

Navigating Principal-Agent relation in Bidaraguppe Milk cooperative society

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## **INTRODUCTION**

The dairy industry, a lifeline for many rural economies, sometimes faces the difficult job of balancing the aims of individual farmers (agents) with those of cooperatives (principals) in charge of milk collecting, processing, and distribution. This complex principal-agent dilemma originates from knowledge asymmetries and the potential of moral hazard, in which farmers may prioritise immediate earnings above quality and long-term sustainability. A pioneering milk cooperative in India provides an illuminating case study on how to efficiently negotiate these hurdles. The cooperative guarantees farmers are financially motivated to produce high-quality milk by carefully designing tiered incentive schemes. Simultaneously, it solves challenges by providing critical support services such as subsidised feed and veterinary care, which reduce production costs and connect farmers' interests with the cooperative's goals.

What distinguishes this cooperative is its unique use of technology, namely instruments for transparent and exact milk quality monitoring. These tools not only close information gaps, but they also build confidence between farmers and cooperatives, assuring a fair and equal process. By focussing on mutual gain, the cooperative has created a vibrant ecosystem in which both stakeholders may thrive, establishing a standard for agricultural innovation. This strategy emphasises the transformational power of combining economic incentives, institutional support, and technical improvements to overcome long-standing coordination challenges, providing a scalable model for other agricultural industries throughout the world.

## **LITERATURE REVIEW**

This 2022 research by Rao and Shenoy explores how rural dairy cooperatives in India deal with common problems like elite capture, where a few numbers of members dominate, and free riding, where people profit without contributing. They discovered that these cooperatives may promote teamwork by associating group incentives with the members' milk's cleanliness. To guarantee that everyone abides by the cooperative's rules, this strategy makes effective use of social ties inside the group. Through a field experiment in Karnataka, the researchers examined how incentive structures, collective action, and cooperative governance interact, offering insightful insights for enhancing cooperative efficacy. A field experiment carried out in 51 dairy cooperative societies (DCS) in northern Karnataka is incorporated into Rao and Shenoy's study. The experiment links milk cleanliness, as determined by the microbiological burden, to group-level benefits. The rewards, which varied in transparency and ranged from ₹0 to ₹2000, were credited to cooperative accounts.

According to research conducted in Indian dairy cooperatives, the quality of milk was raised when group rewards were tied to milk cleanliness. greater personal hygiene habits and greater upkeep of communal facilities led to this. The community's social pressure was essential in ensuring that members upheld ambitious standards. The study did, however, also uncover unexpected repercussions of openness. Some leaders objected to the public disclosure of payments to cooperatives and chose to stay out of the spotlight. In comparison to privately run cooperatives, this transparency significantly decreased the incentives' efficacy in public-facing cooperatives, underscoring the necessity of carefully weighing transparency measures when designing incentives (*Rao & Shenoy, 2022*).

## OBSERVATION

As we began our fieldwork journey in the Bidaraguppe village of Karnataka, it gave me quite the view of a modern and technologically advanced society. Most of the population

in the village is either dependent on farming of vegetables, fruits, or production of milk. There were also the migrant communities who worked in the construction sites and brick factories. The relationship between the farmers who produced the milk and sold it to the milk cooperative unit was particularly interesting to observe. The milk cooperative or union, which oversees gathering, preparing, and distributing milk, is the principal. To guarantee a steady and superior supply of milk, it creates the incentive system and support systems. Milk-supplying farmers are the agents. Their goal is to minimise their expenses and maximise milk production profits. Incomplete contracts, in which some eventualities (such differences in milk quality) are not expressly stated or enforced, control the relationship between the principal and agents. To match farmer behaviour with its goals, the cooperative instead uses incentive systems.

A principal-agent conflict emerges in the field of milk production between the individual dairy farmers (agents) and the milk cooperative (principal). Milk with inadequate fat content might result from farmers' covert practices, such as providing poor feed or ignoring veterinary treatment. The cooperative's incapacity to closely monitor the farmers' input selections leads to this behaviour, which is referred to as a moral hazard.

The cooperative uses tactics like offering veterinarian care and subsidised feed to lessen this danger. The cooperative links farmers' interests with its own by internalising a portion of the production expenses. This lessens the possibility of opportunistic behaviour and guarantees that farmers have the resources needed to satisfy quality requirements, which eventually improves milk quality and boosts profitability for both parties.

The milk cooperative maximises farmer returns by creating a tiered payment system. Milk with more than 3.5% fat costs ₹37 per litre plus a ₹5 subsidy. This tiered approach

encourages producers to prioritise milk quality since only high-quality milk qualifies for the payment. Furthermore, the cooperative provides farmers with timely financial security by making payments directly into their bank accounts every 15 days. This steady and predictable payment schedule promotes confidence between the cooperative and its members. This multidimensional strategy produces an incentive-compatible environment in which farmers directly benefit from meeting quality requirements, hence increasing the dairy cooperative's total profitability and sustainability.

Suppose we want to find the Nash equilibrium price, quality, and contract duration:

Base price of milk above 3.5% fat - ₹37/litre

Subsidy above 3.5% fat - ₹5/litre

Transport levy - ₹2/litre

Final consumer price - ₹44/litre

Payoff for farmers:

With milk quality ( $q > 3.5\%$ ) - ₹37 + ₹5 = ₹42/litre

With milk quality ( $q \leq 3.5\%$ ) - ₹37 litre

So, this shows that farmers have a higher incentive to produce high-fat milk since it increases their revenue by ₹5/litre.

To see the Nash equilibrium,

Farmers want to produce milk with fat content exceeding 3.5%, as it boosts earnings by ₹5/litre.

The cooperative's payment system encourages high-quality milk production while meeting operating expenditures. By limiting the payout to milk over the threshold, the

cooperative avoids overpaying for lower-quality milk. Both sides benefit from adhering to the terms: farmers maximise income by achieving quality requirements, while the cooperative secures a consistent supply of high-quality milk for processing.

Let,

$q$  - percentage of fat in milk

$s(q)$  - subsidy

$s(q) = ₹5$ , if  $q > 3.5\%$

$₹0$ , if  $q \leq 3.5\%$

$p(q)$  - payoff to farmers per litre of milk

$p(q) = ₹37 + s(q)$

$p_c = ₹37 + s(q) + ₹2$

Here the equilibrium condition will be:

- Farmers maximize  $p(q)$  by ensuring  $q > 3.5\%$
- The cooperative maintains  $p_c = ₹44$  to balance costs and keep operations going.

The cooperative's payment structure efficiently matches farmer incentives with its goals. By giving a premium for milk with a fat content above 3.5%, the initiative encourages farmers to prioritise quality by investing in methods such as using better feed or successfully utilising cooperative-provided fodder and medication. This financial incentive system

encourages farmers to adopt techniques that improve milk quality, hence increasing their revenue.

Furthermore, the cooperative reduces information asymmetry by offering fat content measurement equipment. These tools provide precise and transparent assessments of milk quality, lowering the possibility of conflicts and establishing confidence between farmers and the cooperative. This transparency is essential for sustaining a fair and equitable system in which farmers are compensated for their efforts to produce high-quality milk.

The best course of action for farmers is to produce high-quality milk thanks to the incentive-compatible system created by the combination of strong monitoring systems and financial incentives. This technique creates a win-win situation where farmers' interests and the cooperative's purpose of optimising milk quality and profitability are in line, allowing both parties to accomplish their goals without the need for additional changes. By paying premiums and using the cooperative's support services, farmers can maximise their profits while the cooperative is guaranteed high-quality milk.

While maintaining a steady supply of premium milk, the cooperative places a high priority on reducing operating expenses. A diversified approach is used to accomplish this. Farmers are given a substantial incentive in the shape of a ₹5 per litre payment for milk that exceeds the designated fat standard. This encourages farmers to put quality improvement measures first, such as buying better feed or making efficient use of the veterinary treatment and fodder that the cooperative provides.

Nonetheless, the cooperative understands how important cost-effectiveness is. It carefully controls its spending by distributing funds for veterinary services and feed in a way that avoids sweeping fixes that might not be effective or required. This focused strategy

guarantees that resources are used as efficiently as possible to help farmers produce milk of a better calibre without adding needless expenses.

To help with the logistical costs of milk collecting and distribution, a transport charge of ₹2 per litre is also in place. The Indian transit fee of ₹2 operates similarly to a Pigouvian tax. This indicates that its goal is to hold transport service users accountable for the full cost of their use, including the effect on infrastructure. This strategy guarantees that everyone makes a fair contribution to system maintenance, fostering a more sustainable and equitable transport network. When minimising production costs and maximising individual farmer earnings converge, the cooperative operates at a Nash equilibrium. Because of this balance, a system that benefits both the cooperative and its members is encouraged to engage and contribute without the need for outside regulatory actions.

This well-rounded strategy produces a dynamic equilibrium by combining cost-effective policies like the transport charge with targeted subsidies and assistance. This balance encourages farmers to produce high-quality milk to maximise their own income, while the cooperative reduces operating expenses by allocating resources as efficiently as possible and guaranteeing effective logistical operations. This effective strategy supports the general expansion and viability of the dairy sector in addition to guaranteeing the cooperative's long-term existence.

The system's performance at the milk cooperative provides important insights into how contracts that are incomplete—characterized by inherent uncertainties and information gaps—can yet work well. Several important concepts are shown by this system.

First, it serves as an example of how important economic efficiency is. Through the implementation of a quality-based payment and targeted subsidy system, the cooperative

reduces expenses while encouraging farmers to give priority to producing milk of superior quality. This illustrates that reaching intended results does not always need extensive, all-encompassing contracts.

The second thing that the system emphasises is how crucial institutional assistance is to reduce the problems caused by knowledge asymmetry and possible moral hazards. By offering vital resources like high-quality feed and veterinary care, the cooperative directly meets farmers' needs and promotes a more sustainable and just environment. In addition to improving milk production quality, this assistance guarantees that farmer conduct is in line with the cooperative's overarching goals.

Lastly, the approach shows promise for replication and scalability in other cooperatives of a similar nature. Effective data collecting, analysis, and information sharing are made possible using technology, such as the SmartMC software, in conjunction with transparent monitoring systems. In addition to improving the present system's efficacy and efficiency, this technology underpinning offers other cooperatives looking to adopt identical incentive schemes and get comparable results a useful model.

Given the circumstances, the milk cooperative's system is a powerful case study that shows that, despite the inherent complexity and unpredictability, well-thought-out incentive structures, strong institutional support, and the wise application of technology can promote outcomes that are advantageous to all parties.

## CONCLUSIONS

The milk cooperative's success demonstrates the value of a comprehensive approach to addressing principal-agent difficulties in agriculture. By developing smart incentive systems, providing critical support resources, and utilising technology for transparent

supervision, the cooperative has created an environment in which farmers are motivated to supply premium-quality milk while the cooperative ensures its long-term survival. This strategy serves as an inspiring model for other agricultural cooperatives, emphasising the need of aligning incentives, addressing information gaps, and establishing long-term trust among all stakeholders.

## REFERENCES

Rao, M., & Shenoy, A. (2021, January). *Got (clean) milk? governance, incentives, and collective action in Indian dairy cooperatives.*

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