Interventions in the Food Value Chain to Improve Quality and Competitiveness: A Case Study of Dairy Cooperative in India

A Case Study on Food Chain Management

Gopal Naik
Mathew Abraham
Indian Institute of Management Bangalore

Milk Production in India

- India is the ***largest producer of milk*** in the world with a total production of 84 millions tonnes in 2001 (Hemme et al 2003).
- It also has the ***world's largest livestock population***, housing 57% and 16% of the globes buffalo and cattle respectively.
- 80% of the animals kept in small farms with an average of 2-8 animals (ibid). The average animal size on farms in the United States is 88 and 236 in New Zealand
- Dairying is an important economic activity as livestock distribution is ***more equitable than land distribution***.
- About 18 million (**5.5% of the workforce**) is engaged in dairy activities and thus it is considered a focus of anti-poverty and equity-oriented programs (Staal et al, 2009).
- Only 15% of milk produced is marketed through formal systems, while the remaining ***85% is distributed informally***

Karnataka Cooperative Milk Producers' Federation Limited (KMF)

- The birth of cooperative movements in India was in the dairy sector. In Gujarat, milk producers with state support joined hands to have a stake in their produce and share the profits gained by selling their produce. This was known as the ‘Kaira Model’.
- Its success as a cooperative movement led its adoption as a blueprint for all milk cooperatives in the country
- Today almost all states in the India have their own dairy cooperatives supporting millions of small and marginal farmers.
- In Karnataka, a state-level cooperative known as the Karnataka Cooperative Milk Producers' Federation Limited (KMF) was setup in 1974.
- It was India’s first World Bank funded dairy development program modelled on the Anand pattern.
- The KMF today is the third largest milk cooperative in India and the largest in South India in terms of procurement and sale.

Technology Adoption in the Dairy Sector

- Due to its high perishability, milk and milk products have one of the ***most stringent codes of standards***.
- Good supply chain management in milk particularly in the context of cooperative setups, where primary producers are many, is closely linked to good technology adoption.
- Technological innovations like the adoption of ***Bulk Milk Coolers*** (BMC) at the village society level have helped ***increase the scope for the improving milk quality*** in the cooperatives.
- It can help ***reduce sour milk content*** and ***spoilage*** during transportation and storage.
- However, improvement in the quality and competitiveness depends on the ***synergy of technological and organizational improvements*** coupled with operational changes at all levels of the value chain.
- This case focuses on the aspects of technological change and operational improvement and the scope for improvement.

Framework for Analysis

In order to compute the profits (π) of farmers (f), village cooperatives (vc) and district cooperatives (d) the following framework was used:

Benefit to the Farmer:

$$\pi_f = \Delta P_f (Q_f + \Delta Q_f) + P_f \Delta Q_f$$

Benefit to the Village Cooperatives:

$$\pi_{vc} = \Delta P_{vc} (Q_{vc} + \Delta Q_{vc}) + P_{vc} \Delta Q_{vc} - \Delta C_{vc}$$

Benefit to the District Dairies:

$$\pi_d = \Delta P_d (Q_d + \Delta Q_d) + P_d \Delta Q_d - \Delta C_d$$

Benefit to the Farmer

$$\pi_f = \Delta P_f (Q_f + \Delta Q_f) + P_f \Delta Q_f$$

Bangalore Dairy	Benefit per Animal (Rs)	Benefit per Litre (Rs)
Best Case Scenario	30.08	2.89
Present	0	0

Benefit to the Village Cooperatives

$$\pi_{vc} = \Delta P_{vc} (Q_{vc} + \Delta Q_{vc}) + P_{vc} \Delta Q_{vc} - \Delta C_{vc}$$

Village cooperative	Benefit per Animal (Rs)	Benefit per Litre (Rs)
Best Case Scenario	1.36	0.13
Present	-25.18	-2.67

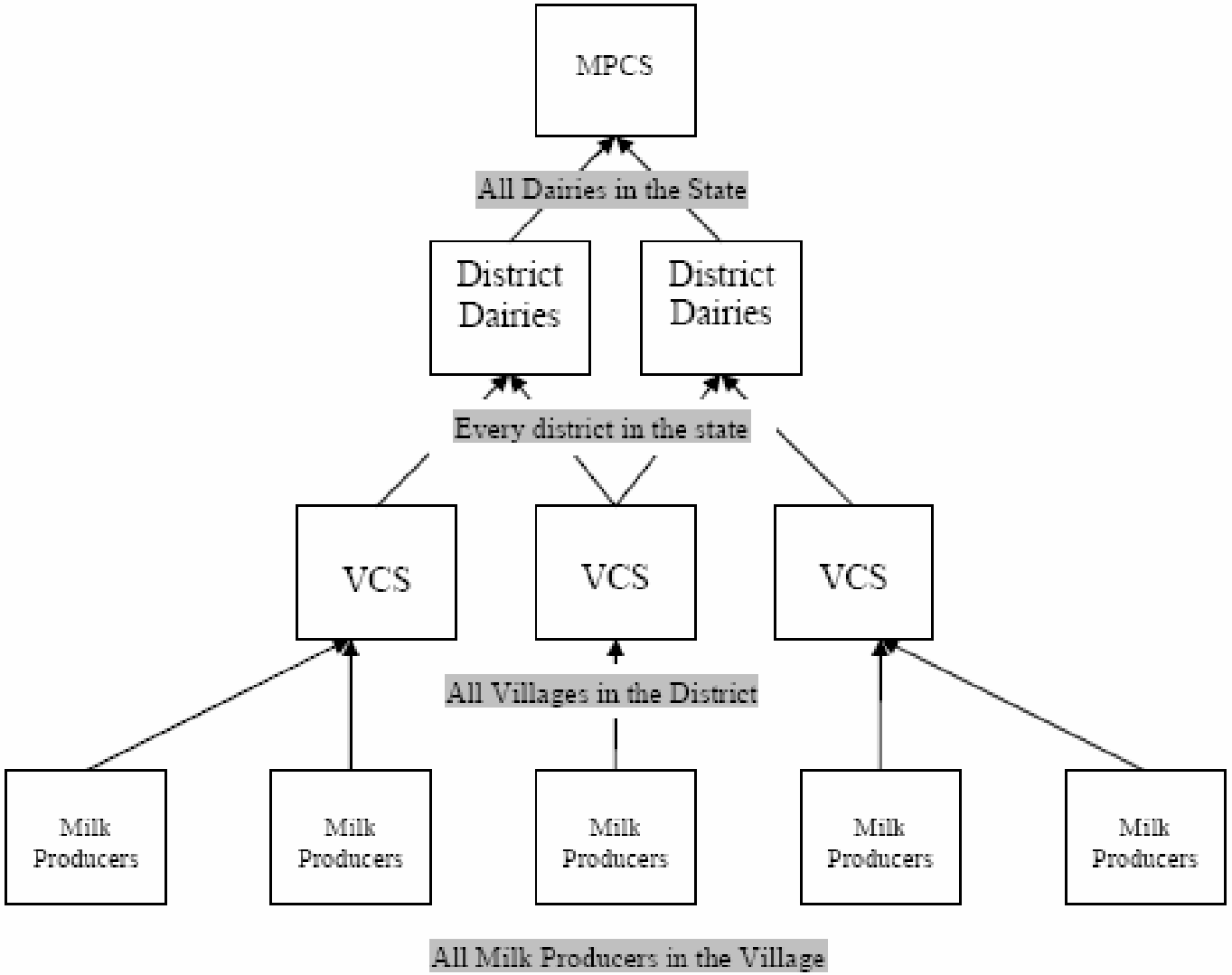
Benefit to the District Dairies

$$\pi_d = \Delta P_d (Q_d + \Delta Q_d) + P_d \Delta Q_d - \Delta C_d$$

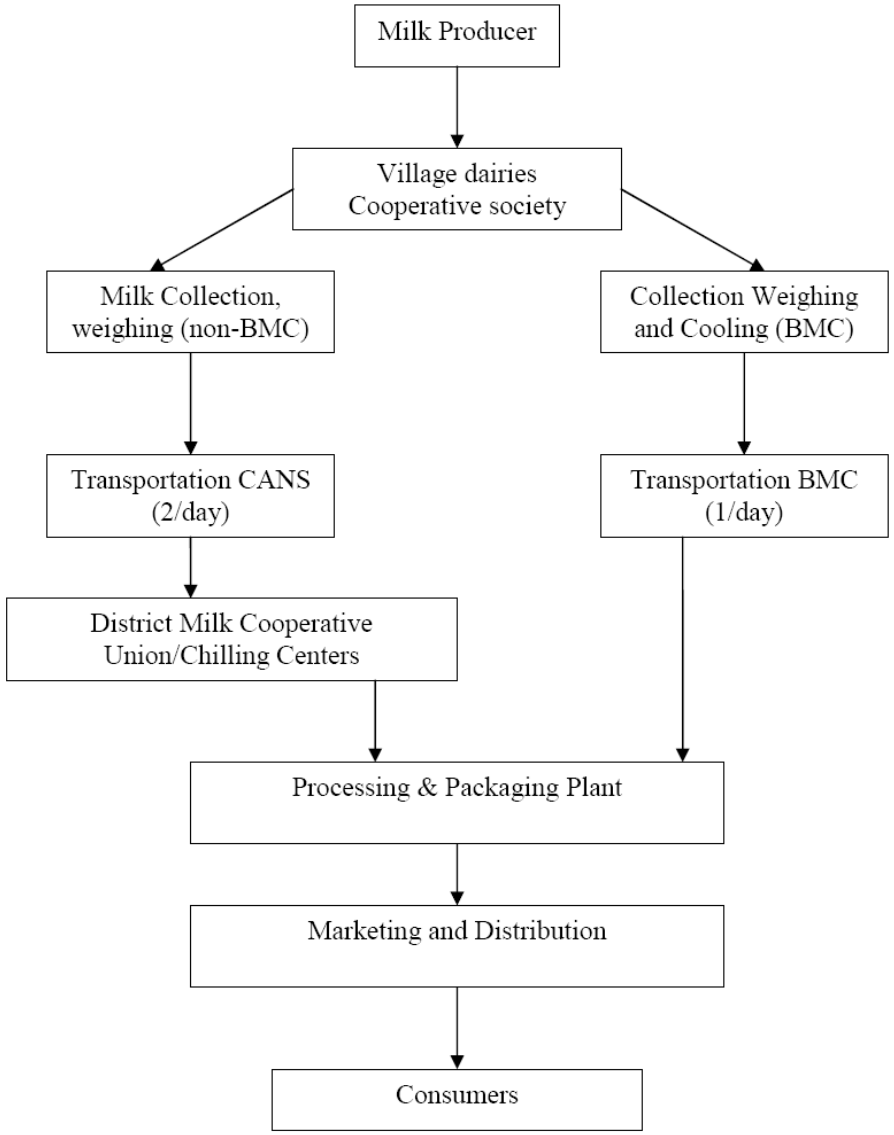
District dairy	Benefit per Animal (Rs)*	Benefit per Litre (Rs)*
Best Case Scenario	17.46	1.67
Present	-	-

*assuming market price of milk is 17 Rs/litre and the cost of processing is 1.49 Rs/litre

The Structure of the Cooperatives



Methods of Procurement in the KMF



Capacity and Production Figures Bangalore Dairy

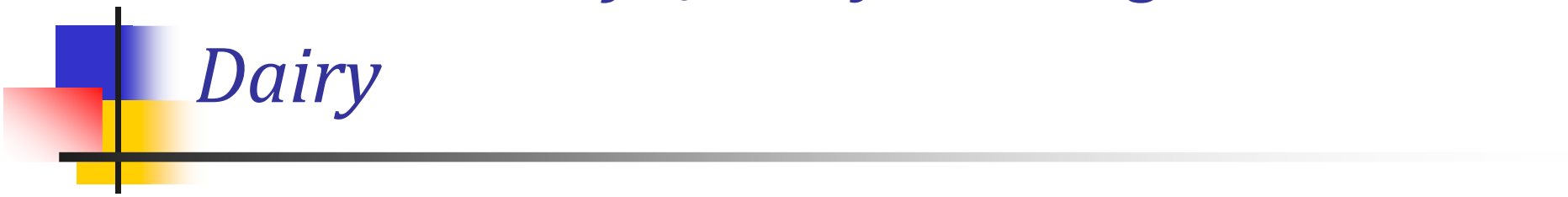
	Bangalore Dairy
Total Number of VCS/DCS	1675
Number of VCS/DCS with BMC	85 plus 172 (total 257)
Number of VCS/DCS without BMC	1418
Average production of VCS/DCS per day	540
Average Production of BMC VCS/DCS	100,000
Average Production of non-BMC VCS/DCS	800,000
Total Milk Production per Day	900,000

BMCs and Improvement in Quality

Parameters	**Can Milk Quality**	**BMC Milk Quality**
Temp. of Milk	25-32°C	6-7°C
Flavour	Slightly Acidic	Fresh
Acidity	0.16-0.18	0.15
*MBRT**	15-30 mins	180-240 mins
Bacteriological Quality		
SPC,cfu/ml+	1-2 crores	10-20 lakhs
Coliform	2-10 lakhs	20-40 thousand
Alcohol Test	Positive	Negative

Source: Karnataka Cooperative Milk Producers' Federation Limited
* = Methylene Blue Reduction Test
+ = Standard Plate Count, Colony Forming Unit/millilitre

Economics of Quality in Bangalore Dairy



Cost of BMCs and Bangalore Dairy

BMC Capacity(Kg)	Price of BMC(Rs)	Capacity Utilization@		Depreciation @ 10%		Interest@10%		User cost of Capital	
		@80%	@67%	@80%	@67%	@80%	@67%	@67%	@80%
1000	600000	800	670	0.21	0.25	0.25	0.29	0.45	0.54
2000	800000	1600	1340	0.14	0.16	0.16	0.20	0.30	0.36
3000	1200000	2400	2010	0.14	0.16	0.16	0.20	0.30	0.36
5000	1500000	4000	3350	0.10	0.12	0.12	0.15	0.23	0.27

Benefits to Farmers- Actual and Best Case Scenario

Particulars	BMC	Total	Best case Scenario	Non BMC	Total	Descriptions
Farmers						
Average Yield	9.4		10.4	9.4		**There is no apparent increase in the quantity of milk from the farmer.** According to the international livestock research institute, the time intervals between milk have an effect on quantity and quality of the milk. As milk collection happens only once a day from BMCs, farmers using this facility have an advantage of prolonging milking intervals.
FAT/SNF content	3.8-4.1/8.3		1.5 Rs/ltr result of increased SNF	4.0-4.3/8.4-8.5		According to the data collected from the Bangalore Dairy, the milk collected in BMCs show a lower FAT/SNF count than milk collected in cans. Interviews with officials at the Bangalore dairy revel that this is due to adulteration at the village cooperative level as well as the transportation level. This is however lower at the non-BMC level because the milk is transported to chilling centres where the milk is tested again, whereas in the case of the BMC centres the milk is transported directly to the main dairy.
Price of Yield	12.98	122.01	@14.48 Rs/litre 150.5	12.98	122.01	

Benefits to MPCS- Actual and Best Case Scenario

	BMC	Total	Best case Scenario	Non BMC	Total	Descriptions
MPCS						
Price to society (3.5%)	(12.79) 13.24	120.22	14.98 Rs/liter as a result of good FAT/SNF 155.79	13.43	126.24	Because of lower fat and SNF in milk, the non-BMC centres get better remuneration for their milk as compared to BMC members.
Maintenance	0.49 per litre	124.82	@.37Rs/litre (3.84) 159.63	-	126.24	The maintenance of BMCs run up an average cost of .90 Rs a litre in the case of BMCs. The maintenance cost adds up the electricity and diesel costs, which is basically the **cost of chilling (0.18 Rs/Litre)**, internal transportation costs as well as incentives paid (which is based on the capacity of the BMC)
Revenue	(Price to Farmers + 3.5% - Cost)	-6.39	1.45		4.23	

Benefits to District Dairy- Actual and Best Case Scenario

	BMC	Total	Best case Scenario	Non BMC	Total	Descriptions
District Dairy						
Transportation	0.20 per litre	126.82	161.71	0.32 per litre	129.24	The cost of transportation in non BMCs are higher as milk is collected twice a day, while this is only once in the case of BMCs. The cost of transportation is marginally higher in the case of non-BMCs than stated here, as it does not take into to account the transportation costs from chilling plant to main dairy (data unavailable)
Spoilage	-	126.82	161.71	.05% per litre or 0.01 Rs. per litre	129.33	
Shortage	0.16% or 0.03 Rs/ltr.	128		-	129.33	
Chilling				.32 Rs/litre	132.33	

Conclusions

- This case on the KMF is an example of how important the synergy between technological innovation and operational changes is to bring about quality and competitiveness.
- In the context of a cooperative setup, where resources are limited and stakeholders are many, appropriated operational changes need to be implemented along with technological innovations to bring about awareness and benefits to all levels of the supply chain.
- Good quality milk low in bacteria and pathogens and high in FAT and SNF content is a product of a well functioning cold chain, where systems are in place at all levels to maintain quality.
- In the KMF, the absence of operational changes with the introduction of BMC have led to losses at the milk union and additional costs at the MPCS and district dairy levels.
- At the final stages of production, better quality milk can help in product diversification and higher value addition