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Production Economics, Cost–Return Analysis and Profitability of Khoa Manufacturing Units in Beed District, Maharashtra, India

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Abstract

Khoa is a traditional concentrated milk product that plays an important role in India's dairy-based sweet industry. Its manufacture provides a value-adding outlet for milk and supports small-scale processing and local trade. The present study evaluates the investment pattern, production costs, returns, profitability and marketing spread of traditional khoa manufacturing units in Beed district, Maharashtra. It draws on a cross-sectional survey of 55 producers selected through simple random sampling across the district's 11 talukas. The economic observations refer to 2007–2008 and are interpreted as historical nominal values. Average establishment investment was ₹2,720 per unit, with buildings accounting for 60.66% and equipment for 30.14%. Across talukas, total production and marketing cost ranged from ₹52.63 to ₹70.08 per kg, while the reported selling price ranged from ₹58.00 to ₹73.00 per kg. The unweighted mean total cost, selling price and net profit were ₹63.50, ₹67.15 and ₹3.65 per kg, respectively. The corresponding benefit–cost ratio was approximately 1.06. Milk was the principal variable input, and variable costs represented approximately 83.28–88.18% of production cost in the talukas for which component figures were available. The producer's share in the consumer rupee ranged from 78.75% to 87.57%. Overall, the results indicate positive but narrow margins and appreciable variation among talukas. Procurement efficiency, milk-to-khoa recovery, fuel use, hygienic processing and improved market access are therefore important considerations for enterprise viability. Since the observations relate to 2007–2008, the monetary estimates should not be treated as current cost or price benchmarks.

Keywords: Khoa; dairy processing; production economics; cost–return analysis; profitability; benefit–cost ratio; marketing margin; Beed district

Introduction

Khoa, also known as khoya or mawa, is a traditional Indian dairy product obtained by heating milk and removing moisture until a semi-solid concentrate is formed. It is widely used in the preparation of peda, burfi, gulab jamun and other milk-based sweets. Beyond its culinary importance, khoa manufacture contributes to the local dairy economy by creating a market for milk, supporting small processing enterprises and supplying sweet manufacturers and traders. Production is commonly labour-intensive and relies on

relatively simple equipment. The quality and yield of the finished product are influenced by the composition of the milk, the heating regime, the extent of moisture removal and hygienic handling during processing (De & Ray, 1952; Rajorhia & Srinivasan, 1979; Pal, 2001).

The economics of khoa manufacture depend on several interrelated factors, including the price and quality of raw milk, conversion yield, fuel and labour requirements, scale of operation, and expenditure on packaging and marketing. Milk generally constitutes the largest single input because a considerable volume of liquid milk is required to produce a unit of concentrated product. Consequently, even a modest change in procurement price or processing recovery can influence the unit cost and the producer's margin. Earlier studies of indigenous dairy products have emphasized the role of raw-material quality, processing efficiency and appropriate technology in determining production costs and product consistency (Arora & Patel, 1976; Kumar & Singh, 1992; Pal, 2001).

The profitability of a milk-processing enterprise is also linked to the economics of milk production at the farm level. Feed and fodder, labour, animal health, depreciation and interest on fixed capital contribute to the cost of milk production, whereas animal productivity and the farm-gate price influence the returns. Research from different Indian dairy-production systems has reported variation in costs and returns according to animal type, feeding practices, productivity and local market conditions (Bhardwaj et al., 2006; Anilkumar & Rai, 2008). Where milk collection, chilling and transport facilities are limited, processing milk into khoa may offer an alternative marketing channel; however, the processing option is profitable only when conversion costs and market returns are favourable.

Beed district offers an appropriate setting for examining these relationships because traditional khoa manufacturing units operate across its 11 talukas and are linked to local milk supplies and regional markets. This study assesses the investment requirements, cost structure, returns, profitability and producer share in the consumer rupee. By examining production and marketing together, it provides a district-level account of the economic conditions represented by the 2007–2008 observations.

Materials and methods

Study area and reference period

The study covered Beed district in Maharashtra, India, including Ambajogai, Ashti, Beed, Dharur, Georai, Kaij, Majalgaon, Parali, Patoda, Shirur and Wadwani talukas. The economic observations relate to the 2007–2008 reference period. All monetary values are therefore nominal historical rupee values and should not be interpreted as estimates of present-day production costs or selling prices.

Sampling and data collection

A micro-level cross-sectional field survey was undertaken using a structured, pre-tested interview schedule administered through personal interviews. The sample comprised 55 khoa producers selected through simple random sampling from major khoa-producing locations in the district's 11 talukas. Information considered in the analysis included fixed investment, milk and other input costs, labour, fuel, water and electricity, packaging, marketing expenditure, selling price and producer returns. The economics of cow- and buffalo-milk production were also examined to provide context for the principal raw-material input.

Cost concepts and analytical procedure

Fixed costs comprised depreciation on buildings, equipment, furniture and fixtures; interest on fixed and reserve capital; rent; permanent labour; and management-related expenses. Variable costs included milk,

casual labour, fuel, water and electricity. Packaging and marketing expenditure was added to production cost to obtain total cost per kilogram of khoa. Net profit was calculated as the selling price per kilogram less total cost per kilogram. The benefit–cost ratio was calculated as selling price divided by total cost; it is therefore a gross-revenue-to-cost ratio and not a return-on-investment measure.

The marketing spread was examined by considering the distribution of the consumer's payment among the producer, marketing expenditure and wholesaler margin. Producer share was calculated as the producer price divided by the consumer price and multiplied by 100. Taluka-level estimates are presented for comparison. District-level summary values are simple, unweighted arithmetic means of the 11 taluka observations; they are not producer-weighted estimates because taluka-specific sample weights are unavailable.

Data handling and limitations

The analysis is descriptive and uses the recorded taluka-level cost and return estimates. These data permit comparisons of investment, production costs, selling prices and net returns, but do not provide a basis for inferential statistical testing. Some entries in the detailed cost-component and marketing-spread calculations require checking against the underlying field records. Accordingly, these components are interpreted cautiously, and no unreported observations or statistical tests have been introduced.

Results

Investment pattern of khoa manufacturing units

Average establishment investment was reported as ₹2,720 per producer. Buildings represented the largest component, at ₹1,650 (60.66%), followed by equipment at ₹820 (30.14%). Furniture and fixtures accounted for ₹130 (4.77%), while reserve capital amounted to ₹120 (4.41%). This distribution indicates that the units were established with a relatively modest capital base and relied substantially on basic premises and equipment. The comparatively low initial investment should, however, be distinguished from operating expenditure, which was dominated by recurring inputs, particularly milk.

Table 1. Investment pattern reported for a traditional khoa manufacturing unit in Beed district**.**

1. **Investment component**	2. **Amount (₹/producer)**	3. **Share (%)**
4. Building	5. 1,650	6. 60.66
7. Equipment	8. 820	9. 30.14
10. Furniture and fixtures	11. 130	12. 4.77
13. Reserve capital	14. 120	15. 4.41
16. Total	17. 2,720	18. 100.00

Cost structure and unit cost of production

Production cost before packaging and marketing ranged from ₹50.78/kg in Dharur to ₹67.98/kg in Georai. After packaging and marketing expenditure was included, total cost ranged from ₹52.63/kg to ₹70.08/kg. The unweighted mean total cost across the 11 taluka observations was ₹63.50/kg. Packaging and marketing expenditure ranged from ₹1.85 to ₹2.20/kg, with an unweighted mean of approximately ₹2.03/kg. Within the reported cost structure, the principal pressure on unit economics therefore arose during production, rather than from the recorded post-production marketing expenditure.

Table 2. Taluka-wise production cost, selling price and net profit of khoa. B:C ratio = selling price ÷ total cost; the mean is the unweighted arithmetic mean of the 11 taluka observations.

19. **Taluka**	20. **Production cost (₹/kg)**	21. **Packaging & marketing (₹/kg)**	22. **Total cost (₹/kg)**	23. **Sale price (₹/kg)**	24. **Net profit (₹/kg)**	25. **B:C**
26. Ambajogai	27. 56.15	28. 2.00	29. 58.15	30. 63.00	31. 4.85	32. 1.08
33. Ashti	34. 64.60	35. 2.10	36. 66.70	37. 70.00	38. 3.30	39. 1.05
40. Beed	41. 65.60	42. 2.15	43. 67.75	44. 70.00	45. 2.25	46. 1.03
47. Dharur	48. 50.78	49. 1.85	50. 52.63	51. 58.00	52. 5.37	53. 1.10
54. Georai	55. 67.98	56. 2.10	57. 70.08	58. 73.00	59. 2.92	60. 1.04
61. Kaij	62. 56.22	63. 1.90	64. 58.12	65. 63.00	66. 4.88	67. 1.08
68. Majalgaon	69. 66.86	70. 2.05	71. 68.91	72. 71.60	73. 2.69	74. 1.04
75. Parali	76. 58.48	77. 1.85	78. 60.33	79. 65.00	80. 4.67	81. 1.08
82. Patoda	83. 65.22	84. 2.15	85. 67.37	86. 70.00	87. 2.63	88. 1.04
89. Shirur	90. 65.52	91. 2.20	92. 67.72	93. 70.50	94. 2.78	95. 1.04
96. Wadwani	97. 58.76	98. 1.95	99. 60.71	100. 64.50	101. 3.79	102. 1.06
103. Unweighted mean	104. 61.47	105. 2.03	106. 63.50	107. 67.15	108. 3.65	109. 1.06

Milk was the principal variable input. Expenditure on milk was reported at approximately ₹41.10–₹49.00/kg of khoa across the legible taluka entries. Fuel expenditure ranged from about ₹2.20 to ₹8.60/kg, suggesting that fuel choice and heating efficiency may contribute to differences in production cost. Variable costs represented approximately 83.28–88.18% of total production cost in the reported taluka observations, while fixed costs accounted for roughly 12.35–16.71%. The tabulated fixed-cost share reaches 16.71% for Beed; this value is retained despite a slightly narrower range stated elsewhere in the study.

Returns and profitability

Each of the 11 taluka-level observations showed a positive reported net return, although the margin was modest. Net profit ranged from ₹2.25/kg in Beed to ₹5.37/kg in Dharur, with an unweighted mean of ₹3.65/kg. The corresponding mean benefit–cost ratio was approximately 1.06, indicating gross sales revenue of about ₹1.06 for every rupee of total cost at the reported prices. The mean profit-to-sales ratio was approximately 5.43%. These descriptive ratios do not adjust for differences in enterprise size or the number of producers represented by each taluka.

Dharur recorded the lowest total cost (₹52.63/kg) and the highest net profit (₹5.37/kg). Comparatively high net returns were also reported in Kaij (₹4.88/kg), Ambajogai (₹4.85/kg) and Parali (₹4.67/kg). In contrast, Beed, Patoda, Majalgaon and Shirur recorded net profits between ₹2.25 and ₹2.78/kg. The observed variation may reflect differences in milk procurement prices, fuel availability, labour arrangements, processing conditions and access to buyers. The available summary data, however, do not allow the contribution of each factor to be isolated.

Milk production economics and raw-material context

The reported average cost of milk production was approximately ₹9.75/litre for cow milk and ₹11.23/litre for buffalo milk. Average net returns were ₹3.34/litre and ₹4.09/litre, respectively. At taluka level, cow-milk production cost ranged from ₹8.02 to ₹10.88/litre, while buffalo-milk cost ranged from ₹9.31 to ₹13.41/litre. Thus, buffalo milk had a higher average production cost but also a higher reported net return per litre. Because khoa recovery depends on milk solids and processing conditions, the composition and quality of the milk supply are important to both yield and product value. Khoa yield was reported to range from 20.26% to 22.60%, with an average of 21.8%; the study associated the comparatively high yield in part with the use of mixed cow and buffalo milk.

Marketing spread and producer share

The producer's share in the consumer rupee ranged from 78.75% in Ambajogai to 87.57% in Shirur. The remaining consumer expenditure was attributed to marketing costs and the wholesaler's margin. The simple mean producer share across the 11 talukas was approximately 83.82%. Although this indicates that producers received a substantial proportion of the final consumer price, marketing expenditure and intermediary margins reduced the share reaching the production stage. Differences among talukas may be associated with market distance, marketing arrangements and the role of intermediaries.

Table 3. Distribution of the consumer rupee in the khoa marketing channel. The Dharur entry contains an internal inconsistency between the reported wholesaler-margin amount and percentage; the figures are reproduced as reported and require verification.

110. **Taluka**	111. **Producer price (₹/kg)**	112. **Producer share (%)**	113. **Marketing cost (₹/kg)**	114. **Marketing cost (%)**	115. **Wholesaler margin (₹/kg)**	116. **Margin (%)**	117. **Consumer price (₹/kg)**
118. Ambajogai	119. 63.00	120. 78.75	121. 5.00	122. 6.25	123. 12.00	124. 15.00	125. 80.00
126. Ashti	127. 70.00	128. 80.00	129. 3.50	130. 4.00	131. 15.00	132. 16.00	133. 87.50
134. Beed	135. 70.00	136. 83.33	137. 4.00	138. 4.76	139. 10.00	140. 11.90	141. 84.00
142. Dharur	143. 58.00	144. 83.45	145. 3.50	146. 5.03	147. 11.50	148. 9.50	149. 69.50
150. Georai	151. 73.00	152. 82.95	153. 4.00	154. 4.54	155. 11.00	156. 12.50	157. 88.00
158. Kaij	159. 63.00	160. 85.13	161. 3.50	162. 4.72	163. 8.00	164. 10.81	165. 74.00
166. Majalgaon	167. 71.60	168. 85.64	169. 3.00	170. 3.59	171. 9.00	172. 10.76	173. 83.60
174. Parali	175. 65.00	176. 86.02	177. 3.00	178. 3.97	179. 7.50	180. 9.93	181. 75.50
182. Patoda	183. 70.00	184. 83.33	185. 4.00	186. 4.76	187. 10.00	188. 11.90	189. 84.00

110. **Taluka**	111. **Producer price (₹/kg)**	112. **Producer share (%)**	113. **Marketing cost (₹/kg)**	114. **Marketing cost (%)**	115. **Wholesaler margin (₹/kg)**	116. **Margin (%)**	117. **Consumer price (₹/kg)**
190. Shirur	191. 70.50	192. 87.57	193. 3.50	194. 4.34	195. 6.50	196. 8.07	197. 80.50
198. Wadwani	199. 64.50	200. 85.83	201. 4.00	202. 6.20	203. 7.00	204. 9.72	205. 75.50

Discussion

The results portray khoa manufacture in Beed district as a small-scale activity with a modest establishment investment and a high dependence on recurring raw-material expenditure. Buildings and equipment together accounted for most of the reported initial investment, indicating reliance on basic premises and traditional processing arrangements. Although packaging and marketing expenditure was relatively low in the recorded accounts, low-cost packaging and limited storage may constrain product protection, traceability and access to more distant markets.

The predominance of milk in variable expenditure is consistent with the economics of a concentrated milk product. Milk procurement price and conversion yield are therefore central to the producer's unit cost. At the reported mean yield of 21.8%, approximately 4.6 kg of milk would be required, on a simple mass equivalent basis, to obtain 1 kg of khoa. Actual milk requirements will vary with milk composition, the final moisture level and processing losses. Improvements in recovery can consequently have a meaningful effect on unit economics. Earlier investigations of khoa manufacture have likewise discussed the influence of milk type, dehydration conditions and processing methods on product characteristics and production efficiency (De & Ray, 1952; Rajorhia & Srinivasan, 1979; Arora & Patel, 1976).

Differences in cost and net return among talukas were substantial. Dharur had the lowest reported total cost and the highest net return, while Beed recorded the lowest net profit. These differences should not be attributed to a single cause on the basis of the available summary data. Milk prices, fuel type, labour arrangements, processing scale and access to buyers may all influence the outcome. Regional variation in dairy-enterprise costs and returns has also been documented in studies of Indian milk-production systems (Bhardwaj et al., 2006; Anilkumar & Rai, 2008). Khemchand et al. (1994) examined the economics of production and marketing of khoa-based indigenous milk products, reinforcing the importance of considering processing and marketing costs together.

The mean benefit–cost ratio of approximately 1.06 indicates positive but limited profitability at the historical prices. A margin of this size leaves a unit vulnerable to increases in milk or fuel prices, reduced recovery, product rejection, spoilage and delayed payment. The reported short storage period in rural areas and the limited availability of cold-storage facilities may also affect producers' bargaining position relative to intermediaries who can aggregate and refrigerate larger quantities. Shared chilling and storage facilities, producer groups, transparent weighing and pricing, and direct links with sweet manufacturers may help improve market access and reduce avoidable transaction costs.

The mean producer share of approximately 83.82% should be interpreted with care. The marketing-spread table contains an inconsistency in the Dharur wholesaler-margin percentage, and the available information does not include sample weights needed to calculate a producer-weighted district estimate. Moreover, a high producer share does not by itself demonstrate adequate net income; it must be considered alongside milk

procurement costs, family labour, depreciation, risk and the opportunity cost of resources. Sound enterprise analysis requires consistent treatment of both explicit and implicit costs (Panse & Sukhatme, 1985).

A further consideration is the age of the economic observations. Input prices, wages, energy costs, packaging materials, transport charges and consumer prices have changed since 2007–2008. The estimates presented here are therefore best interpreted as a historical account of the cost structure and profitability of khoa manufacturing in the study area. They should not be used to represent current enterprise economics. A new survey based on a clearly defined sampling frame and contemporaneous input and output prices would be required to establish present-day cost and return estimates.

Conclusions and implications

The surveyed khoa manufacturing units in Beed district combined a modest initial investment with a cost structure dominated by variable expenditure and a narrow but positive margin at the reported 2007–2008 prices. Across the 11 taluka-level observations, mean total cost was approximately ₹63.50/kg, mean selling price was ₹67.15/kg and mean net profit was ₹3.65/kg. Milk was the dominant cost component, whereas recorded packaging and marketing expenditure was comparatively small. The highest reported net profit occurred in Dharur and the lowest in Beed. The producer's share in the consumer rupee ranged from 78.75% to 87.57%, subject to the noted inconsistency in the Dharur marketing-spread entry.

Improving the viability of these enterprises requires attention to reliable, quality-based milk procurement, efficient fuel use, reduced processing losses, improved recovery and hygienic handling. Collective access to refrigeration, appropriate packaging, transparent weighing, timely price information and direct marketing arrangements with sweet manufacturers may strengthen producers' position in the value chain. Training in cost accounting and food-safety practices would further support enterprise management. Updated field research using current prices is essential before these historical estimates are applied to present-day investment or policy decisions.

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