CHAPTER – V

MAIZE VALUE CHAIN ANALYSIS

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CHAPTER – V

MAIZE VALUE CHAIN ANALYSIS

The main purpose of this chapter is to systematically portray and analyze the framework of value chain. A comprehensive attempt has been made to analyze the different forms of value chain. The chapter is divided into two parts for proper presentation of the fact. Part A describes the theoretical framework of value chain, value chain activities, and drivers in forming an effective agro products value chain. Part B deals with the value chain for maize processing. In this part, an attempt is made to assess the value addition to maize at growers and processors level. Potentiality for the maize processing units in the study area for the next few years is estimated in this chapter.

A. Theoretical framework of value chain

The value chain describes the full range of activities, which are 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 to final disposal after use. Production per se is only one of a number of value added links. Moreover, there are ranges of activities within each link of the chain. Although often depicted as a vertical chain, intra-chain linkages are most often of a two-way nature – for example, specialized design agencies not only influence the nature of the production process and marketing, but also are in turn influenced by the constraints in the downstream links in the chain.
There is a considerable overlap between the concept of a value chain and similar concepts used in other contexts. One important source of confusion — particularly in earlier years before the value chains outlined, became increasingly widespread in the research and policy domain — was one of nomenclature and arose from the work of Michael E Porter in the mid 1980s. Porter distinguished important elements of modern value chain analysis. Different stages of supply (inbound logistics, operations, outbound logistics, marketing and sales, and after sales service), the transformation of inputs into outputs (production, logistics, quality and continuous improvement processes), and the support services the firm marshals to accomplish the task (strategic planning, human resource management, technology development and procurement).

All the value chain functions need not be performed within a single link in the chain, but may be provided by other links (for example, by outsourcing). Porter refers to these essentially intra-link activities as the value chain. Porter complements this discussion of intra-link functions with the concept of the multi-linked value chain itself, which he refers to as the value system. The value system basically extends his idea of the value chain to inter-link linkages.

In essence, therefore, the elements in Porter’s analysis are subsumed by modern value chain analysis. The primary issue is one of terminological confusion. Womack and Jones exacerbate this problem in their influential work on
lean production. They similarly use the phrase value stream to refer to what most people now call the value chain.

Another concept, which is similar in some respects to the value chain, is the filière (whose literal meaning in French is a "thread"). It is used to describe the flow of physical inputs and services in the production of a final product (a good or a service). In terms of its concern with quantitative technical relationships, it is essentially not different from the Porter and Womack and Jones\textsuperscript{12} value stream. French scholars built on the analyses of value added process in US agricultural research, to analyze the processes of vertical integration and contract manufacturing in French agriculture during the 1960s. The early filière analysis emphasized local economic multiplier effects of input-output relations between firms. It focuses on efficiency gains resulting from scale economies, transaction and transport costs, etc.

A third concept, which has been used to describe the value chain, is that of global commodity chains, introduced into the literature by Gereffi\textsuperscript{3} during the mid-1990s. Gereffi's contribution has enabled important advances to be made in the analytical and normative usage of the value chain concept. Particularly, because of its focus on the power relations, which are embedded in value chain analysis. By explicitly focusing on the coordination of globally dispersed, but linked, production systems, Gereffi has shown that many chains are characterized by a dominant party (or sometimes parties) who determine the overall character of the
chain, and as lead firm(s) becomes responsible for upgrading activities within individual links and coordinating interaction between the links. This is a role of 'governance', and here a distinction is made between two types of governances: those cases where the coordination is undertaken by buyers ('buyer-driven commodity chains') and those in which producers play the key role ('producer-driven commodity chains').

Importance of value chain analysis

There are three main sets of reasons why value chain analysis is important in this era. They are:

With the growing division of labour and the global dispersion of the production of components, systemic competitiveness has become increasingly important. Efficiency in production is only a necessary condition for successfully penetrating markets. Entry into markets which allows for sustained income growth – that is making the best of market opportunities - requires an understanding of dynamic factors within the whole value chain.

The growing importance of systemic competitiveness

Adam Smith observed that the division of labour was determined by the extent of the market. By this he meant that small-scale markets allowed for little specialization – the entrepreneur making a small number of chairs employed no one and undertook all the different tasks that were required in making the final product. But as the market expanded, so it became profitable to employ workers,
and to allow each of them to specialize. Smith argued that specialization of task meant that workers did not waste time picking up and putting down their work-in-progress, and allowed them to concentrate on developing their specific skills. Moreover, it also opened the way to the introduction of mechanization, as simple, repetitive tasks were much easier to mechanize than complex tasks.

From the perspective of the production plant, increasing scale meant that the work process could be subdivided into an increasing number of workstations, and the objective of F.W. Taylor’s theories on work organization was to increase the efficiency of each of these workstations through “scientific management” procedures. This approach towards production organization dominated from the 1890s until the late 1970s. It even infiltrated the thinking towards the examples of electronically automated production processes, where new automated machines were seen as “islands of automation”. But, increasingly, the approach towards intra-firm and inter-firm production organization shifted towards a more systemic focus. In the first place, the application of just-in-time principles to production flow made it obvious that striving towards “island-efficiency” often led to bottlenecks and systemic inefficiency. This meant that sometimes it was important to tolerate “inefficiency” at a particular point in the production line to achieve plant-efficiency. For example, the objective of reducing inventories (which we now know is pivotal in achieving competitive production) means that individual workers should only continue working if the next stage in the production process
requires materials; if not, they should stop and avoid “pushing” additional work-in-progress materials on to the next worker which would only lead to the build-up of work-in-progress. In the process, the individual worker might become less “productive”, but the whole system will be operating with lower inventories, greater responsiveness and higher levels of quality.

A second reason promoting systemic thinking was that the use of electronics-based automation technologies in different parts of the plant led to the possibility of coordinating the different machines through EDI (Electronic Data Interchange). And, finally, the need to get products to the market more quickly meant that the historical divide between development, design, production and marketing had to be bridged. Rapid product innovation required that these formerly distinct functions work together in a process of “parallel/concurrent” engineering.

This systemic approach towards intra-firm and intra-firm efficiency began to spill over into thinking about inter-firm linkages during the 1980s. Here, two developments were particularly important. First, Toyota in Japan had shown from the late 1970s that the development of just-in-time, total quality management and continuous improvement procedures within the firm might make no discernible difference towards its own competitiveness unless its various tiers of component suppliers – accounting for 60-70 percent of total product costs – adopted similar practices. It therefore arranged for its first tier component suppliers to ensure that
similar processes were adopted throughout the supply chain. The second major influence here, with its origins in the US, was the development of thinking about core competence. The logic of this is that firms should concentrate on those resources which they possessed which were relatively unique, provided a valuable service to customers and which were difficult to copy, and that they should outsource the remaining competences to other firms in the value chain. This extended the complexity of production, and the consequent need to ensure systemic competitiveness between firms. A Value Chain in its own operations, its own efforts to upgrade and achieve efficiency will be of little effect. The same challenge is true for national or regional economic management, upgrading the performance of individual firms in a region may have little impact if they are embedded in a sea of inefficiency.

Different types of value chains

Building on the concept of governance, Gereffi has made the very useful distinction between two types of value chains. The first describes those chains where a buyer at the apex of the chain plays the critical governing role. *Buyer-driven chains* are characteristic of labour intensive industries (and therefore highly relevant to developing countries) such as agro-processing, footwear, clothing, furniture and toys. The second describes a world where key producers in the chain, generally commanding vital technologies, play the role of coordinating the various links – *producer-driven chains*. Here producers take responsibility for assisting the efficiency of both their suppliers and their customers. In more recent work, Gereffi
has pointed out that producer-driven chains are more likely to be characterized by Foreign Direct Investment (FDI) than are buyer-driven chains (Gereffi, 1999). He also argues that each of these different types of value chain is associated with different types of production systems. More contentious is the suggestion that producer driven chains are a reflection of the old “import substituting industrialization order”, whereas buyer-driven chains are more attuned to the outward-oriented and networked production systems of the 21st century.

In most value chains there are multiple points of governance. (in all three areas of legislative, judicial and executive governance). At any one point in time, a number of different parties may be setting rules (which may differ in nature), auditing performance and assisting producers to achieve the required standards. These parties may be from within the chains themselves or in the local community or in business associations. There may thus be overlaps between vertical and horizontal form governance.

The intangibles are to be found in all links – for example, the control of logistics in the production phase, the conceptual phase in advertising. But certain links in the value chain are particularly rich in intangible activities, such as design and branding, and the coordination of the chain itself.

The shift from producer- to buyer-driven chains is therefore illusory and arises because at this point in the competitive cycle, branding and marketing are becoming increasingly important in many chains. However, a closer examination
of chains will however show a pervasive shift to a wider arena of intangibles and it is because of this that a chain can simultaneously appear to be both buyer- and producer-driven.

Similarly particular product families (for example, toys or clothing) may simultaneously have buyer-driven and producer-driven chains, depending on which intangibles the lead parties dominate.

Value chain and income distribution

In the present study an effort is made to know the income distribution in the maize value chain across the value delivery process. The distributional outcome in the value chains is to be seen in the incomes arising to capital (for its entrepreneurship, risk-taking and ownership of technology), labour (for its effort), and to the owners of natural resources (for their command over inputs which arise as gifts of nature) in each of the links in the value chain.

The key to understanding distributional outcomes is to be found in a focus on the incomes, which are sustained in different parts of the chain, rather than on profits. These may be computed by the ratio of “output” to employment. But, in this case, it needs to focus on the value added (that is output value minus input costs) rather than the gross value of sales/exports in each link of the value chain. The reasons for this are obvious – for example, a buyer near the apex of the value chain may account for only a small portion of total chain value added, but will have a very large share of the value of turnover.
However, although the "average" incomes sustained in any particular link in the chain may help in mapping the location distribution of returns (for example, those between horticultural growers in India and those in a rich countries retail sector), it does little to tell us about the distributional outcomes within any particular link of the chain or any particular location. These incomes therefore need to be decomposed, and here which decomposition is involved reflects the focus of enquiry. For example, it may be what economists call a functional decomposition (between labour and capital), or perhaps a gender division, a mapping of age-related earnings, ethnic earnings, or the division between skilled and unskilled workers.

**Determinants of income distribution in value chain**

After mapping the incidence of income distribution, it is necessary to understand the determinants of income distribution. This requires a focus on rents and barriers to entry. Where the levels of competition are high, incomes are under threat. The only way in which income growth can be sustained is through an enduring barrier to entry or - where barriers to entry are transient - by the firm.

Value chain analysis provides a direct line of entry into identifying the nature and extent of these barriers to entry along the chain. By focusing on the nature of entry barriers in each of the links, as well as on the coordination of inter-link activities. It also provides a perspective for focusing on the dynamics of entry barriers, and carries the perspectives on core competences and dynamic
capabilities considerably further forward by also considering the rents, which accrue from inter-firm relationships. This may be referred to as “endogenous” rents or entry barriers, that is, those created directly by participants in the value chain itself.

But there are also a series of entry barriers, related to value chain dynamics, but which are largely exogenous to the activities of the chain. For example, firms in a particular locality may gain from “externalities”, that is, from the presence of other firms or skills, which aids their efficiency. Recognition of the importance of the industrial districts has grown in recent years, not just in relation to richer countries but also in developing countries (Nadvi and Schmitz, 1999)\(^7\). A second type of exogenous entry barrier lies in the realm of trade policies, either by protecting producers from import competition, or by providing preferential access to final markets.

However, the distinction between determinants to barriers to entry, which are endogenous and exogenous to the chain, is not as clear as it might seem. In many cases, purposeful action by influential chain participants might result in the establishment of exogenous entry barriers – for example, firms may lobby for protection, or may pressure local governments for better infrastructure. Similarly, exogenous factors may lead to the creation of endogenously-determined entry-barriers – for example, efficient government may introduce policies which assist
firms to develop dynamic capabilities, engage in supply chain development activities or to reposition themselves in the chain.

**Generic value chain structure**

Value chain analysis is a strategic tool for assessing the value addition to a product right from its raw material stage to end use level. Raw materials supply, production, marketing and consumption stages are different activities, scattered into different geographical locations. At times, these activities may be in different countries also. Certain stages in the value chain add more value to the final product. Generally, the income generated by production, processing and marketing activities in the value chain depends on the amount of value added by these activities. Value delivery in the value chain is an integrated process. Success or efficiency of an activity in the value chain depends on the efficiency of its upstream and downstream activities.

Value chain analysis can be used to assess the income and employment distribution at different stages and regions. Each activity in a value chain is a hub for creating income and employment. Policy makers at Government level may consider regional development programs based on value chain analysis.

According to Michael Porter, value chain analysis as a strategic system consists primary and supportive activities. This holistic approach, gives a better insight for analyzing the cost and benefit received at different stages and also core-competency of the chain.
Value chain analysis is a means of segregating various activities of a business and identifies them with respect to their contribution towards value generation by identifying the cost i.e., inputs consumed by that activity and the output generated out of that activity. Traditionally, value chain consists of two kinds of activities classified as primary and secondary activities. The primary value chain analysis is a tool for identifying potential comparative advantages. The value chain provides the form with a comprehensive framework for
systematically searching for ways to provide superior value to the customers. Every firm is a collection of activities that are performed to design, produce, market, deliver and support its products. The value chain can be desegregated into nine primary and support activities. Such a division can help a firm to understand existing and potential sources of advantage as also low value or redundant activities or processes. The nine activities consist of five primary activities and four-support activities.

1. The Primary Activities: They represent the sequence of bringing materials into business, operating on them, sending them out, marketing them and servicing them. The primary activities comprise of the following:

   - Inbound logistics (Sourcing and purchase)
   - Operations (Manufacturing and allied activities)
   - Outbound logistics (Distribution and logistics for product delivery)
   - Marketing and sales (Communicating and persuading customers)
   - Services (After sales service)

2. The Support Activities: The secondary activities comprise of the following:

   - Firm infrastructure (Covering the overhead of general management, planning, finance, accounting, legal and government affairs borne by all primary and support activities).
• Human resource management (Provides and manages human resources across the organization)

• Technology development (Develops means to make the existing operations more efficient and also contributes to newer means to deliver customer value).

• Procurement (Involves procuring resources other than raw material and utilities to carry out primary and secondary activities).

Three key elements of value chain

Value chain analysis rests upon three key elements. These elements determine the income distribution across the different activities in the chain. The three key elements are\textsuperscript{10},

1. Entry barrier and dynamic rent
2. Value chain governance
3. Systemic efficiency

Dynamic rent

Generating dynamic rent in value chain through entry barriers is nothing but producers manipulating the rent through core competency and uniqueness as the common strategy. Both endogenous and exogenous factors are responsible for establishing entry barriers and rent.
**Value chain governance**

Supervising and regulating the various activities in the value chain for effective coordination is also more important. Framing rules and guidelines, ensuring that there is a perfect coordination among various activities is necessary for smooth flow of products and also proper distribution of income among the activities. There are different types of governance – judiciary, executive and legislative governance. These supervisory functions decide who has to play which role so that there will be coordination all along the chain.

In case of maize processing, value chain governance involves deciding the activities at different stages of the chain. Important value chain activities in the maize value chain are growing, procurement, shipment to factories through intermediaries, production or processing of maize by using dry or wet milling operation, shipment of main and by products of maize to tertiary processing through marketing intermediaries and marketing services. These sequential and logical steps with necessary governance minimize the wasteful activities in the maize value chain is the judiciary governance i.e., policy makers need to decide and encourage each activity. Since agro-based food industries are resources based industry, it would be more advantageous, if the production or processing units gets located near the resources. Processing of maize is an important activity in the maize value chain. It contributes more value to the chain, and consequently more income is received by the factors of production at this stage. The judiciary governance in the maize value chain directs the location for establishing different
activities of the chain. In turn, it insists on the rural industrialization to minimize the gap between industrially developed and backward regions.

Maize industry creates opportunity for several other ancillary units in the region. Therefore, executive governance acts as an exogenous influencer on maize value chain. As explained by the Porter in his Porter Dimond, a manufacturing unit creates opportunity for several other units, such as raw materials, physical resources, knowledge resources, capital resources and infrastructure.

According to Porter\textsuperscript{11}, competitive advantage of a region to produce a product more advantageously depends on factors condition, firm strategy, structure and rivalry, demand conditions, related and supporting industries etc. The figure given below shows the elements of Porter Diamond.

\textbf{Figure - 5.2: Porter's diamond structure}

Systemic efficiency

The emerging value chains find their basis in the systems concept of value delivery. The corporate no longer look upon the activities performed by them as the only activities that lead to value generation. The process of value delivery extends beyond the value chains of the individual firms. The concepts of value system entails the process of conversion of resources i.e. inputs to the outputs i.e. products or offerings resulting out of value addition. These outputs serve as inputs for the stakeholders value chain. The stakeholders may consist of customers, suppliers, shareholders and even other participants to business such as government, publics etc. Such interactions are greatly facilitated by the bridges built by advances in information technology. The integration of information’s systems of suppliers and customers along with the firm’s information systems greatly facilitates the operations. The reaction time has been reduced, so have the levels of inventories resulting into immense savings without tradeoff in the efficiency of the business operations. Often managers are tempted to look at the individual aspects of value delivery. Systems approach affirms the impact on value addition viewed in totality, accruing from a holistic viewpoint. This might call for a trade off in costs.

In order to make the best use the specialized operations of each participant to the process of value chain, firms have realized the leverages accruing of outsourcing operations and concentrating on integration of the process and performance of those activities that provide long-term competitive advantage to
the firms. Such activities may consist of brand building, making marketing more efficient etc. It is noteworthy that even the suppliers are not left behind in reaping the advantages accruing of such an arrangement. For them, their operations become the core activities and their capability to perform them in best of their ability lends them the desired competitive advantage.

Critical dimensions of agro-products value chain

More tightly aligned supply or value chains from genetics through producers and processors to end-users and consumers increasingly characterize the agricultural sector. The adoption of supply chain and qualified supplier approaches in the agricultural sector is a relatively new phenomena; understanding some of the critical dimensions of a supply or value chain will help to understand the implications of this new way of organizing the food production and distribution system.

The fundamental concept of a supply or value chain is to explicitly specify the value creating activities in the production-distribution process, and to provide an explicit structure for the linkages among these activities or processes. For example, in the grain and oilseed production and distribution industry, the value chain might have the activities or processes and the participants depicted in below figure 5.3. Thus, the first task in specifying a value chain is to identify the processes or activities that are necessary to create the attributes or products that will be demanded or used by the end-user or consumer.
The second critical dimension of a value chain is the specification of the product flow features of the chain. These features would include the transportation and logistics necessary to move products between processes. The details of flow scheduling to make sure that products are available at various stages of the process without accumulating excessive inventory, the enhancement and maintenance of various quality attributes, and the full utilization of plant and equipment in all stages of the value chain to reduce down-time or bottle-necks. At the same time, a critical issue in managing the product flow in a supply chain is managing slack or flexibility to accommodate unexpected interruptions or events. Concepts of statistical process control, inventory management, and logistics management are critical to understand the product flow dimension of a value chain.

The third important dimension of a value chain is the financial or cash flow across the participants and processes. Recent development of electronic funds transfer technology has improved the efficiency of financial and funds flow compared to earlier systems of billing and check writing. An additional element of this dimension is the sharing of financial performance information across the stages or processes and participants in the chain. Such information is typically presumed to be proprietary in nature, but more open sharing of financial information between chain participants may be critical to improving the financial and physical performance of that chain.
A fourth critical dimension of a value chain is the information flow across the chain. Important elements of this dimension are the accuracy of messages (whether messages are signals or noise), the strength of these messages, the cost of messaging, the speed of transmitting and receiving messages, and the openness to sharing rather than retaining critical information among participants. The information flow characteristics of a chain are becoming increasingly critical to its performance.

A fifth important dimension of a value chain is the incentive systems that are in place to reward performance and share risk. Such systems might include price premiums, profit sharing, minimum pricing arrangements, window contracts, cash flow or financial assistance contracts, loan guarantees, qualified supplier recognition programs, cost sharing arrangements, long-term commitments, and knowledge or market access. Increasingly, the conflicts encountered with more rigid contract and similar incentive systems that do not adjust with market conditions and development of more flexible incentive systems such as contribution based percentage sharing of final product gross revenue.

A sixth and final dimension of a value chain is the chain governance / coordination system. Alternative governance or coordination systems might include open access markets and various forms of contracts, strategic alliance, and joint ventures, franchising arrangements, networks, cooperatives and vertical ownership. The choice of governance / coordination system will have a significant
impact on who has power and control in a value chain and how risks and rewards are shared.

The figure given below provides a visual presentation of the six critical dimensions of a agro products value chain.

**Figure – 5.3: Critical dimensions of a value chain for agro produces**

![Diagram of value chain](image)


*Drivers for formation of tightly aligned supply / value chain*

The fundamental drivers of more tightly aligned supply or value chains in the food production / distribution industries are four fold: demand and consumption, productivity and technology, government regulations and policies, and resources.

1. **Demand and consumption**

Consumers are becoming more discriminating in the food products they consume; different consumers want different characteristics and they increasingly have the ability to pay for these unique characteristics.
Some of the dimensions of the changing consumption pattern of consumers that are driving the formation of more tightly aligned supply chains are –

1. Healthfulness and safety
2. Taste and variety
3. Convenience and freshness
4. Anytime availability
5. Price and quality
6. International sourcing and selling
7. Origin of product
8. Animal welfare and environment
9. Processing method

2. *Productivity and technology*

Advances in technology in the food production and distribution system are facilitating or enabling the information of more tightly aligned supply chains. These improvements in technology and productivity include –

1. Information technology
2. Biotechnology
3. Monitoring and measuring technology
4. Transportation and logistical technology
5. Environmental technology
6. Economies of scale
7. Efficiencies of specialization
3. **Government regulations and policies**

Changes in the role of governments worldwide to simultaneously reduce subsidies and protection from international competition, and to increase regulation with respect to consumer concerns in resulting in increased pressures to form more tightly aligned supply chains. Important changes in government policy that encourage supply chain formation include –

1. Food safety regulations
2. Reduced farm subsidies
3. Harmonization of trade regulations
4. Increased privatization
5. Shift from market protection to global market access.

4. **Resources**

Finally, the shift in the resources essential to complete in global markets is resulting in pressures to form more tightly aligned supply chains. These resource pressures include –

More sophisticated research and development

1. Increased importance of knowledge and information
2. A more efficient distribution channel
3. A more skilled labor force
4. More sophisticated technology
5. More globally accessible capital and finance
6. Global access to all resources from all locates
Core competencies in chain formation

Forming more tightly aligned supply chain requires skill or competencies that may not be part of the traditional production and distribution systems in the agricultural industries. One means of determining what skills are important is to study the successful supply chains in other industries as. Furthermore, it is quite possible that the more successful supply chains may be formed by those who are less tradition bound, and may be event those from outside the traditional agricultural industries. For example, Wal-Mart has been successful in implementing supply chain concepts in retail merchandising; now they are bringing that same set of skills and competencies to food distribution.

Some of the core competencies that are essential in successfully forming and managing more tightly aligned supply chains include—

- Increased focus on product and process development
- Emphasis on market flexibility to meet changing consumer demands.
- Improved ability to respond and customize products to end-user needs.
- Continued focus on cost control and efficiency.
- More emphasis on risk management.
- Optimization of the logistics and transportation / distribution system.
- A focus on holistic system that integrate the entire supply chain.
- Increased emphasis on quality and quality assurance along the chain.
- More emphasis on information and information sharing.
- Increased skill in negotiation and joint decision-making.
- Development of cooperative / collaborative attitudes and perspectives.
- Capacity to trust and to be trust-worthy.
Therefore, return on factors of production for agricultural produces depends largely on differentiation of product by value addition. Producing quality food grain, proper post harvest management is focused in agriculture for enhancing the produce value. Uniqueness prevents the entry of competitors and creates higher rent for the producer. Crop varieties are widely used in today’s agriculture. In agro-produce value chain, dynamic rent is generated through producing and processing agricultural output as per the requirements of the market. For example in recent years, maize and maize products are used in place of wheat and rice as ingredients in preparing food products.

**Small-scale value addition to agro-products**

Value addition for many of the small-scale / household scale processed foods is apparently impressive. However, the market for these processed foods is location and season / time-specific in addition to ethnic specificity. These seriously limit the width of the market as well as the large-scale processing of the produce. Further, as these processed foods are appreciated and demanded by specific communities at specific periods, branding and associated market professionalism are lacking. Thus scale economies in the high value addition household processed foods are not emerging. However, companies, which have made their name through their brands, for instance, can integrate through buy back arrangements with the producers / gatherers of amla, jamoon fruits and processing them to fruit juice and sell them with their brand name. Upon gaining experience, institutional arrangements can be developed to promote scale processing of ethnic
processed foods made by millets, which are largely anti-diabetic. The table given below shows the small-scale value addition to some agro produces grown in the state.

**Table – 5.1:**

**Value addition in small-scale / household level processing of cereals and millets in Karnataka**

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Product</th>
<th>Cost of raw material (Rs./Kg)</th>
<th>Cost of Processing (Rs./Kg)</th>
<th>Market price of the product (Rs./Kg)</th>
<th>Value addition (Rs./Kg of raw material)</th>
<th>Per cent of value addition over value of raw material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>Rice flakes (Avalakki)</td>
<td>10</td>
<td>02</td>
<td>25</td>
<td>13</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Puri (Mandakki)</td>
<td>08</td>
<td>15</td>
<td>20</td>
<td>10.5</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>Bhathada Aralu</td>
<td>10</td>
<td>04</td>
<td>25</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Pappad (Happala)</td>
<td>10</td>
<td>10</td>
<td>40</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>Wheat</td>
<td>Flour</td>
<td>13</td>
<td>03</td>
<td>20</td>
<td>07</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Maida</td>
<td>15</td>
<td>05</td>
<td>22</td>
<td>07</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Soji (Rava)</td>
<td>13</td>
<td>02</td>
<td>18</td>
<td>05</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Bakery Items</td>
<td>13</td>
<td>05</td>
<td>25</td>
<td>12</td>
<td>92</td>
</tr>
<tr>
<td>Maize</td>
<td>Feed</td>
<td>06</td>
<td>02</td>
<td>10</td>
<td>04</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Soji</td>
<td>06</td>
<td>03</td>
<td>12</td>
<td>06</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Maize flakes</td>
<td>08</td>
<td>05</td>
<td>20</td>
<td>12</td>
<td>150</td>
</tr>
</tbody>
</table>

Source:
2. Cost of processing / preparation excludes the value of raw material lost due to primary conversion, packing, branding, labeling, grading, storing, transportation and other marketing costs.

The table 5.1 shows that, value addition to different agro produces by small scale processing operation varies from 38 to 200 percent. Rice is more viable for small scale processing followed by maize.
B. Value chain analysis for maize processing

Maize value chain consists of a large number of activities namely, growing, processing and marketing of processed products at different markets. Each of these links in the chain has both backward and forward linkages. Seeds, fertilizers, labour, farm technology are the important backward linkages at growers level. Post-harvest management, grading and marketing of raw maize are the forward linkages. Value addition at growers level depends on input cost and output value and the productivity of maize. The production and return on investment at grower’s stage of the maize chain depends on upstream and downstream activities.

Another important stage in the maize value chain is processing of raw maize into different maize and maize derived products. Maize processing consists of primary, secondary and tertiary processing. At primary processing, maize is graded and packed on the basis of quality and variety. Market value of the raw maize at this stage is determined on the basis of primary processing. Therefore, agro produce processing largely depends on the quality and quantity of maize grown by the farmers. Both growers and traders undertake the primary processing.

In the secondary processing, raw maize is converted to different main and by-products. These products are further used in tertiary processing for manufacturing wide variety of food and industrial products. Secondary processing is an important value link activity in the maize value chain. The secondary process involves small-scale maize milling, dry milling and wet milling.
operations. Maize products obtained in the secondary processing are sold in different markets. Floors, flakes, semolina, and grits are sold in consumer market, bakery and food industry. Poultry and animal feeds manufacturer also uses the processed maize products. The starch obtained in wet-milling operations is used by different of industries such as food, pharmaceuticals, paper, textile, hotel, and adhesive industries.

In the maize value chain more physical and market value is added at the secondary processing. Value addition at this stage is an important activity, which helps in effective utilization of surplus maize of the farmers. This stage supports the growers by offering better price and also provides quality products for tertiary food processing units.

Presently, the total quantity of maize grown in the study region is not fully available for secondary processing. The growers hold part of the maize to meet food and seed purposes. The rest is supplied to the market. According to an estimate, maize produced in India is utilized for human consumption (33 per cent), starch and by-products production (9 per cent), poultry feed (46.5 per cent), brewery (0.5 per cent) and animal feed (11 per cent)\textsuperscript{13}. There is no precise data available on the utilization pattern of maize in Karnataka. However, the discussion with farmers and policy makers indicate that only 15 to 20 per cent of maize is utilized in the state for human consumption. The remaining 80 per cent is supplied to processing factories especially poultry and animal feed plants and
starch units. So, more than 70 per cent of the marketable surplus is supplied to the processing units in neighboring states like Maharashtra, Gujarat etc.

Value chain analysis for maize processing is undertaken in this study to assess the processing possibilities of maize. Since maize processing creates direct and indirect employment as well as income generating opportunity in the region. Therefore, it can be a boon for rural people in the state.

*Value links in maize value chain*

The value chain for agro produces varies widely in the form and complexity with the kind of processing performed and the kind of raw material processed. The important linkages in the flow of maize are growers, agro produce traders, processing units, marketing intermediaries for marketing of processed products and final customers.

Maize value chain consists of strategic components and activities involved in the movement of raw maize from growers through the processors to the final customers. At each stage of the chain value is added. Traders and intermediaries are the links between each stage in the chain. The smooth functioning of value delivery through value chain is facilitated by supply chain. Supply chain links both upstream and downstream activities. Upstream activities consist of supply side of the chain and downstream activities are marketing and distribution activities of the chain. The efficiency and effectiveness of an activity in the chain will have impact on both upstream and downstream activities. Therefore, in the
value chain, value addition ability of chain partner is not independent but interdependent. The following are the value partners in the maize value chain.

1) Growers
2) Traders
3) Maize processors
4) Food products manufacturers
5) Marketers
6) Customers

Growers and traders belong to primary industry in the economy. Processors, food products manufacturers and marketers belong to secondary industry. Therefore, maize value chain spreads into primary and secondary sectors of the economy.

Maize growers include large number of small, medium and large-scale farmers. Basically, the growers are scattered into wide geographical area with small landholding. The total production of maize in the study area is 6.93 metric tons. It comes from large number of farmers in an area of 2.12 lakh hectares. Therefore, supply side of the maize value chain is critical task. The total maize production in the study area is more than 50 per cent of the total maize grown in the state. The maize in this region is grown in all the three seasons - Khariff, Rabi and summer.
The production cost is an important determinant of market value of maize. Production cost consists of expenditure on seeds, fertilizers, manures, farm equipments, labour etc. The market value of the maize grown by the farmers is the value addition by them. But, more economic value is added to the maize in the successive stages of the chain. Secondary, tertiary processing, branding and marketing add more value. During the interaction with the growers in the study area, it is learnt that the market price of raw maize at times less than the cost of production. The un-remunerative market price of maize discourages the growers to increase the area and quantity of production. As a result of that, when there is a market glut, growers decrease the production and demand the state government to purchase the marketable surplus with supportive price.

The interaction with the farmers and agricultural officers reveal that there is no significant change in the farm gate price of maize in the last ten years period. The increase in the farm gate price is just negligible. The stagnation of maize price is attributed to the lack of effective maize utilization in the region. Presently, there are only two maize processing units in the state (one small and one large-scale unit). In total there are 17 large and medium-scale units in the country. More than 80 percent of them are concentrated in North Indian states like Gujarat, Maharashtra, and Madhya Pradesh.

In Karnataka, only 5-10 per cent of the maize is processed through large-scale operations, about 40 to 50 per cent is utilized for poultry and animal feed
units. And about 10-15 per cent is used for food purpose. Presently, the large quantity of marketable surplus maize in the study area is sold in other states for processing purpose.

Value chain of maize involves seed selection; cultivation, farm management, post-harvesting, procurement and processing of maize in a factory system and marketing processed products in consumer and industrial market. Processing and marketing of processed products add highest value to the raw maize. Maize processing or milling is a secondary processing, it is an intermediary level in the maize commodity chain. Maize products obtain from the secondary processing (main and by-products of maize) is used to manufacture variety of industrial and food products. Therefore, in the tertiary processing, end use products like bakery products, confectionaries, starch, maize oil, grits, semolina, flakes, animal feeds etc, are produced. In large-scale operation, more variety of starch-derived value added commercial products are produced. Products like ethanol, liquid glucose, maltodextrine, dextrose, sucrose etc. These products are supplied to industries like food, healthcare, pharmaceutical, textile, adhesive, confectionery hotel industries etc.

In medium and large-scale maize processing units the commercial value of the maize is enhanced to its maximum level. The data obtained from existing maize processing units reveal that, the large-scale maize processing units enhance the maize value several fold higher than medium and small-scale processing.
Maize procured from the farmers at a reasonable price of Rs.450 to Rs.500 will become several fold value added products through different stages of processing. The processed products are then used to manufacture maize based products. The activities involved in the maize processing stage are as shown below.

*Stages involved in processing of maize*

- Stage – 1 : Cleaning of maize
- Stage – 2 : Soaking of maize
- Stage – 3 : Grinding of maize
- Stage – 4 : Germ separation
- Stage – 5 : Regrinding of maize
- Stage – 6 : Screening
- Stage – 7 : Separation of gluten
- Stage – 8 : Protein and impurities separation
- Stage – 9 : Pure starch
- Stage – 10 : Bagging of starch powder

Each of the above step is an important activity in the processing stage of maize value chain. Value addition to the maize in the process depends on the scale of processing. Large scale processing results in more number of value added products compared to the small scale processing. Therefore income and employment generated by processing depends on the scales of operation employed. In the next part of this chapter, scales of operation and resulting value addition to the maize is shown in detail.

The chart given below shows the schematic picture of the value chain linkages involved in the maize value chain. It consists three types of logistic activities namely- inbound logistic or backward linkages, processing or in-plant logistic and out bound logistic or forward linkages.
Figure - 5.4: Value links in the maize value chain

Seed selection (raw maize seeds) → Cultivation & farm management → Post-harvest management (Separation, Grading, Packaging) → Transportation → Maize market (APMC, Dealers, C&F Agents, Factory)

Inbound Logistics

Food Products → Seeds (Animal / Industrial Products)

Dry

Floor → Husk → Grits (Big/ Small)

Large → Germ → Small

Flakes → Oil / Cake → Semolina / Floor

Processing

Maize Germ (Oil)

Dry Starch

Acid Hydrolysis

Glucose D → Dextrose Monohydrate → Liquid Glucose → Maltodextrin → Sorbital

Outbound Logistics

Consumer Market → Feeds Market → Industrial Market (Food, Pharma, Textile etc.)

Source: Hand Book of Value Chain Analysis
Tabular presentation of the value chain

The tabular analysis shows the maize value chain in great detail. It consists of all the three levels of processing—primary, secondary and tertiary.

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
<th>Use of Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed maize</td>
<td>Maize grain and seed</td>
<td>Used to produce maize products and by-products</td>
</tr>
<tr>
<td>Chemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agronomy support</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure – 5.5: Small and large-scale growers**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
<th>Use of Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize grain</td>
<td>Maize meal, fortified maize products, maize bran, opaque beer, extruded food products, cooking oils and stock feeds.</td>
<td>Human and animal consumption</td>
</tr>
</tbody>
</table>

**Figure – 5.6: Millers, manufacturers, brewers and expellers**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Outputs</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize bran, masese</td>
<td>Processed products</td>
<td>Feed for cattle, dairy cows, sheep, horses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bran for bakery products</td>
</tr>
<tr>
<td>Maize meal /germ</td>
<td>Processed products</td>
<td>Flour for table products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feed for cattle, dairy cows, sheep, horses, poultry and pig</td>
</tr>
<tr>
<td>Oil</td>
<td>Processed products</td>
<td>Refined oil – cooking oil, salad dressings, shortening, margarine</td>
</tr>
</tbody>
</table>

**Figure – 5.7: By-products processing**

The figures No-5.4, 5.5, 5.6 and 5.7, show the schematic and tabular analysis of the value chain. According to this, maize value chain is a longest chain consists primary secondary and tertiary processors. Proper linkages connect each party in the chain. Two types of logistics ensure the flows in the chain are inbound
logistics and outbound logistics. The commercial value to the maize is added at each level.

*Value addition by the growers*

The maize value chain starts from seeds selection and farming at the growers level. The difference between input cost and output value of the produce at farmers level is the value addition by the farmers. The table given below shows the input and output cost of maize production per hectare in the study area.

**Table – 5.2: Production Cost of Maize in the Study Area**

(Rupees per hectare)

<table>
<thead>
<tr>
<th>Cost</th>
<th>Traditional</th>
<th>Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional Maize</td>
<td>Kharif</td>
</tr>
<tr>
<td>Input cost</td>
<td>7,815</td>
<td>10,215</td>
</tr>
<tr>
<td>Output value</td>
<td>10,670</td>
<td>19,483</td>
</tr>
<tr>
<td>Net return</td>
<td>2,855</td>
<td>9,268</td>
</tr>
<tr>
<td>Output input ratio</td>
<td>1.40</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Source: Directorate of economics and statistics, MAI, reports New Delhi

The table-5.2 indicates the production cost of maize in the study area. The above estimation is made on the basis of the information collected from the director of agriculture, FAO yearbook, and the progressive farmers and the joint director of district agricultural offices. The input cost includes the cost of seeds, fertilizers, manures, land preparation, sowing, harvesting and post-harvesting activities. The input cost also includes the labour and machineries used in different
stages of maize production and harvesting. Input and output cost ratio is highest for hybrid maize during khariff crop followed by hybrid maize during rabi. The input cost and output value of traditional maize is comparatively lower because of the low yield and high cost of production. In the study area more quantity of hybrid maize is grown during rabi season.

*Marketable surplus of maize in the study area*

Marketable surplus of food grains in India as compared to other crops is quite low between 8 to 15 per cent. Marketable surplus of maize in some parts of the country is more than 50 per cent. The surplus of maize is the surplus available with farmers after meeting their own requirements, for food, feed and seeds. But the consumption of maize in Karnataka for food has declined over a period of time resulted in considerable increase in the surplus. The use of maize in daily diet has been replaced by rice, jowar, wheat and ragi. The shift in consumption pattern is attributed to the increase in purchasing power of the local people and prevalent public distributional system of the government.

The marketable surplus of maize in the study area arrived at through discussion with farmers and agricultural officials and on the basis of the APMC; reports on arrivals and sales are given as under.
Table –5.3: Estimated market surplus of maize in the study area during 2004-05

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>District</th>
<th>Production (MT)</th>
<th>Market Surplus (%)</th>
<th>Surplus (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Bagalkot</td>
<td>1,21,633</td>
<td>70</td>
<td>85,143</td>
</tr>
<tr>
<td>02</td>
<td>Belgaum</td>
<td>3,06,039</td>
<td>65</td>
<td>1,98,925</td>
</tr>
<tr>
<td>03</td>
<td>Bijapur</td>
<td>35,820</td>
<td>60</td>
<td>21,492</td>
</tr>
<tr>
<td>04</td>
<td>Bellary</td>
<td>99,860</td>
<td>70</td>
<td>69,902</td>
</tr>
<tr>
<td>05</td>
<td>Gadag</td>
<td>65,112</td>
<td>75</td>
<td>48,834</td>
</tr>
<tr>
<td>06</td>
<td>Dharwad</td>
<td>65,281</td>
<td>68</td>
<td>44,391</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,93,745</strong></td>
<td><strong>68 %</strong></td>
<td></td>
<td><strong>4,68,687</strong></td>
</tr>
</tbody>
</table>

Source: Data from farmers and district agricultural office & APMC Report

The table-5.3 shows the total production of maize in the study area and estimated marketable surplus. The total maize grown in the study area is 6,93,745MT, which is about 41.52 per cent of the total maize grown in the state. The marketable surplus as per the information given by farmers and policy makers in the study area is 4,68,687MT, which is nearly 68 per cent of the total maize grown in that region. The marketable surplus available in the study area is more than the total maize production in Himachal Pradesh.

The rupee value of the surplus maize in the study area @ Rs.4, 500/MT is 17.33 crores (17.328960). The surplus maize is a potential raw material for few maize processing units with production capacity of 50,000 to 60,000 MT per annum. Since, maize is the strategic raw material for the maize processing units, processing unit in this region can be more viable. From this finding, the hypothesis one, “There is a potentiality for maize processing units in the study area,” is proved.
5.1 Estimated Market Surplus of Maize in the Study Area

<table>
<thead>
<tr>
<th>Districts</th>
<th>Production (MT)</th>
<th>Surplus (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bagalkot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgaum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bijapur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bellary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gadag</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dharwad</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Graph showing production and surplus for different districts]
The raw maize available in the study area is enough to feed few large-scale units. Other factor endowments for maize processing units listed in the previous chapter are also adequately available in this region. So that, the government drive in promoting agro-based food processing unit can be achieved by establishing processing units.

Presently, the marketable surplus of the maize in the study area is sent to processing units in neighboring states like Maharashtra, Gujarat, etc. The maize production in the region is constantly growing. But, the corresponding market price of maize is not very remunerative. There is no significant increase in the market price of maize in the study area for the last few years. The table given below shows the farm gate price of maize as prevailed in the APMC market.

<table>
<thead>
<tr>
<th>Year</th>
<th>Price per MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-99</td>
<td>4030</td>
</tr>
<tr>
<td>1999-00</td>
<td>4160</td>
</tr>
<tr>
<td>2000-01</td>
<td>4250</td>
</tr>
<tr>
<td>2001-02</td>
<td>4300</td>
</tr>
<tr>
<td>2002-03</td>
<td>4500</td>
</tr>
<tr>
<td>2003-04</td>
<td>4700</td>
</tr>
<tr>
<td>2004-05</td>
<td>5000</td>
</tr>
</tbody>
</table>

Source: APMC Reports

According to table-5.4 there is no significant increase in the farm gate price of maize for the last few years. A good market and price for maize depends on the utilization of it. Therefore, maize-processing units would enhance the utilization of surplus maize in the state and create good market for the surplus. Processing units also encourage the agricultural productivity.
5.2 Farm Gate Price of Maize in the study area

![Graph showing the farm gate price of maize from 1998-99 to 2004-2005. The x-axis represents the years from 1998-99 to 2004-2005, and the y-axis represents the price in Rs per quintal. The graph indicates a steady increase in the price over the years.]
Product Mix of large Scale processing

Value addition to maize varies from small-scale unit to a large-scale unit or dry milling to wet milling operations. Value addition and scale of operations are analyzed in this study on the basis of the data obtained from the existing maize processing units. The table given under shows the large and medium scale units with capacity of 150 and 100 MT per day and resulting products.

Table-5.5: Product mix of large and medium scale maize processing units

<table>
<thead>
<tr>
<th></th>
<th>Unit – I</th>
<th>Unit – II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>150MT/day</td>
<td>100MT/day</td>
</tr>
<tr>
<td>Raw material</td>
<td>Maize</td>
<td>Maize</td>
</tr>
<tr>
<td>Finished products</td>
<td>Starch powder, gluten, germ, husk, liquid glucose, dextrose monohydrate, malto dextrin, sorbital</td>
<td>Starch, grits, maize husk, maize germ, gluten etc.</td>
</tr>
</tbody>
</table>

Source: Report CFTRI, Mysore

The above table-5.5 reveals the product mix of large and medium scale units. A detailed analysis of the value addition by the different scale of maize processing units is given in the following table. A unit with 150 M.T per day production capacity is a large scale-processing unit, which can produce the products mentioned in the table 5.6 in the wet milling operation. The comparison made between large and medium scale units in the subsequent part of this study enables to assess the degree of value addition by each type of processing unit.

Further, the table given below shows the quantity of main and by-products obtained by processing one tonne of maize in large-scale operation.
The above table-5.6 shows that, the recovery of starch by processing one tonne of maize is 20.20 percent followed by maize husk, dextrose monohydrate, liquid glucose, malto-dextrine etc. The loss incurred by processing is also noteworthy. Employing latest processing technology by the maize processing units can minimize loss. Value addition by processing one tonne maize in large-scale operation is as under.
Table – 5.7: Sales realization from one-ton of maize processed

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Quantity (Kg.)</th>
<th>Price / Ton (Rs.)</th>
<th>Value (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Starch</td>
<td>202.00</td>
<td>11,846</td>
<td>2,393.00</td>
</tr>
<tr>
<td>02</td>
<td>Maize germ</td>
<td>64.70</td>
<td>14,000</td>
<td>905.80</td>
</tr>
<tr>
<td>03</td>
<td>Maize gluten</td>
<td>64.70</td>
<td>9,000</td>
<td>582.30</td>
</tr>
<tr>
<td>04</td>
<td>Maize husk</td>
<td>126.90</td>
<td>675</td>
<td>85.65</td>
</tr>
<tr>
<td>05</td>
<td>Liquid glucose</td>
<td>90.30</td>
<td>30,000</td>
<td>1,173.90</td>
</tr>
<tr>
<td>06</td>
<td>Dextrose monohydrate</td>
<td>123.00</td>
<td>20,000</td>
<td>2,460.00</td>
</tr>
<tr>
<td>07</td>
<td>Malto-dextrin</td>
<td>78.50</td>
<td>55,000</td>
<td>4,317.50</td>
</tr>
<tr>
<td>08</td>
<td>Corn steep liquor</td>
<td>50.80</td>
<td>6,000</td>
<td>304.80</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12,222.95</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey

According to the table-5.7 value addition per tone of maize in large and medium size units depends on the type of end products obtained from the operation. Range of value added products obtained in large-scale units are relatively more than the products obtained in small and medium scale units. Therefore, large-scale units add more value to the raw maize than the small-scale units.
The table-5.8 clearly indicates that value addition in large-scale processing to the maize is about 144.46 percent.

**Product mix of small and medium scale maize processing units**

Main and by-products obtained in small and medium scale maize processing operations are in less value added. Manufacturer of consumer and industrial goods use these products. The important products obtained in small-scale operation are – starch, maize gluten and maize husk. These products are
further used to manufacturing human and animal feeds. The following table (5.9) shows the product mix and sales realization in a small-scale unit by processing one-tonne of maize.

Table – 5.9: Sales realization from one ton of maize processed in a small-scale unit

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Quantity (Kg.)</th>
<th>Price / Ton (Rs.)</th>
<th>Value (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Starch</td>
<td>623.00</td>
<td>12,500</td>
<td>7,787.50</td>
</tr>
<tr>
<td>02</td>
<td>Maize germ</td>
<td>64.25</td>
<td>15,000</td>
<td>963.75</td>
</tr>
<tr>
<td>03</td>
<td>Maize gluten</td>
<td>64.02</td>
<td>9,000</td>
<td>576.18</td>
</tr>
<tr>
<td>04</td>
<td>Maize husk</td>
<td>125.80</td>
<td>700</td>
<td>88.06</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>9,415.49</strong></td>
</tr>
<tr>
<td></td>
<td>Purchase value of maize</td>
<td></td>
<td></td>
<td><strong>5000.00</strong></td>
</tr>
<tr>
<td></td>
<td>Value addition</td>
<td></td>
<td></td>
<td><strong>4,415.49</strong></td>
</tr>
<tr>
<td></td>
<td>Percentage of value added</td>
<td></td>
<td></td>
<td><strong>88.30</strong></td>
</tr>
</tbody>
</table>

Source: Field survey

The table-5.9 shows that the sales realization by processing one ton of maize is Rs.9,415.49. Total sales realization includes starch Rs.7,787.50 followed by maize germ Rs.963.75, maize gluten Rs.576.18 and husk Rs.88.06. The comparison of the value addition by large and small-scale units indicates that large scale maize processing gets more commercial values to the maize (144.46%) than small scale processing. From this finding, second hypothesis, “Maize gets more commercial value through large scale processing than small scale processing”, is proved.
Assessment of maize processing potentiality

Maize is one of the important agricultural crops in the study area, grown in over an area of 2.2 lakh ha with annual production of 6.93 lakh MT and market surplus is about 4.67 lakh MT per annum. At present, the processing of maize to value added products are very negligible in the region. It is one of the staple foods for the local people but its consumption has declined over a period of time. Increased income levels and the PDS support available for rice and wheat by Government of India have led to the reduction of consumption of maize by local people and thereby leaving a huge marketable surplus. This surplus is tapped at cheaper rates by the processing units in neighboring states, as stated earlier.

The marketable surplus of maize available in the study area can be put to use locally for processing into value added products. Though, there is a huge potential, it may not be possible to process the entire surplus maize to value added products within the state. It requires huge investment and also market development would take time. Keeping these factors in view, the following processing potential is estimated in table (5.10) as feasible for the state to plan. The plan estimated in the following table is based on the assumption that the maize production in the region continues to grow annually. For calculation purpose four-lakh metric ton per annum is considered in the following table. Out of the marketable surplus, 15%, 20%, 30%, and 40% is used for assessing the number of units required in the study area for processing.
Table – 5.10: Assessment of potentiality for maize processing units

<table>
<thead>
<tr>
<th>Particulars</th>
<th>2006-07</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market surplus (lakh MT)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Processing (%)</td>
<td>15</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Raw material (MT)</td>
<td>60,000</td>
<td>80,000</td>
<td>120,000</td>
<td>160,000</td>
</tr>
<tr>
<td>Wet milling - units of capacity MT/ annum</td>
<td>50,000</td>
<td>1 Existing</td>
<td>1 E + 1 N = 2</td>
<td>2 E + 1 N = 3</td>
</tr>
<tr>
<td></td>
<td>one unit</td>
<td>50,000+40,000</td>
<td>90,000+40,000</td>
<td></td>
</tr>
<tr>
<td>Other units-1000MT/annum</td>
<td>10</td>
<td>10E+20 N = 30</td>
<td>30 E + 0 N = 30</td>
<td>30 E + 0 N = 30</td>
</tr>
</tbody>
</table>

E = Existing, N = New

According to the table-5.10, three large-scale units - one with a capacity of 50,000 MT per annum and two units with 40,000 MT per annum can be established in the state in a span of four years. Apart from the large-scale units, 30 small-scale maize mills with an annual capacity of 1000 MT per annum can also be established. In total, these units can process forty percent of the marketable surplus of maize in the study area. Thereby, maize processing in this region contributes to the rural industrialization and employment through agro-based industry.

The above table indicates that maize processing in the study area has enormous potential. Processing can come up easily with a sizable investment and employment just by utilizing 40 percent of the marketable surplus. The excess maize available after meeting the requirement of processing units can be sent to other states for processing purpose. In the study area suitable locations are to be identified the policy maker for the processing units. Small-scale units for manufacture of corn flakes, poultry and animal feed units, dry milling units for manufacture of grits and other products can be set up in all maize growing areas.
The other critical factors required for establishing maize processing units are listed in the previous chapter. The important factors like land, water, manpower, electricity, Agro-tech Park and other economic and physical infrastructure are adequately available in the study area. A proper entrepreneurial awareness with certain incentives would definitely motivate the prospective entrepreneurs to do the needful.

References:
13. Ranjit Kumar et al. Improved Maize Technology in North India, Indian Agricultural Research Institute, pp. 1-128.