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# The landscape of agro-processing industries in Jammu & Kashmir

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**Abstract** The diverse agro-climatic conditions in the state of Jammu and Kashmir favour the cultivation of several high-value food and non-food commodities, but their growth potential remains under-exploited due to poor infrastructure and investment. This paper maps agro-processing units in the state and assesses their efficiency, inclusiveness and prospects for future growth. The findings show that the agro-processing sector is dominated by small-scale industries and is labour-intensive, and it lacks capital investment and market linkages.

**Keywords** Agro-processing, employment, market linkages, factor productivity

**JEL classification** L66, L25, L52

## 1 Introduction

The terrain in the state of Jammu & Kashmir (J&K) is difficult and its infrastructure under-developed, but agro-industrialization has started. Progress is gradual, but the Eco-friendly Industrial Policy 2004 and, subsequently, the Industrial Policy 2016 have begun attracting private investment in agro-based industries, value addition and supply chains. These policies emphasize the promotion of agro-industrialization utilizing locally available raw material, labour and skills. This is expected to accelerate agricultural and economic growth and create employment opportunities for the local population.

The agro-climatic conditions in the state are diverse and favourable to the production of several high-value niche foods (apple, walnut, almond, cherry, saffron and mushroom) and non-food commodities (silk and pashmina wool). Multi-dimensional efforts have been made, especially by public sector agencies and research institutions, to increase production, but little effort has been made towards post-harvest management (marketing, storage and processing).

This paper maps the dimensions of agro-processing. It aims to examine the performance of the agro-processing sector; analyse cost structure, capital investment, employment, capacity utilization and value addition; identify the sector's strengths, weaknesses, opportunities and threats; and suggest measures to harness the untapped or under-utilized potential of agro-based industries. Its findings are likely to be of use to policymakers and entrepreneurs.

## 2 Data

The Himalayan state of Jammu & Kashmir is divided into Jammu, Kashmir and Ladakh. Each division has a distinct topography and agro-climatic conditions conducive to the production of niche agricultural commodities. Accordingly, certain types of agro-based industries have evolved in each region.

This paper uses both secondary and primary sources to gather information on the various dimensions of agro-industries, but much of the analysis is based on primary data collected from 223 industrial units spread over the entire state. The published or unpublished data from secondary sources were utilized to identify and

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**Table 1. Distribution of sample agro-processing units (number)**

Type	Jammu	Kashmir	Ladakh	Total
Food				
Apricot and sea buckthorn	-	-	21	21
Fruit processing/canning	4	9	-	13
Walnut	5	2	-	7
Rice mills	10	-	-	10
Flour mills	3	14	-	17
Oilseeds	7	16	-	23
Spices	-	7	-	7
Honey	-	30	-	30
Dairy	4	3	-	7
Mutton	-	3	-	3
Non-food				
Veneer	-	27	-	27
Plyboard	4	10	-	14
Cricket bat	-	40	-	40
Silk reeling	-	7	-	7
Total	37	165	21	223

map the types of agro-based industries and to sample industries to assess technical and economic performance.

In the first stage, we identified agro-processing units and classified these into different groups based on the main raw material used for its transformation into the main value-added product. These groups include apricot and sea buckthorn processing, oilseed processing, rice mills, flour mills, spices and condiments, canning, walnut processing, dairy, mutton, silk reeling, and veneer, plyboard and cricket bat manufacturing units.

Having classified the industrial units, we selected 223 agro-processing units of different types from the three regions of the state (table 1). The sample size is fairly representative of the agro-processing sector as at least 30% of the units from each group have been selected for this study. In the case of walnut, fruits, mutton, dairy and non-food industries, the sampled units comprise more than 60% of their respective number in the state.

From the selected manufacturing units, we collected information on their type, size, location, installed capacity and utilization, capital investments, labour use, sources of raw material, supply chain, cost of

processing, value addition, marketing of processed products, financial accounts, profits, equity position, sales promotion strategies and general constraints.

### 3 Analytical framework

For a major part of analysis in this paper we rely on the ratios, averages and indices to assess the performance of agro-processing. The unit cost of processing was worked out by dividing the total cost (sum of different cost items in processing) by the quantity of output produced.

$$\text{Manufacturing cost (Rs/q)} = L [C_R + C_L + C_p + C_O + F] / Y$$

Where, Y is the total quantity of final processed output produced.  $C_R$ ,  $C_L$ ,  $C_p$  and  $C_O$  are the costs of raw material, labour, power/fuel and other items (e.g., additives/preservatives) respectively. F is the fixed cost /unit and was estimated as

$$F = r (FC) + d (FA)$$

Where, FC is total fixed capital invested in the business, FA is the value of fixed assets used in the business, r is the market rate of interest, that we have assumed 8% per annum; and d is the depreciation on fixed assets (2% on buildings and 6% on plant and machinery).

To assess the efficiency of capital and labour used in processing we estimated the following Cobb-Douglas function:

$$Y = a K^{\alpha} L^{1-\alpha}$$

Where, Y is the value of the processed output (Rs. in lakhs), K is the capital investments (Rs. in lakhs) on land, buildings, plant and machinery as well as on variable cost items; and L is the number of persons employed.  $\alpha$  is the elasticity of capital, and  $(1-\alpha)$  is elasticity of labour.

Marginal productivity of capital and labour are estimated as follows

$$MP_K = \frac{(1-\alpha) Y}{K}$$

$$MP_L = \frac{(1-\alpha) Y}{L}$$

Marginal rate of factor substitution between capital and labour is estimated as

$$MRS_{KL} = \alpha L / (1 - \alpha) K$$

$$MRS_{LK} = \alpha K / (1 - \alpha) L$$

The share of capital and labour in the value of output was computed using Euler's added up theorem, i.e.,  $Y = \alpha Y + (1 - \alpha) Y$ ; where,  $\alpha Y$  is the share of capital and  $(1 - \alpha) Y$  is the share of labour in total output.

## 4 Results and discussion

The agro-based industries in J&K are small but vital to the livelihood of thousands of people. However, the structural transformation of agriculture in favour of high-value commodities – coupled with technological change, the availability of institutional finance and enabling policies – is leading to a transformation of agro-based industries in terms of scale, investment and employment.

### 4.1 Investment, employment and returns

#### 4.1.1 Capital investment

Table 2 shows capital investment on land, buildings, plant and machinery in different types of agro-based industries.

Dairying appears a capital-intensive enterprise (Rs. 4.70 crore/unit), followed by flour mills (Rs. 3.28 crores/unit), plyboard and walnut units. Concentrated apple juice, spices and edible oil mills require capital

**Table 2. Costs and returns from agro-processing units (lakh Rs/processing unit)**

Industry group	Capital investment	Fixed cost	Variable cost	Total cost	Gross returns	Net returns
Apricot & sea buckthorn	16.17	1.88	4.06	5.94	7.91	1.97
Apple	200.00	26.52	150.29	176.81	252.00	75.19
Walnut	253.31	45.12	269.61	314.73	430.17	115.44
Canning	78.72	10.24	77.07	87.31	116.58	29.27
Spices	104.70	12.95	121.68	134.63	198.76	64.13
Dairy	470.00	62.62	745.27	807.89	930.38	122.49
Mutton	29.07	3.49	87.18	90.67	115.99	25.32
Honey	1.91	0.24	1.02	1.26	1.89	0.63
Ghani oil mills	2.62	0.33	0.54	0.87	1.74	0.87
Large oil mills	162.60	21.55	160.51	182.06	275.73	93.67
Rice mills	52.41	6.71	35.53	42.24	66.75	24.51
Flour mills	328.96	41.06	153.64	194.70	264.78	70.08
Silk reeling	20.47	2.59	28.20	30.79	50.30	19.51
Veneer	24.74	3.25	93.84	97.09	137.05	39.96
Plyboard	254.00	34.08	291.23	325.31	439.27	113.96
Cricket bat	6.49	0.81	16.38	17.19	22.91	5.72

investment of more than Rs 1 crore. These industries can be categorized as medium-scale industries. Canning units and rice mills are small-scale; others are micro-scale. In our sample, only one plyboard manufacturing unit had capital investment of Rs. 10.75 crores.

#### 4.1.2 Costs and returns

Total cost comprises the amortized annual value of fixed costs and expenses on raw material, transportation, fuel, wages, additives, etc., and operational expenses make up a major portion of total cost. There is a significant variation in cost and its structure across industries. In the dairy industry, variable costs account for 92.25% of the total cost, followed by the plyboard (89.52%) and walnut (85.66%) industries (Table 3). Overall, operational expenses account for close to 90% of the total cost.

Likewise, there is also a significant difference in the turnover and net returns across industries. Dairy industry has the highest turnover (Rs. 9.30 crore) with a net income of Rs. 1.22 crore, followed by the walnut and plyboard industries with net returns of over Rs. 1 crore. The higher capital investment and oligopoly market structure of these industrial groups could be the defining factors of their high profitability.

#### 4.1.3 Employment

The plywood industry appears more labour-intensive; on an average it employed 83 persons per unit, followed by spice, walnut, veneer, large oil mills and dairy industries in that order. However, most of the horticulture-based processing units operate for a limited period and provide seasonal employment. Increasing the line of activities through composite units will add to employment as well as returns for entrepreneurs. Investments in the food processing industry have high employment multiplier effects – about 2.5 times that of other industries (Bhavani, Gulati and Roy 2006). The gender imbalance in employment is huge, and women's engagement is low, but women make up more than 70% of the workforce in the sea buckthorn and apricot-based processing units in Ladakh, and women make up 11–40% of the workforce in the canning, walnut, silk reeling and honey processing industries (Table 3).

#### 4.1.4 Value addition

The extent of value addition varies across industries; it depends on the stage of product development and on the adoption of technologies and other activities such as branding and packaging (table 4). Value addition is

**Table 3. Extent of employment**

Industry group	Employment (no./annum)	Male (%)	Female (%)
Apricot & sea buckthorn	15	26.7	73.3
Apple	32	100.0	0.0
Walnut	57	66.6	33.4
Cherry & allied canning	32	60.0	40.0
Spices	72	83.3	16.7
Dairy	37	100.0	0.0
Mutton	13	100.0	0.0
Honey	4	88.7	11.3
Ghani oil mills	2	100.0	0.0
Large oil mills	43	100.0	0.0
Rice mills	11	100.0	0.0
Flour mills	32	100.0	0.0
Silk reeling	11	78.3	21.7
Veneer	42	100.0	0.0
Plyboard	83	100.0	0.0
Cricket bat	9	100.0	0.0

**Table 4. Extent of value addition and efficiency measures**

Industry group	Value addition (%)	BCR	Capital output ratio	Per worker investment (lakh Rs.)	Per worker value output (lakh Rs.)	Return on investment (%)
Apricot & sea buckthorn	93.41	1.33	0.75	1.08	0.53	33.05
Apple	121.98	1.43	0.70	6.25	7.88	42.52
Walnut	46.98	1.37	0.73	4.44	7.55	36.68
Canning	74.36	1.33	0.75	2.46	3.64	33.53
Spices	65.73	1.48	0.68	1.45	2.76	47.63
Dairy	21.44	1.15	0.87	12.70	25.15	15.16
Mutton	57.8	1.28	0.78	2.24	8.92	27.91
Honey	23.53	1.5	0.67	0.48	0.47	50.12
Ghani oil mills	67.33	1.99	0.50	1.31	0.87	99.64
Large oil mills	95.71	1.51	0.66	3.78	6.41	51.45
Rice mills	104.38	1.58	0.63	4.76	6.07	58.00
Flour mills	66.5	1.36	0.74	10.27	8.27	35.99
Silk reeling	81.35	1.63	0.61	1.86	4.57	63.38
Veneer	66.85	1.41	0.71	0.59	3.26	40.77
Plyboard	93.67	1.35	0.74	3.06	5.29	35.03
Cricket bat	51.68	1.33	0.75	0.72	2.55	33.29

the highest in the case of apple (122%) and rice (104%). The veneer industry adds value to the extent of 67%. Veneer is raw material for the plyboard industry, where it gets value addition up to 94%. In other industries, value addition is not as high.

#### 4.1.5 Benefit-cost ratio (BCR)

The industries that have low capital requirement also have a higher benefit-cost ratio (BCR). The highest BCR, close to 2, is found in oil mills have, and the lowest BCR, 1.15, in the dairy industry. On the whole, most industries appear worth investing in. The return on investment – obtained by dividing the benefit from an investment by the cost – is similar to the BCR.

#### 4.1.6 Capital-output ratio

The capital output ratio shows the efficiency of capital; it is estimated by dividing the total cost by the value of output. The capital output ratio is the highest (0.87) in the dairy industry and in the mutton processing industry (0.78). The ratio ranges from 0.70 to 0.75 in most industries.

The capital-labour ratio is another measure of efficiency. The investment per worker is the highest in the dairy industry (Rs. 12.70 lakhs), flour mills (Rs.

10.27 lakhs), apple processing, walnut processing and rice mills. The investment per worker is closely associated with the value of output per worker; as investment increases, the efficiency of labour also improves.

#### 4.2 Industrial linkages

The linkages of agro-processing industries with suppliers of inputs or raw materials and with output selling markets are key to the development of the agro-processing sector (table 5). The backward linkages developed by the processors are mainly for securing the raw material. The sea buckthorn, apricot, apple, oil, rice, silk and veneer industries depend on locally produced raw material and their suppliers. However, for other industries, the dependence on outside raw material supply varies from 5% for plyboard to 93% for spices. Industries in the Jammu region procure a sizeable proportion of their raw material from neighbouring states. Small-scale units often have direct links with producers, while the large units depend on contractors/middlemen.

The forward linkages for disposal of their finished products vary across industries. More than 90% of the apple juice, walnuts and cricket bats find way to markets outside the state. The walnut and apple



**Table 5. Extent of backward and forward linkages (in %<sup>#</sup>)**

Industry group	Backward Linkage		Forward Linkage	
	Within state	Outside state	Within state	Outside state
Apricot & sea buckthorn	100.0	0.0	56.7	43.3
Apple	100.0	0.0	5.0	95.0
Walnut	92.0	8.0	7.2	92.8
Cherry & allied canning	73.4	26.6	27.0	73.0
Spices	6.8	93.2	77.3	22.7
Dairy	73.3	26.7	93.0	7.0
Mutton	92.8	7.2	63.3	36.7
Honey	93.0	7.0	71.8	28.2
Ghani oil mills	100.0	0.0	100.0	0.0
Large oil mills	62.7	37.3	97.7	2.3
Rice mills	100.0	0.0	37.1	62.9
Flour mills	22.4	77.6	100.0	0.0
Silk reeling	100.0	0.0	57.0	43.0
Veneer	100.0	0.0	27.3	72.7
Plyboard	95.2	4.8	88.6	11.4
Cricket bat	82.0	18.0	8.4	91.6

<sup>#</sup> represents linkages with per cent of firms in the value chain

**Table 6. Factor product relationships**

Industry group	Constant	Elasticity coefficients		R <sup>2</sup>
		Capital	Labour	
Food industries	5.37	0.43 (0.28)	0.57* (0.27)	0.87*
Non-food industries	2.96	0.48* (0.083)	0.52* (0.19)	0.81*
All agro-industries	4.45	0.45* (0.087)	0.55* (0.089)	0.83*

Note: \* indicates significant at 5% level; figures in parentheses are standard errors

industries have organized forward linkages. For the cricket bat industry, the forward linkages outside state are large, but weak, as the customers remain changing. Flour mills have no forward linkages outside the state, as all the processed products are sold locally; however, they have strong backward linkages outside the state for the procurement of raw material. The veneer industry has forward linkages within as well as outside the state for semi-finished products. This industry has fewer but strong forward linkages with the plyboard industry. On the other hand, the plyboard industry has strong forward linkages within the state.

### 4.3 Factor productivity and technical efficiency

Table 6 presents the estimates of the restricted Cobb-Douglas production function. The regression coefficients show that labour plays a dominant role in the agro-processing sector. In the food industries,<sup>1</sup> the elasticity of production with respect to labour was 0.57 as against 0.43 for capital. In the case of non-food industries, the elasticities of both capital and labour are similar. These results are similar to those reported in Bathla and Gautam (2013) and indicate a scope for labour absorption in agro-industries.

<sup>1</sup> Food industry include processing of fruits, spices, mutton, milk, honey and milling of oilseeds and cereals while as non-food industry activities are in silk reeling, veneer making from poplar logs and its subsequent use in plyboard manufacturing and cricket bat making from willows.

**Table 7. Factor productivity and factor shares**

Industry group	Marginal productivity (Rs in lakhs)		Contribution in output (%)		Factor substitution rate	
	Capital	Labour	Capital	Labour	Capital	Labour
Food industries	1.67	5.23	43.27	56.73	0.1527	5.7302
Non-food industries	2.79	3.23	48.13	51.87	0.1802	5.9211
All agro-industries	1.07	2.43	45.71	54.29	0.1388	6.1022

The contribution of labour and capital to value addition and the marginal rate of factor substitution also reveal that the marginal productivity of labour is high. In food processing, the marginal productivity of labour is estimated at Rs. 5.23 lakhs and that of capital at Rs. 1.67 lakh per Rs. 1 lakh of investment (Table 7). The contribution of labour in the value of processed output is estimated at about 55%. In all agro-industries, per Rs. 1 lakh of capital investment, the marginal productivity of labour is worked out to be Rs. 2.43 lakhs and the marginal productivity of capital Rs. 1.07 lakh.

The rate of factor substitution reveals that capital investment of over Rs. 5.73 lakhs is required to replace one unit of labour in food processing and of Rs. 5.92 lakhs in non-food industries. This clearly shows that

labour would continue to play a major role in the agro-processing sector.

## 5 Strengths, weaknesses, opportunities and threats (SWOT) analysis

There is ample scope for the development of agro-processing in J&K, especially in commodities where it has a comparative advantage in the production of raw material. An analysis of the strengths, weaknesses, opportunities and threats (SWOT analysis) of the processing sector is carried out on three dimensions – those common to all the industries in the state as a whole, those specific to selected regions and finally those pertinent to specific processing industries (table 8). The analysis reveals a tremendous scope for value addition in temperate fruits and other ancillary industries for processing niche commodities.

**Table 8. SWOT Analysis of the agro-processing sector in Jammu & Kashmir**

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Each region of the state has a distinct resource base, agro-climatic conditions and agricultural produce</li> <li>Small-scale processing industries enjoy locational advantage and comparative cost advantage on rentals and capital structures in rural areas</li> <li>Niches for temperate horticultural products as organic food products for export and premium price</li> <li>Horticulture is emerging as a fast-growing sector and there is potential for the development of processed products</li> <li>Livestock is growing and there is potential for processed livestock products</li> <li>There is scope for the development of the tannery industry as there is enough raw material to run these units round the year</li> <li>The vast agro-forestry base can be used to upscale and diversify wood-based products and industries</li> </ul>	<ul style="list-style-type: none"> <li>The high-cost mountain economy poses special development challenges</li> <li>Raw material procurement and outward supply of processed products incur high transport costs because the region is landlocked and far from major markets</li> <li>Harsh winters hamper industrial activity and bear heavily on the performance of industrial units</li> <li>Most agro-based food processing units have a single line of activity and operate only for a particular season; raw material, too, is available only seasonally</li> <li>Power supply is poor; processors incur high costs in running their units on heavy diesel generators</li> <li>There is little brand promotion, and indigenous industries have a narrow market base</li> <li>The linkages between R&amp;D labs and industry are inadequately developed</li> </ul>

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**Opportunities**

- Eco-friendly industrial policy has given an impetus to the processing sector, which needs sustained support
  - Market reforms offer great scope for contract farming and effective integration between producers and processors
  - Indigenous industries can rule the market on account of quality, purity and hygiene
  - Walnut, apricot, saffron, sea buckthorn and other traditionally organic products can be branded, and better prices realized
  - The aromatic and medicinal plants industry has a ready, attractive market in India and overseas
  - There is a massive opportunity in using the pulp of apples and other temperate fruits for baby foods, jams, jellies, squashes and juices
  - A railway link between the Kashmir valley and the rest of the country will enable an uninterrupted supply of raw material, lower the cost of inbound freight and outward marketing and boost industrial activity in the region
  - Setting up agri-export zones (AEZs) and food parks in the state will boost the export-oriented agro-based processed products industry
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**Threats**

- Stiff competition from multinational and transnational companies poses a major threat to indigenous industry
  - Aggressive marketing by big players has glutted markets with branded products; the increasing consumer preference towards branded products is a burgeoning threat to local industry
  - If MNCs enter into forward contracts with producers and procure raw material in bulk directly, small local processors may find it difficult to procure an adequate supply
  - Tiny and small firms are at risk of technological obsolescence, but they lack the capital to upgrade their technology and compete in the market
  - Small, scattered landholdings with non-remunerative agriculture pose a threat to the growth and development of agro-processing industries
  - Climate change, hailstorms and the incidence of pests and diseases affect the production of horticultural fruit crops, the supply of raw material and the productivity of the agro-processing sector
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**6 Conclusions and policy implications**

Despite topographical limitations, the state of J&K has been industrializing gradually. The Industrial Policy 2016, which aims to promote rapid industrialization in the state, has evoked the interest of the private sector. Different agro-based industries have come up in different regions depending on the raw material supply base, leading to region-specific processing of niche commodities.

The investment pattern and infrastructure development profoundly impact the industrial environment, employment generation, economies of scale and the development of quality products. Operational expenses constitute the major portion of cost across all industries. There is significant variation in turnover and net returns across industries, and capital-intensive industries realize a higher turnover. Labour is found to play a dominant role, and the marginal rate of factor substitution indicates high displacement cost of labour by capital. This suggests there is a huge scope for creating employing opportunities in the agro-processing sector.

The processing units need to diversify their activities and put in place more product lines to harness scope economies. At the same time, they should invest in brand promotion of niche commodities, especially organic products like walnut, apricot and sea buckthorn. Further, there is a need to upgrade the size and technology of quality produce and simultaneously link with small-scale units to supply semi-finished products for high-end product development.

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