IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154186

A STUDY ON LOGISTICS OPTIMIZATION ON MILK COLLECTION AND DISTRIBUTION

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Abstract: This paper is about streamlining logistical operations in the milk collecting and distribution network of the Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO). This is aimed at achieving efficiency, minimization of operation cost, and delivery of fresh milk in time. The study examines route planning, cold chain maintenance, fuel consumption, and technology application as the main factors among the supply chain farmers, collection agents, transporters, and distribute with the help of a descriptive research design and a purposive sample of 116 respondents throughout the supply chain. Structured questionnaires were used to collect the data which were analyzed in terms of percentage analysis, regression, chi-square, and t-tests. The results indicate that although route planning and real time tracking have enhanced the operations, there are still some challenges in the areas of communication, vehicle maintenance and digital tools. Poor implementation of technology and erratic scheduling have impacts on quality of milk and expenses. The study concludes by stating that a combination of GPS tracking, data analytics, and efficient communication systems will be able to enhance the performance of logistics to a considerable extent. Some of the recommendations would be to optimize routes better, train more, and service equipment. ANIIDCO will be able to create an efficient, cost effective, and sustainable milk supply chain to the island region by enhancing coordination and embracing digital innovation.

Keywords: Technology utilization, Cold chain maintenance, Sustainable milk supply chain.

1. INTRODUCTION

The dairy industry is a vital part of the global food supply chain, which ensures the daily nutritional requirements of millions of consumers around the world. In addition, it also provides a livelihood for millions of farmers. Since milk is a perishable item, it is necessary to process it immediately and handle it properly so that the quality, safety, and nutritional value of the milk remain intact. In this context, the logistics of the supply chain play a vital role in the dairy supply chain, which includes the collection of milk from the farms and delivering it to the consumers. Efficient logistics ensure the quick delivery of the products from the farms to the consumers, thereby maintaining the quality of the products. Inefficient logistics would result in major problems for the organizations, which would lead to loss of products, increased costs of operation, and lower consumer satisfaction. Delays in the supply of products would also affect the quality of the products. Thus, efficient logistics have now become a necessity for the organizations. In the modern competitive market, the optimization of the logistics of the supply chain is a major advantage for the organizations. It would help the organizations in the dairy supply chain to maintain the quality of the products, lower the costs of the supply chain, and satisfy the consumers effectively.

1.1 OBJECTIVES OF STUDY

Primary Objective

[1]. To improve the milk collection and distribution system of ANIIDCO for better freshness, faster delivery, and lower cost.

Secondary Objectives

[2]. To identify the problems in the current milk collection process and suggest improvements.

[3]. To analysis the delivery routes and timings to make milk distribution more efficient.

[4]. To analysis transport cost and resources are used and find ways to reduce wastage.

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1.2 SCOPE OF STUDY

- The examination is limited solely to the collection and distribution system of milk under ANIIDCO in the island territory of Andaman & Nicobar Islands.
- It involves analysis of transportation, necessary time to deliver, utilization of resources and cost incurred, relating to each logistics of milk.
- The examination is recommending improvements to use of technology, improve efficiency and maintaining quality across the milk supply chain.
- Aims to improve Delivery Speed And Customer Satisfaction

1.3 LIMITATION OF STUDY

- Study May be limited to a Specific Region, Dairy Unit Or Organiztion
- Time Constraints May limit in- Depth Analysis of all Logistics Activities
- Finding May Be Applicable to all dairy industries or Regions
- Financial Constraints May Restrict Detailed Field Research and data collection

2. REVIEW OF LITERATURE

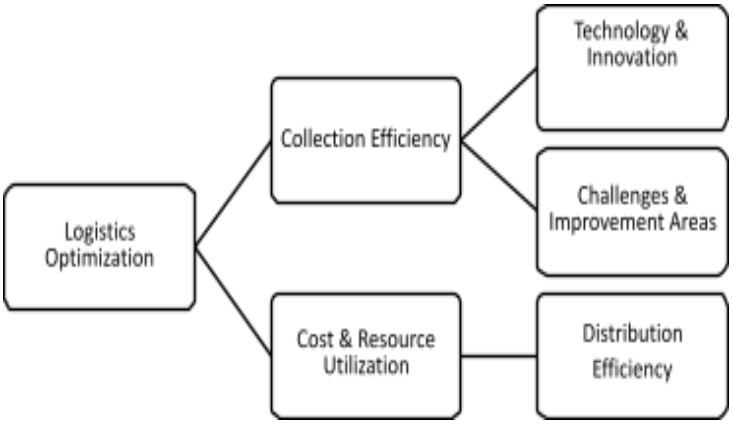
- **Adriano et al. (2020)** examined dynamic routing techniques for milk-run collection systems and emphasized the importance of route optimization in reducing transportation time and operational costs.
- **Bilgen and Çelebi (2013)** focused on integrated production scheduling and distribution planning in dairy supply chains using hybrid modeling techniques.
- **Claassen and Hendriks (2007)** analyzed periodic milk collection problems using mathematical optimization models.
- **Chokanat et al. (2021)** proposed an optimization approach for multi-compartment raw milk transportation. The study demonstrated that efficient allocation of compartments based on milk quality and quantity helps in reducing contamination risks and improving delivery efficiency.
- **Dutta and Bose (2015)** explored cold chain logistics in the dairy industry and highlighted its critical role in preserving milk quality.
- **Kumar and Singh (2018)** studied the role of technology in dairy logistics and found that GPS tracking, real-time monitoring, and data analytics improve route planning and operational transparency.
- **Sharma et al. (2019)** investigated challenges in milk distribution systems and identified issues such as poor infrastructure, inefficient routing, and lack of coordination among stakeholders.

2.2 RESEARCH METHODOLOGY

Research methodology is a systematic and rationalized course of action to answering a research question that mentions specific method/s for data collection and analysis and the rationale for selection of those methods.

2.3 RESEARCH DESIGN

The present study will adopt a descriptive research design to explore employee engagement within the organization. A descriptive design is suitable because it helps in describing the existing conditions, practices, and relationships without manipulating any variables.



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3. SAMPLING METHOD

Purposive sampling method to select representative dairy farms, collection points, and distribution centers. Sampling was also based on the volume of milk production, distance from the processing units, and access. This ensured small- and large-scale producers would be included and would portray the realistic variables present in the current milk collection and distribution system.

3.1 SAMPLING SIZE

The study titled "Logistic Optimization on Milk Collection and Distribution in ANIIDCO" was conducted with a sample size of 116 respondents to analyze the efficiency of milk supply

3.2 THE STATISTICAL TOOL

The Statistical tool used for solving a sample test by **Chi-square** test for Real time tracking for milk transport and **independent sample T-test** for Checking the Time of delivery to reliable customers

3.3 ANALYSIS

CHI-SQUARE TEST

Null Hypothesis (H_0): There is no significant association between educational qualification **and the** opinion on using real-time tracking for milk transport vehicles.

Alternative Hypothesis (H_1): There is a significant association between educational qualification and the opinion on using real-time tracking for milk transport vehicles.

Table: 01-Chi Square Test

		DO USE REAL TIME TRACKING FOR MILK TRANSPORT VEHICLES					
		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	Total
EDUCATIONAL QUALIFICATION	10TH	4	8	3	2	3	20
	12TH	8	4	5	5	4	26
	DIPLOMA	6	15	8	5	3	37
	UNDERGRADUATE	6	4	2	6	1	19
	POST GRADUATE	1	7	4	1	1	14

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Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.005[a]	16	.385
Likelihood Ratio	17.516	16	.353
Linear-by-Linear Association	.066	1	.797
N of Valid Cases	116		

a. 17 cells (68.0%) have expected count less than 5. The minimum expected count is 1.45.

Total	25	38	22	19	12	116

Source: Author Computed

INTERPRETATION

The p value (Asymp. Sig.) is 0.385, which is greater than 0.05, indicating no significant association between the two variables. This means that educational qualification does not influence the use or opinion on real-time tracking.

INDEPENDENT SAMPLE T-TEST

1. Null Hypothesis (H 0): No significant difference between the two groups exists in the perception regarding whether the milk is delivered to the retailers punctually and dependably.
2. Alternative Hypothesis (H 1) The perception of the two conditions of whether milk is delivered to the retailers on time and in a reliable manner is significantly different between the two groups

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TABLE 2- Independent Sample T Test

Independent Sample T Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
DELIVERY OF MILK RETAILERS IS DONE ON TIME AND RELIABLY	Equal variances assumed	.542	.463	-.325	114	.746	-.10933	.33686	-.77665	.55799
	Equal variances not assumed			-.295	20.434	.771	-.10933	.37021	-.88053	.66187

Source: Author Computed

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INTERPRETATION

The Sig. (2-tailed) value is 0.746, and it is more than 0.05, which shows no significant difference between the groups. The significance of variance of the Levene test of 0.463 indicates the assumption of equal variances. The difference (-0.10933) is too small, which contributes to the insignificance of the difference between groups. In general, the findings indicate that the respondents have common opinions about the reliability and timeliness of milk delivery.

4. FINDINGS

- The data may not be exactly satisfactory to the Chi-Square assumptions since the number of expected counts of less than 5 in the high cell counts is high. In general, it can be observed that real- time tracking is used in all levels of education.
- The difference (-0.10933) is too small, which contributes to the insignificance of the difference between groups. In general, the findings indicate that the respondents have common opinions about the reliability and timeliness of milk delivery.
- The existing milk collection system faces delays due to inefficient route planning and poor scheduling.
- Lack of proper coordination between collection centers and distribution units leads to time and cost inefficiencies
- Manual record-keeping systems create errors and lack of real-time tracking

5. SUGGESTION

- Digital tools and real time tracking systems need to be implemented more often in order to keep an eye on the movements of the vehicles, the temperature of milk, and the time of delivery.
- This will aid in decreasing the delays, quality of products and an overall coordination in the milk supply chain.
- GPS and optimization software can be used to create an efficient route that requires less fuel consumption and time.
- Maintenance of vehicles regularly and capacity utilization is important as a way of enhancing efficiency in operations and reducing transportation costs.

6. CONCLUSION

Through the analysis of the logistics optimization in the milk collection and distribution, it is evident that even though some of the variables including route planning and real time tracking are on the increase, there are still more problems. Weak communication, poor technology utilization, and inconsistent schedules of collection still influence the efficiency of operations and milk quality. The results indicate that the process of logistics is to be streamlined, on a more systematic, and technology-driven basis.

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