropha cultivation were observed in the selected states and are presented in Table 23. The widely seen model was the farmer-centric cultivation model where farmers cultivate jatropha in their own lands with some government assistance like provision of subsidized seedlings and other inputs, extension support, etc. This was predominant in the Sikar district of Rajasthan and Bilaspur district of Chhattisgarh, where the surveys were conducted. Another common model was the government-mediated production where the community wastelands are leased out to local SHGs or Joint Forest Management Committees (JFMCs). The farmers, as members of SHGs or JFMCs, are granted rights to cultivate and harvest jatropha seeds. Various governments bodies like National Oilseeds and Vegetable Oils Development Board, state biofuel boards[6], forest departments, etc, are instrumental in sustaining the activities. The government extends substantial encouragement to the farmers by providing inputs like free or subsidized seedlings, other inputs like fertilizers and manures, follow-up and monitoring support for plant maintenance, marketing support, etc. Also, the labor involved in the initial establishment is being sourced under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) by paying mandatory wages. This practice is under operation in 11

6 Biofuel Authority (BFA) in Rajasthan, Chhattisgarh Biofuel Development Authority (CBDA) in Chhattisgarh and Uttarakhand Bio-fuel Board (UBB) in Uttarakhand.

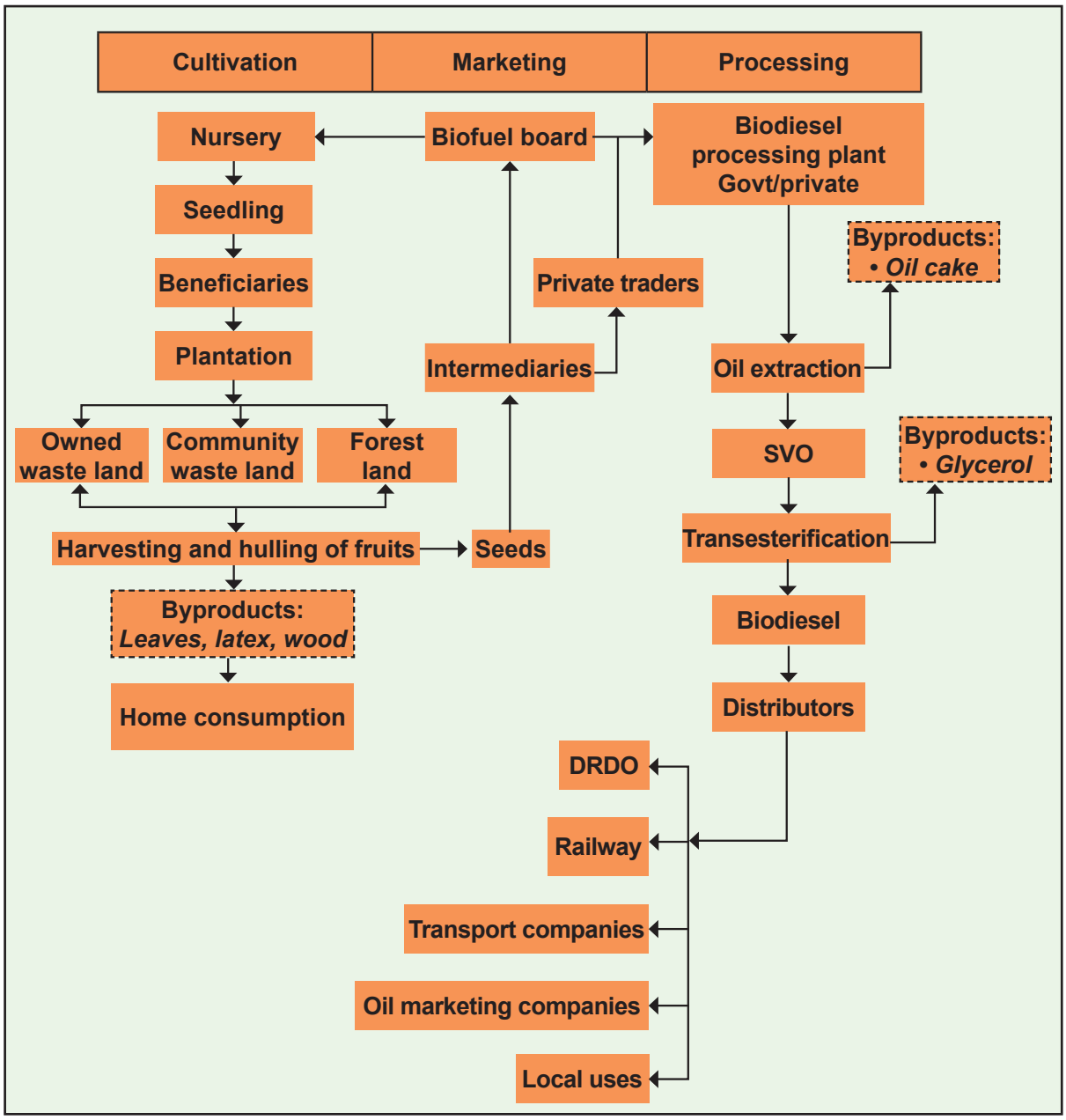


Figure 13. A typical jatropha-based biodiesel value chain: Schematic representation.

DRDO: Defense Research and Development Organization; SVO: Straight Vegetable Oil. Various stakeholders like government, producer farmers, market intermediaries, traders, biodiesel processers, distributors and consumers are involved in the jatropha chain, though minor regional variations are observed. .

districts of Rajasthan, 9 districts of Uttarakhand and several districts of Chhattisgarh. A number of recognized NGOs are also active participants in this model of cultivation, by being involved in different promotional activities.

The third was the corporate, business oriented model of cultivation. *Estate Farming* and *Contract Farming* were the two variants within this model. In the *Estate Farming* model, large corporate companies like D1 Mohan Bio-fuels Ltd. based in Chhattisgarh and Tamil Nadu, Nandan Biometrics in Andhra Pradesh and Jain Irrigation Systems Pvt. Ltd. in Maharashtra cultivate jatropha in either their own land or community land leased-in from the local *panchayats*. In this model, the company employs the local villagers to cultivate the crop and the right to harvest rests with either the company

or is shared with the *panchayats*. *Contract farming* mode of operation with buy-back arrangements with the farmers was also found prevalent in some parts of jatropha-growing areas. In this mode, the company provides inputs, technical guidance and other extension services during the initial years of establishment. The contracts can be reached either at a pre-decided price for the seeds or just with the understanding that the company will purchase the seeds at the prevailing market price. Some public sector undertakings like Indian Oil Corporation (IOC), Oil and Natural Gas Corporation (ONGC) and private bodies like Indian Farmers Fertilizer Cooperative Limited (IFFCO) have also recently entered into contract farming arrangements with the farmers.

(b) Agronomic and Economic Performance at Farm Level

Agronomic and economic assessments of jatropha cultivation were carried out based on the primary data collected from the states of Rajasthan, Chhattisgarh and Uttarakhand. A majority of the jatropha farmers in the surveyed area fell under the category of marginal and smallholder farmers. Some medium category farmers were also involved in growing of jatropha but large category farmers were totally absent. In Uttarakhand, only marginal farmers were involved under government-mediated cultivation. The average plot size was of less than one quarter of a hectare in Rajasthan while it was a little more than half a hectare in Chhattisgarh. The highest area under an SHG in Uttarakhand was of 8 ha and the lowest was of 2 ha with an average size of 3.87 ha (Table 24). Age of the seedlings had crossed three years in Rajasthan, nearing 3 years in Chhattisgarh and more than four years in Uttarakhand. Fairly good survival of seedlings was noticed in Rajasthan and Chhattisgarh, while moderate survival

Table 24. Different models of jatropha cultivation at farm level.

Operator	Land ownership	Rights on harvest	Government role
Farmer	Farmer	Farmer	Subsidy on seedlings
Farmer (SHG/JFMC)	Community	SHG/JFMC	Lease of land, subsidy on inputs, employment guarantee
Corporate	Private/Community	Corporate	Subsidy for setting up processing plants

Table 25. Details of jatropha cultivation at farm level in selected states.

State	Farmer category[£]	Area under jatropha (ha)	Age of seedlings (year)	Number of seedlings in planted area	Survival rate of seedlings (%)	Yield (t/ha)
Rajasthan	Marginal (26)	0.08	3.4	148	73	2.01
	Small (22)	0.10	3.0	191	79	2.41
	Medium (12)	0.26	3.6	558	84	2.92
Chhattisgarh	Marginal (6)	0.72	2.8	2633	86	2.52
	Small (36)	0.60	2.7	1535	87	2.62
	Medium (18)	0.72	2.7	1630	84	2.70
Uttarakhand	Marginal (60)	3.87*	4.5	7950	61	2.22

*Community area allotted to self-help groups where marginal farmers were growing jatropha.

[£] Marginal: Less than 1 ha; Small: 1-2 ha; Medium: 2-10 ha. Figures within the parentheses indicate number of farmer-respondents in each category

rate of 61% was observed in Uttarakhand. The yields were more or less similar across the states and farm-categories and were between 2-3 tons per hectare at third year. Even though wide ranges in yield have been reported for jatropha, our results were consistent with the yield estimates reported under moderate management conditions.

The initial establishment activities of jatropha cultivation during the first three years were found to create employment for 85-108 man days in the selected states under moderate management conditions (Table 26). An additional 1h man day labor per 50 kg of pods harvested was required from

Table 26. Input application pattern during initial period of establishment of jatropha in surveyed plots.

State	Labor (human days/ha)*			Manure (t/ha)	DAP£ (kg/ha)	Percent farmers irrigating/year		
	Family	Hired	Total			Once	Twice	Thrice or more
Rajasthan	90	18	108	1.90	150	12	48	40
Chhattisgarh	85	12	97	1.60	0	57	43	0
Uttarakhand	71	14	85	0.80	0	100	0	0

Notes: Farmers applied manures and fertilizers only in the first year in all three states.

*Labor incurred during first three years for planting, fertilizer and manure application, irrigation, etc.

£only 35 percent of the farmers applied fertilizer (di-ammonium phosphate) while planting in Rajasthan. Figures for Chhattisgarh and Uttarakhand apply only for the first year.

the third year onwards. Therefore, on an average, around 40-50 man days would be created per hectare per year as the plants start yielding, and it would further increase as the plants reach maturity. In all sampled households, more than 80% of the employment created in jatropha cultivation activities was catered from within the family. In all the three states, farmers were found to apply fertilizers and manures only in the first year. The farmers applied both manures and fertilizers in Rajasthan, while in the other two states they applied only manures. The plants were irrigated during the initial 2-3 years, but with varying intensity in different states. In Rajasthan, around 40 percent of the farmers irrigated three or more times during the initial years while 48 percent of the famers irrigated twice and the rest 12 percent only once. In Chhattisgarh, around 43 percent of the farmers irrigated twice while 57 percent irrigated only once in the first year. In contrast, in Uttarakhand, all farmers irrigated only once in the first year leaving the crop rain fed in the rest of the years. None of the farmers in any of the locations was found to follow any crop protection measures.

The economics of jatropha cultivation was found to vary considerably depending upon the cultivation model and location, as is evident from the cost of cultivation figures for the three selected states presented in Table 27. While Rajasthan farmers incurred a cost of around ₹ 31,295/ha, during the first year, the estimates for Chhattisgarh and Uttarakhand were ₹ 8,319/ha and ₹ 12,050/ha, respectively. This can be attributed to the inter-state variations in subsidies on seedlings and other inputs, variations in labor charges, differential usage of inputs, etc. The farmers in the Sikar district of Rajasthan had to pay ₹ 6-10 per seedling as they did not get any subsidy from the state government[7]. The cost of seedling alone came to be around 35% of their total cost. In contrast, Chhattisgarh farmers were getting seedlings at a highly subsidized rate of ₹ 0.50 per seedling and the Uttarakhand farmers were provided hundred percent subsidy on seedlings. Wage rate was another major component of cultivation cost and it also varied across states (wage rates in Rajasthan, Chhattisgarh and Uttarakhand were ₹ 150,

7 Rajasthan government provides jatropha seedlings at subsidized rate under the government-mediated jatropha cultivation program operational in only 11 districts, in which Sikar district does not fall.

Table 27. Economic analysis of jatropha cultivation in selected states.

Particulars	Rajasthan			Chhattisgarh			Uttarakhand		
	I year	II year	III year onwards	I year	II year	III year onwards	I year	II year	III year onwards
Land preparation	1125	0	0	375	0	0	900	0	0
Digging pits	5625	0	0	2125	0	0	4800	0	0
Sapling cost	11250	1500	0	1065	225	0	0	0	0
Planting	3000	375	0	1125	375	0	2400	0	0
Manure	3125	0	0	2375	0	0	2400	0	0
Fertilizer	3325	0	0	0	0	0	0	0	0
Irrigation	1000	1000	1000	500	0	0	500	0	0
Harvesting	0	0	6750	0	0	2500	0	0	5400
Sub-total	28450	2875	7750	7565	600	2500	11000	0	5400
Incidentals (10%)	2845	288	775	756	60	250	1050	0	540
Total cost	31295	3163	8525	8321	660	2750	12050	0	5940
Returns	0	0	17812.5	0	0	17875	0	0	13500
Net profit	-31295	-3163	9288	-8321	-660	15125	-12050	0	7560

Notes: The figures are averages across sampled farmers.

Wages: ₹ 150, ₹ 50 and ₹ 120 for Rajasthan, Chhattisgarh and Uttarakhand, respectively.

Cost of saplings: ₹ 6 and ₹ 0.50 per seedling in Rajasthan and Chhattisgarh, respectively, 100 percent subsidized in Uttarakhand.

Cost of fertilizer: ₹ 9.50 / kg of DAP and manure @ ₹ 500 per ton.

Cost of irrigation: ₹ 500 per irrigation per hectare

Price of jatropha seeds: ₹ 7.50/kg in Rajasthan, ₹ 6.50/kg in Chhattisgarh and ₹ 6/kg in Uttarakhand.

₹ 50 and ₹ 120 per day, respectively). These differences also got manifested in profits, pay-back period, etc, and indicated the differential level of incentives for jatropha cultivation in different locations in India.

The above analysis shows that the break-even period and profitability of jatropha cultivation depend on the level of government support to the program in the initial years. In the selected district in Rajasthan, it would take 5-6 years for the farmers to cover the initial establishment cost as opposed to the Chhattisgarh and Uttarakhand farmers who start realizing profits from the third year onwards. Since most of the jatropha cultivators fall under the categories of marginal and smallholder farmers, who do not have other off-farm sources of income, the government support in the initial years is crucial.

Considering the long-term nature of investment in jatropha cultivation, a few discounted measures of financial assessment like net present value (NPV), benefit cost ratio (BCR) and internal rate of return (IRR) were worked out for the selected states and are presented in Table 28. The long-term prospects of jatropha cultivation were found promising in all the three states due to low recurring costs associated with farm management[8]. In relative terms, the farmers of Chhattisgarh would benefit more than those of the other two states due to lesser initial investment, minimal input usage and lower wage rates prevailing there. However, it is cautioned that this analysis would hold only if the current parity of seed prices is maintained in the future also.

8 The future costs were worked out based on the present package of practices being followed by the farmers as obtained from the surveyed data.

Table 28. Financial measures for assessing the feasibility of investment in jatropha cultivation.

	Rajasthan			Chhattisgarh			Uttarakhand		
Period	NPV (₹)	BCR	IRR (%)	NPV (₹)	BCR	IRR (%)	NPV (₹)	BCR	IRR (%)
Year 5	-12197	0.76	-5	22033	3.47	72	5105	1.19	24
Year 10	17461	1.23	20	61023	6.13	85	26853	1.63	42
Year 15	35876	1.39	24	85233	8.17	85	40358	1.75	44
Year 20	47310	1.47	25	100265	10.18	85	48743	1.81	45

Note: A 10 percent discount rate was used for the calculations.

None of the sampled farmers in any of the three states reported any case of crop land being substituted for jatropha cultivation. Farmers who cultivated jatropha in their own lands used only waste or fallow lands that were previously lying unused. Some farmers cultivated jatropha as fences around the crop lands. Some farmers in Rajasthan and Chhattisgarh did express concern about the loss of grazing land for cattle due to jatropha cultivation, it being an animal deterrent crop. The loss of common grazing land could result in the shortage of fodder and thus could negatively affect the livestock economy in the jatropha growing areas as has been reported in a recent study conducted in Tamil Nadu. A majority of the farmers were of the opinion that the currently available germplasm is low-yielding with long gestation period and the government has to take necessary steps to develop high yielding varieties. They also believe that the full yielding potential of jatropha cultivation would only be realized when adequate irrigation and fertilizers are made available; it presently, is not a profitable proposition due to low prices of jatropha seeds. The ability of jatropha to prevent soil erosion in the hilly terrains was also highlighted. In a nutshell, the farmers considered jatropha not as a major profit winning crop but only a supplementary crop that provided them with additional employment and income, that too with government support during the initial years of establishment.

i. Seed Marketing

The farm-produced jatropha seeds take different routes to reach the processing plants. Largely, three types of actors are involved in this activity; (i) government agents who collect the seeds on behalf of the state bio-fuel boards or government-owned processing plants, (ii) local traders who collect the seeds and then supply to the processing plants or their agents and (iii) corporate agents who collect seeds directly from the farmers.

In the Sikar district of Rajasthan, all the sampled farmers sold the seeds to local traders only (Table 29). In most cases, petty shopkeepers were involved in collection of seeds from the farmers; they either transported them to processing plants or sold to the company agents who procured the seeds in bulk. In some instances, these seeds were even transported to Chhattisgarh to be used in raising nurseries for new planting. In Chhattisgarh, farmers in the Kota block of Bilaspur district sold seeds

Table 29. Various agencies involved in jatropha seed marketing.

	Share of seeds (%) marketed		
State	Government agents	Local traders	Private companies
Rajasthan	0	100 (7.5)	0
Chhattisgarh	50 (6.5)	0	50 (10.0)
Uttarakhand	100 (6)	0	0

Note: Figures within the parentheses indicate prices received for farmers in ₹/kg

to government agents, while those of Marwahi block marketed the seeds to the private company agents. The farmers could get a higher price of ₹ 10/kg for their seeds from the private company, but they got only ₹ 6.50-7/kg when they sold the seeds to the government agents. The State Bio-fuel Boards also used the seeds for both processing and raising new plantations. In Uttarakhand, where the government mediated production was dominant, farmers sold the seeds only to the government agents at a price of ₹ 6/kg. It was noted that in places where local traders were involved in jatropha seed procurement, the marketing margin was considerably high. In Rajasthan, the price at which the processing plant[9] purchased the seeds from traders was around ₹ 12-13/kg, whereas the farmers sold the seeds at the rate of ₹ 7.50 to ₹ 10/kg, depending on the locality. This means that the marketing margin between the farmers and the processing plant was around ₹ 3-5.50/kg. This margin included both the traders' profit and costs on transportation and handling. To avoid this extra margin, some private processing plants were procuring the seeds directly from the farmers by paying a higher price as was the case in Chhattisgarh.

j. Seed Processing and Biodiesel Production

Seed processing infrastructure is one of the key requirements in the jatropha seed-based biodiesel value chain and is presently a major constraint holding back the development of the biodiesel sector in India. In most of the jatropha growing areas, modern processing plants have not come up in sufficient numbers so far. This is because of two major reasons; first, the government intends to bring private participation to build this capacity but the private players visualize potential risks in investing in this area because of uncertainty regarding the supply of sufficient feedstock and market demand for biodiesel. Second, the unavailability of processing capacity is making the farmers to down-scale their production and this poses a threat to even the existing processing plants. The cost of production of biodiesel increases substantially if the units are run under low economies of scale. The problem worsens with increase in the price of seeds due to the involvement of middlemen and higher transportation costs when the seeds are sourced from distant places. To substantiate these points, the cost of production of biodiesel in two processing plants, Rajasthan State Mines and Minerals Ltd. (RSMML) biodiesel plant in Udaipur and Chhattisgarh Biodiesel Development Authority (CBDA) processing plant at Raipur, was compared in the study[10].

The physical and monetary details regarding input requirement per day and corresponding production of biodiesel and other by products in the two manufacturing plants have been presented separately in Table 30. It was observed that the RSMML plant crushed 1 ton of jatropha seeds while the CBDA plant processed 10 tons of seeds with respective jatropha yields of 250 kg and 2730 kg. The cost of biodiesel production in the RSMML facility was around ₹ 40 per kg whereas in the CBDA unit it was nearly ₹ 19 per kg, the difference being significant. However, there were multiple reasons behind the cost difference. In Rajasthan, the cost of seeds at factory gate was around ₹ 12/kg because of the reasons stated above. In contrast, the CBDA unit could procure the seeds at ₹ 6.50/kg directly from the farmers and incurred nominal costs on handling and transportation as sufficient seed was available nearby. In addition, the economies of scale favored the CBDA processing plant in bringing down the cost in comparison with the RSMML plant. The RSMML plant also faced shortage of seeds in spite of the fact that sufficient seeds are produced in Rajasthan, the reason being diversion of seeds for nursery raising under government support. Due to all these constraints, the RSMML plant is on the verge of closure and currently uses the produced biodiesel in the company's own fleet of trucks.

The above discussion makes it clear that if processed at sufficient levels of economies of scale, as in the CBDA processing plant, jatropha based biodiesel is economically viable and can substitute petro-

9 The Rajasthan State Mines and Minerals Ltd. (RSMML) owned jatropha processing plant at Udaipur.

10 In Uttarakhand, a transeterification unit of capacity 50 MT per day oil was established by Uttarakhand Bio-fuel Ltd. (UBL) at Haridwar. However, since the study team could not gain access to their data, details are not presented here.

Table 30. Cost of production of biodiesel in Rajasthan and Chhattisgarh- A comparative study.

	RSMML plant		CBDA plant	
Inputs	Quantity	Value (₹)	Quantity	Value (₹)
Jatropha seeds	1 ton / day	12000	10 tons / day	65000
Unskilled labor	2 man days	300	6 man days	720
Managerial labor	1 man day	450	1 man day	600
Administrative labor	1 man day	250	4 man days	1600
Chemicals				
1. Methanol	60 litres	630	600 litres	6600
2. Sodium hydroxide	2 kg	50	21 kg	540
Electricity	25 units	250	250 units	2500
Interest on fixed capital	@ 10%	650	@ 10%	6800
Depreciation on machinery	@ 10 %	270	@ 10 %	1700
Depreciation on other assets	@ 4 %	440	@ 4 %	2740
Freight and other incidentals		350		6500
Total cost		15640		95300
Revenue from byproducts				
Glycerol	46 kg	1380	467 kg	10274
Oil cake	700 kg	4200	6750 kg	33750
Total revenue		5580		44024
Net cost incurred (a-b)		10060		51276
Recovery of biodiesel	250 kg		2730 kg	
Net cost (₹/kg of biodiesel)		40.24		18.78

diesel, with a current price of ₹ 18-20 per litre sans taxes. The technology would prove more profitable in the event of further hikes in price of crude oil, the probability of which is very high. However, it is mandatory to build up the necessary infrastructure in places where the feedstock crops are growing well and where a future potential is visible. In this context, the private sector has a major role to play. Several private companies like Nova Bio fuels, Panipat; Emami Biotech, West Bengal; Universal Bio fuels, Andhra Pradesh; Royal Energy, Mumbai and many others have already shown their presence in the field. A demand pull arising out of mandatory blending requirement can be a strong stimulus to such initiatives. The next section outlines the current state of affairs regarding the identified biodiesel distribution chains in India in general and in the selected states in particular.

k. Biodiesel Distribution

Presently, the biodiesel distribution does not follow any well-developed supply chain even though several public sector undertakings and private companies have ambitious plans to enter into the sector in a big way. As of now, the consumers of biodiesel in the country include Indian Railways, Defence Research and Development Organization (DRDO), state road transport corporations, and some private companies. Other than this, local consumption in tractors, trucks, diesel pump sets, etc, is also prevalent. Public sector oil marketing companies (OMCs) like Hindustan Petroleum (HP), Bharat Petroleum (BP), IOC and ONGC are in the process of setting up extensive network of bio fuel distribution chains. However, presently they are concentrating more on developing jatropha plantations through contract farming arrangements with local governments and farmers. Some

efforts for establishing commercial tie-ups with private companies for setting up processing capacity are also underway. The Indian Railways have started using 5% blend of biodiesel in narrow gauge engines. A separate body 'Indian Railways Organization for Alternate Fuels' (IROAF) instituted under the Indian Railways is building networks with potential biodiesel suppliers such as Southern Online, Hyderabad and Royal Energy, Mumbai. Several state transport corporations such as Andhra Pradesh State Road Transport Corporation (APSRTC), Navi Mumbai Municipal Transport Corporation (NMMTC), Uttar Pradesh State Road Transport Corporation (UPSRTC), and Calcutta Tramways Company Ltd, have also started blending biodiesel with HSD in their fleet of buses. The Kolkata Police Department has tied up with Emami Biotech for regular supply of biodiesel to be used in their wireless fleet.

An account of the status of bio fuel distribution in the selected states is also provided based on the interviews conducted with the various stakeholders in these states. In Rajasthan, RSMML is the only major jatropha oil processing unit, though some smaller oil expelling units are also working locally. RSMML utilizes the produced oil only in its fleet of trucks due to lack of cost-effectiveness in production. The Rajasthan State Road Transport Corporation (RSRTC) is sourcing biodiesel from some local small-scale biodiesel units to conduct pilot runs in their buses. Along with this, some farmers are using Straight Vegetable Oils (SVO) made from jatropha in their tractors and diesel pumps. The CBDA processing plant in Chhattisgarh is supplying the biodiesel produced in its unit to the Indian Railways, DRDO, Mahindra and Mahindra Ltd. and some transport companies within the state. Some village electrification committees based in Chhattisgarh are also using biodiesel to cater to the local electricity needs. In Uttarakhand, commercial use of biodiesel is yet to be started. Currently, it is only used for meeting local energy needs.

Addressing the constraints

The above discussion makes it clear that the development of a commercial biodiesel industry based on jatropha and other non-edible oilseeds is at a very nascent stage in India at present. The farm surveys have suggested that the farmers are not happy with the current yield of the crop. To address this constraint, identification of superior germplasm with high-yield potential through systematic varietal improvement programs is a pre-requisite to large-scale planting. A centrally coordinated breeding program that replaces the current piecemeal approach in research can pay high dividends. It is also widely felt that jatropha is not a fully domesticated crop and cannot be grown successfully in all kinds of marginal lands. Unscrupulous planting irrespective of the geographical and climatic contours can only sabotage the program. Most of the jatropha growing farmers being marginal, smallholder or resource-poor, initial support in the form of subsidized seedlings and other inputs, technical assistance, buy-back assurance, minimum support price (MSP), etc, is of utmost importance for the success of biodiesel production. Premature withdrawal of support facilities may also boomerang the program. Economic viability of jatropha plantations is critical in retaining the interest of the farmers. Higher prices of seeds are being realized presently because of their demand for seedlings for new planting. However, once this phase is over, there is every chance of prices going down unless a jatropha seed market with both backward and forward integration is evolved. The probability of the program to topple would be higher if this transformation does not happen in course of time. The promoters of this industry, including various government organizations, OMCs, private enterprises, and NGOs seem to be concentrating too much on increasing the area under the crop. But simultaneously, it is also vital to develop stable supply chains so that the feedstock produced is effectively marketed, processed and brought to the end-users. Even though some progress has been made in terms of area coverage, the processing infrastructure is way less than optimal. Moreover, most of the existing processing facilities are working under sub-optimal capacities. An area-wise critical assessment should precede investing in processing infrastructure so as to fully utilize the economies of scale in processing. Also, a demand pull for biodiesel is lacking due to which distribution channels are not well defined. Since

cost-effectiveness of biodiesel also depends on the revenue from its by-products such as oil cake and glycerine, simultaneous expansion of by-product markets is also equally important.

Conclusions

It is too early to judge the success of India's bio fuel program though it was launched seven years ago. There are too many unknowns at this stage, particularly about the jatropha based biodiesel program. Still, farm studies suggest that jatropha is a profitable crop in the long-run, provided government support in the form of input subsidies and technical and marketing assistance is made available during the initial few years. The farmers consider jatropha as a supplementary crop that can augment their income and employment to a certain extent but are also concerned about the uncertainty regarding its yield potential, long-term economic viability essentially linked with a sustained demand for seeds, undesirable externalities like loss of common grazing land, etc. On the seed processing front, biodiesel can compete with petro-diesel if the processing plants are operated at sufficient economies of scale. This can be realized by ensuring a stable supply of feedstock and consistent market demand of biodiesel and its by-products. Proper backward and forward integration at each level of the supply chain is therefore crucial in making the biodiesel industry operate at an economically viable scale. So far, the participation of the corporate sector in developing the processing infrastructure and distribution channels has been feeble. Necessary steps have to be taken to bridge this gap. A centrally co-coordinated mechanism to supervise research, extension, development of processing and market infrastructure and various other assistance programs should replace the existing piecemeal approach. Legal provisions to check a possible breach of jatropha area towards food crops is also worth considering. To conclude, proactive orientation of all the stakeholders is critically important in sustaining the momentum of the program.

Chapter 5

Profitability Indicators for Agro-based Value Chain Companies

Profit is the driving force for sustainability of continuous participation of all stakeholders in the continuous up-gradation of the value chain. Profitability indicators for companies involved in food value chains is presented in Table 31 and the profitability of major food value chain companies is presented in Table 32, which indicates, that the companies with global presence (HLL, Britannia, ITC, etc) are highly profitable, while companies with local presence such as Heritage are not so profitable. The companies involved in supporting activities like credit (SKS Micro-finance) are also highly profitable, which indicates the scope for expanding activities in these areas.

Table 31. Profitability indicators of firms in value chain.

Indicators of profit	Weaknesses and strengths	Data sources
Margins on sales (gross profit/net sales) (operating income/net sales)	Sales margin is generally slimmest when value added is thinnest; it is a good indicator of operating profit margins, but it ignores capital invested in the business	Interview with finance function in firms; balance sheets
Return on net assets (net income/net assets)	Takes account of equity and loans and payment schedules to debtors and creditors	Balance sheets
Return on equity (net income/equity)	Ignores leverage through the use of loans or payment schedules to debtors and creditors	Balance sheet
Share of total value chain profit	It is a good indicator of profitability of a firm if it involves only in specific businesses	Balance sheets and interviews with finance function in firm

Table 32. Profitability indicators of companies in food value chain in India.

Profitability indicator	HLL	Britannia	ITC Agro-Tech	Heritage	SKS Micro-finance
Operating margin (%)	15.7	6.0	4.0	5.7	56.5
Gross Profit Margin (%)	14.7	4.9	3.5	3.5	55.5
Net Profit Margin (%)	12.3	3.4	3.8	0.6	18.1
Return on Net worth (%)	85.3	29.4	16.7	6.5	18.4
Return on equity (%)	106.8	24.7	21.3	16.1	16.2

A financial ratio (or accounting ratio) is a relative magnitude of two selected numerical values taken from an enterprise's financial statements. Often used in accounting, there are many standard ratios used to try to evaluate the overall financial condition of a corporation or other organization. Financial ratios may be used by managers within a firm, by current and potential shareholders (owners) of a firm, and by a firm's creditors. Security analysts use financial ratios to compare the strengths and weaknesses in various companies.

Profitability ratios

Profitability ratios measure the company's use of its assets and control of its expenses to generate an acceptable rate of return. Before proceeding to understand various measures of firm performance, this section provides a brief introduction of definitions used for measuring the indicators. Various abbreviations may be used in financial statements. Sales reported by a firm are usually net sales, which deduct returns, allowances, and early payment discounts from the charge on an invoice. Net income is always the amount after taxes, depreciation, amortization, and interest, unless otherwise stated. Otherwise, the amount would be Earnings Before Interest and Taxes (EBIT), or Earnings Before Interest, Taxes, Depreciation, and Amortization Ratios (EBITDA). Companies that are primarily involved in providing services with labor do not generally report "sales" based on hours. These companies tend to report "revenue" based on the monetary value of income that the services provide. Note that Shareholder's Equity and Owner's Equity are not the same thing, Shareholder's Equity represents the total number of shares in the company multiplied by each share's book value; Owner's Equity represents the total number of shares that an individual shareholder owns (usually the owner with controlling interest), multiplied by each share's book value. It is important to make this distinction when calculating ratios. Cost of goods sold (COGS) is sales value in a year. Profitability ratios measure the company's use of its assets and control of its expenses to generate an acceptable rate of return, Gross margin, Gross profit margin or Gross Profit Rate.

Gross margin: Gross profit margin or Gross Profit Rate

$$\frac{\text{Gross Profit}}{\text{Net Sales}}$$

OR

$$\frac{\text{Net Sales} - \text{COGS}}{\text{Net Sales}}$$

Operating margin, Operating Income Margin, Operating profit margin or Return on sales (RoS)

$$\frac{\text{Operating Income}}{\text{Net Sales}}$$

(Note: Operating income is the difference between operating revenues and operating expenses, but it is also sometimes used as a synonym for earnings before interest and taxes (EBIT) and operating profit.)

Profit margin, net margin or net profit margin

$$\frac{\text{Net Profit}}{\text{Net Sales}}$$

Return on equity (ROE)

$$\frac{\text{Net Income}}{\text{Average Shareholders Equity}}$$

Return on investment (ROI ratio or Du Pont Ratio)

$$\frac{\text{Net Income}}{\text{Average Total Assets}}$$

Return on assets (ROA)

$$\frac{\text{Net Income}}{\text{Total Assets}}$$

Return on assets Du Pont (ROA Du Pont)

$$\left(\frac{\text{Net Income}}{\text{Net Sales}}\right)\left(\frac{\text{Net Sales}}{\text{Total Assets}}\right)$$

Return on Equity Du Pont (ROE Du Pont)

$$\left(\frac{\text{Net Income}}{\text{Net Sales}}\right)\left(\frac{\text{Net Sales}}{\text{Average Assets}}\right)\left(\frac{\text{Average Assets}}{\text{Average Equity}}\right)$$

Return on net assets (RONA)

$$\frac{\text{Net Income}}{\text{Fixed Assets + Working Capital}}$$

Return on capital (ROC)

$$\frac{\text{EBIT (1–Tax Rate)}}{\text{Invested Capital}}$$

Risk adjusted return on capital (RAROC)

$$\frac{\text{Expected Return}}{\text{Econimic Capital}}$$

OR

$$\frac{\text{Expected Return}}{\text{Value at Risk}}$$

Return on capital employed (ROCE)

$$\frac{\text{EBIT}}{\text{Capital Employed}}$$

Note: The ROCE is somewhat similar to (ROI), which calculates Net Income per Owner's Equity

Cash flow return on investment (CFROI)

$$\frac{\text{Cash Flow}}{\text{Market Recapitalization}}$$

Efficiency ratio

$$\frac{\text{Non-interest expense}}{\text{Revenue}}$$

Net gearing

$$\frac{\text{Net Debt}}{\text{Equity}}$$

Basic Earnings Power Ratio

$$\frac{\text{EBIT}}{\text{Total Assets}}$$

Liquidity ratios

Liquidity ratios measure the availability of cash to pay debt.

Current ratio (Working Capital Ratio)

$$\frac{\text{Current Assets}}{\text{Current Liabilities}}$$

Acid-test ratio (Quick ratio)

$$\frac{\text{Current Assets} - (\text{Inventories} + \text{Prepayments})}{\text{Current Liabilities}}$$

Cash ratio

$$\frac{\text{Cash and Marketable Securities}}{\text{Current Liabilities}}$$

Operation cash flow ratio

$$\frac{\text{Operating Cash Flow}}{\text{Total Debts}}$$

Activity ratios (Efficiency Ratios)

Activity ratios measure the effectiveness of the firm's use of resources.

Average collection period

$$\frac{\text{Accounts Receivable}}{\text{Annual Credit Sales} \div 365 \text{ Days}}$$

Degree of Operating Leverage (DOL)

$$\frac{\text{Percent Change in Net Operating Income}}{\text{Percent Change in Sales}}$$

DSO Ratio

$$\frac{\text{Accounts Receivable}}{\text{Total Annual Sales} \div 365 \text{ Days}}$$

Average payment period

$$\frac{\text{Accounts Payable}}{\text{Annual Credit Purchases} \div 365 \text{ Days}}$$

Asset turnover

$$\frac{\text{Net Sales}}{\text{Total Assets}}$$

Stock turnover ratio

$$\frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Receivables Turnover Ratio

$$\frac{\text{Net Credit Sales}}{\text{Average Net Receivables}}$$

Inventory conversion ratio

$$\frac{365 \text{ Days}}{\text{Inventory Turnover}}$$

Inventory conversion period (essentially same thing as above)

$$\left(\frac{\text{Inventory}}{\text{Cost of Goods Sold}} \right) 365 \text{ Days}$$

Receivables conversion period

$$\left(\frac{\text{Receivables}}{\text{Net Sales}} \right) 365 \text{ Days}$$

Payables conversion period

$$\left(\frac{\text{Accounts Payables}}{\text{Purchases}} \right) 365 \text{ Days}$$

Cash Conversion Cycle

Inventory Conversion Period + Receivables Conversion Period - Payables Conversion Period

Debt ratios (leveraging ratios)

Debt ratios measure the firm's ability to repay long-term debt. Debt ratios measure financial leverage

Debt ratio

$$\frac{\text{Total Liabilities}}{\text{Total Assets}}$$

Debt to equity ratio

$$\frac{\text{Long-Term Debt + Value of Leases}}{\text{Average Shareholders Equity}}$$

Long-term Debt to equity (LT Debt to Equity)

$$\frac{\text{Long-term Debt}}{\text{Total Assets}}$$

Times interest-earned ratio / Interest Coverage Ratio

$$\frac{\text{EBIT}}{\text{Annual Interest Expense}}$$

OR

$$\frac{\text{Net Income}}{\text{Annual Interest Expense}}$$

Debt service coverage ratio

$$\frac{\text{Net Operating Income}}{\text{Total Debt Service}}$$

Chapter 6

Conclusions and Summary

In the previous sections, we have presented some concepts and practical implications of value chains. The aim of value chain analysis is to identify constraints and opportunities for value chain development. Under the HOPE project, we have selected regions where there is scope for expansion of pearl millet and sorghum value chains for the benefit of smallholder farmers and also poor consumers. According to this view, in addition to meeting the low-end segments like feed, raw material for alcohol industry at competitive prices, the HOPE project should also focus on providing value-added products and try to promote their commercialization with adequate technical, financial and infrastructure support.

It is to be noted that the farming communities themselves with the support of state agricultural universities and the private sector should have the driving role in determining the appropriate levels of investment in value chains (with HOPE project team at ICRISAT as facilitator). The role of the state sector should be in providing an enabling and facilitating environment for all stakeholders. A supply driven approach, typical of most development projects is unlikely to be successful in bringing the necessary linkages and transformation of agriculture required for commercial agriculture. A demand-driven approach recognizes that commercial stakeholders need to develop their capacity of making investment decisions in order to learn how best to adapt and innovate in a changing environment. Having commercial stakeholders in the driving seat of project investment decisions is also consistent with the policy changes that have happened in the 1990s, namely the adoption of a more market-oriented approach and the emphasis on participatory planning and decentralization.

One approach to commercialization would be to list the constraints to development of value chains and then make the efforts needed to alleviate those constraints. For example, limited access to modern inputs would imply provision of modern inputs and demonstrations. If successful, this approach might perhaps induce some crop diversification and increase the marketed surplus of some farmers and their income. However, their level of commercialization would not necessarily be different from the one currently in place. If the objective is to move one step-further in the path towards higher levels of value chain, a different approach is needed. Such an approach could be to take the current situation of already commercialized farmers (organized as smallholder farmer groups or cooperatives), trade associations and agro-enterprise associations and facilitate them to move further along the value chain. In order to do so, there needs to be a provision of institutional mechanisms for these organizations to express their needs for technology, information, capacity development and infrastructure that would raise their business from its current level to a higher level. The expectation is that this change of approach will build ownership, address demand and facilitate the emergence of effective stakeholder networks and market linkages in the entire value chain.

The training material has attempted to examine the concepts of value chain and benefits that could accrue to the producers from the institutional innovations that link production with marketing. The following conclusions are drawn from the review and empirical analysis. Institutional innovations linking producers to markets reduce transaction costs to the producers significantly. The extent of decline, however, depends on the nature of commodity, and its frequency of transactions. The transaction costs are higher for highly perishable commodities with greater frequency of sale (milk, multi-cut vegetables, egg, spinach), compared to the commodities that are less perishable with low sale frequency (like coarse cereals).

Institutional innovations do not influence much the production costs. Nevertheless, by reducing transaction costs they improve farm profitability substantially. Transaction costs are higher for small producers, and they are the most benefited from institutional innovations be it in the form of contract farming or cooperatives or producers' association.

Institutional innovations allocate production and price risks between the contracting firm/agency and the farmer. In general the production risks are borne by the producers. Some schemes, however, share a part of production risks as in the case of broilers, wherein the risk of limited mortality is borne by the firm. Nevertheless, the firms help producers minimize production risk by providing them management and technical advice. The allocation of price risks depends on the nature of commodity and its frequency of sale. Contract farming schemes are often blamed for their bias against small producers. Evidences from the selected case studies are mixed.

Another criticism against contracting firms is their tendency to extract monopsonistic rent from the producers because of the perishable nature of the commodities and farmers immediate need for the cash (Gulati et al. 2006). This does not get any empirical support from our case studies. There is little if any difference in the prices realized by the contract and independent producers. In fact, firms like Nestle and Reliance pay a premium price to the producers to maintain a steady supply of raw material. The producers, except in cases where the firm shares most of the production costs, are free to sell their produce to anyone offering better prices. But, no opportunistic tendency has been observed among the producers probably because of long standing relationship between the producers and the firms.

Many contract farming schemes provide credit to small producers to ease out the capital constraint in value addition. Some critics argue that by doing so the firm makes producers excessively dependent on it for credit, and keep them in perpetual indebtedness as to have a control over their production and marketing decisions. Some of the criticisms arise out of theoretical perceptions and apprehensions, and lack empirical support.

Several policy implications emerge from this study. First, the firms by assuming the marketing functions contribute towards developing organized markets for value added products, which hitherto are thin and fragmented. In this way the firms help producers to avoid exploitation from a host of marketing intermediaries, and improve farm profitability.

Second, most of the institutions provide free extension and support services to the producers as a part of contract. In recent years, the public extension system has been criticized on account of its inefficiency in delivery of service and rising burden on public exchequer. Thus, promotion of institutions like contract farming could facilitate the process of privatization of public extension services at no cost to the public exchequer.

Third, in order to get raw material of desired quality for processing, many private firms undertake research activities. Though until recently the private sector's contribution to agricultural research has remained limited, development of agribusiness activities is expected to improve the interface between private and public sector research.

Fourth, some contracting schemes provide credit and insurance (in terms of risk sharing) facilities to the producers. Such provisions are mutually beneficial particularly when the market for these instruments is under-developed and imperfect. The firm gets an assured supply of raw material, and the producers have easy access to credit and are insured against income shocks due to price fluctuations. Besides, both the parties face reduced costs of transaction. Many firms are hesitant to make these provisions because of lack of legal structure governing contract schemes. For instance, in most of the contract schemes output price is left indeterminate because forward contracting is not allowed in many agricultural commodities.

Fifth, value addition in agriculture is labor intensive, and its promotion through institutional innovations generates opportunities for employment to millions of producers. Its multiplier effects are much larger. Integration of production with marketing, processing and distribution creates employment and income generating opportunities not only in the food industry but also in the industries supporting agriculture and food industry.

Sixth, for many firms vertical integration is a means of sustaining/improving the export earnings and therefore it contributes towards improving the exports of value added items. In this pursuit, the firms keep on improving the quality of the product right from the stage of production to packaging, and thus educate producers about the quality issues such as SPS that are becoming important in international trade. In contract farming it is therefore necessary for the central government to develop guidelines for formulating policies for contract farming by the states under whose jurisdiction the subject of agriculture falls. Contract farming should be legalized so as to protect the interests of both the producers and consumers.

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About ICRISAT

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International Crops Research Institute for the Semi-Arid Tropics

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The **International Crops Research Institute for the Semi-Arid Tropics** (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, of whom 644 million are the poorest of the poor. ICRISAT innovations help the dryland poor move from poverty to prosperity by harnessing markets while managing risks – a strategy called Inclusive Market-Oriented Development (IMOD).

ICRISAT is headquartered in Patancheru near Hyderabad, Andhra Pradesh, India, with two regional hubs and five country offices in sub-Saharan Africa. It is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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