

# Technology-Driven Dairy Enterprise Management and Sustainable Rural Business Development: An Empirical Study in Ahmednagar District



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## Abstract

Technology is seen as a key tool which can be used for managing dairy enterprise for sustainable rural entrepreneurship, operational efficiency and socio-economic development in India. The contribution of modern day dairy enterprise system in enhancing performance of business starters and sustainable rural business development is studied in Ahmednagar District, Maharashtra in the present study. This paper used both exploratory and descriptive researched design using primary and secondary data. The primary data were collected through 100 dairy entrepreneurs, through structured questionnaires, interviews, discussion and observation technique. One-Sample t-test, descriptive statistics and percentage analysis were used to analyze data. The findings indicate that the respondents are extensively utilizing modern dairy technologies such as automation, improved breeds of cattle, scientific feeding and digital management. The study provides important management and policy implications on the use of technology to manage rural enterprises, digital transformation and sustainable business development in emerging rural economies. Moreover, dairy entrepreneurs tended also to be more involved in environmentally friendly activities, e.g., waste reduction, cultivation of green fodder, and utilization of resources effectively. The presence of institutional support mechanisms like government subsidies, cooperative networks, financial assistance and training programmes were found to be major drivers that enable technological adoption and enterprise modernization. The study contributes to business and management literature by examining how technology-enabled enterprise systems improve operational efficiency, entrepreneurial performance, and sustainable rural business development.

**Keywords:** Dairy Enterprise Management, Rural Entrepreneurship, Technology Adoption, Operational Efficiency, Sustainable Development, Dairy Innovation

## 1. Introduction

The rural Indian economy, particularly agriculture and its related industries remain as the mainstay of the Indian economy, playing a significant role in creating employment and ensuring food security and livelihood sustainability. Dairy farming, among these industries has been one of the most stable and resilient agricultural practices given its periodic income generation, nutritional value and the ability to generate employment opportunities in the rural areas. Dairy farming in India has over time changed its traditional subsistence business to a commercial and technology-based business due to modernization, sustainability issues, and entrepreneurship (P. Kumar & Singh, 2019). The dairy industry is not only a source of income to the rural households, but also a source of agricultural development and socio-economic change in the country. Dairy farming is also essential to complement the income of farms and enhance the livelihoods of rural communities in other districts, like Ahmednagar in Maharashtra with the help of cooperative organizations and formal milk collection frameworks (Avhad et al., 2015). The contemporary dairy farming practices have been of growing

significance in the past years because of the fast-rising technological innovations, the increasing demand of consumers on quality dairy products and the rise in awareness on sustainable farming practices. The current dairy production encompasses breeding science, automated milking and precision feeding, cattle health, climate wise livestock production and digital supply chain (GAJANAN, 2021). These inventions go a long way in enhancing productivity, operational efficiency and profitability and diminishing risks of production and environmental degradation. Singh and others highlighted that automation and scientific dairy operations help to achieve a higher efficiency and better farm management performance in the up-and-coming agricultural economies (Knapp et al., 2014). Likewise, the issue of environmental sustainability has become an essential part of contemporary dairy businesses because of the anxiety about the emission of greenhouse gasses, use of water, and waste disposal (Mohini et al., 2016). Sustainable dairy farming practices are becoming increasingly viewed as a necessity in terms of balancing economic growth and environment protection and social well-being. The

use of green fodder, production of biogas, the use of organic manure, and effective water conservation systems are some of the practices that can decrease the ecological footprint of dairy farming and increase productivity in the long term (Leinonen, 2019). Climate-smart livestock systems indicate that enhanced herd productivity and advanced feed management can go a long way in lowering the production of methane and achieve sustainability in the dairy production systems (Mech et al., 2023). Moreover, the studies on the model of methane emission prediction show the relevance of technological innovation and scientific monitoring linked to the particular environmental challenge related to livestock farming (Alam et al., 2026). Sustainable production of dairy is thus expanding to be considered an all-encompassing strategy of integrating profitability, environmental stewardship, and social inclusion (Sarkar et al., 2024). The rural populations have also created large entrepreneurial opportunities due to the modernization of dairy farming into a modernized enterprise, particularly to the youth and small-scale farmers. Dairy entrepreneurship encourages self-employment, diversification of incomes, and rural enterprise development through value-added dairy practices, adoption of digital marketing, and cooperative involvement (Thakur, 2020). Education, institutional support, training exposure, and access to extension services are likely to affect entrepreneurial behaviour in dairy farmers (Avhad et al., 2015). Entrepreneurial orientation can also be reinforced through government programs, cooperative types of dairy programs and policy interventions by enhancing access to finance, veterinary services and technological support systems (Sivasankar et al., 2025).

The Ahmednagar District offers a good background to analyzing the nexus between dairy modernization and the rural entrepreneurship because of its high level of cooperation, large milk procurement system, and the growing use of agri-technologies. Economic studies on drought affected areas of Maharashtra suggest that the scientific feeding system, better management of herd, and collaborative marketing have a significant role to play in making dairy more profitable and sustainable (Sapkal et al., 2025). Furthermore, the challenge of climate variability and environmental issues have enhanced the demand of having robust livestock systems that can remain productive amidst the fluctuating agricultural conditions (Berry et al., 2015; Sejian et al., 2021).

Even with the increased significance of the modern dairy farming, there are a number of issues that still plague its adoption by rural farmers. The high cost of food, inaccessibility to modern technologies, and insufficient veterinary facilities, water shortage, and lack of technical expertise are also significant barriers to sustainable development of dairies

(Sapkal et al., 2025). Moreover, smallholder dairy farmers are usually hindered financially and operationally to implement automation and precision dairy technology. The solution to these problems will involve combined policy assistance, training programmes, and technological dispersion and institutional cooperation between cooperatives, extension agencies, and government agencies (Sivasankar et al., 2025).

It is against this backdrop that the current study seeks to explore the role of modern dairy farming in sustainable rural entrepreneurship in the Ahmednagar District. The research aims at the application of the contemporary dairy practices, the role of technology and sustainability in maximizing the entrepreneurial opportunities, and the institutional aspects affecting the development of dairy enterprise.

### Objectives:

1. To analyze the adoption level of modern dairy farming practices among dairy farmers in Ahmednagar district.
2. To examine the role of modern dairy farming in promoting rural entrepreneurship.
3. To evaluate the economic, social, and environmental sustainability.
4. To identify the key drivers and challenges influencing the adoption of modern dairy farming.
5. To propose strategic recommendations and policy interventions for improving rural livelihood outcomes in Ahmednagar district.

### Hypothesis

H0 (Null): Modern dairy farming does not significantly contribute to sustainable development of farmers.

H1 (Alternative): Modern dairy farming significantly contributes to sustainable development of farmers.

### 2. Review of Literature

According to the Resource-Based View (RBV) theory, valuable resources and capabilities are the source of sustainable competitive advantage for an organization. Technological adoption, automation systems, digital monitoring tools, managerial capabilities and institutional support are all strategic enterprise resources that can help improve the operational efficiency, enterprise productivity and enterprise sustainability in technology-driven dairy enterprises. Dairy entrepreneurs who efficiently utilise technological and organisational resources are more likely to achieve superior enterprise performance, entrepreneurial growth and sustainable competitive advantage in rural business environment (Sarkar et al., 2024).

The Triple Bottom Line (TBL) theory also stresses that sustainable businesses must be concerned with economic performance, social development and environmental sustainability at the same time.

Economic sustainability is measured by the profitability of the enterprise, the productivity of the operations, and the generation of income in technology-driven dairy businesses; social sustainability is measured by the development of the entrepreneur, creation of jobs, and the empowerment of rural economies; and environmental sustainability is measured by waste management, cultivation of green fodder, climate-sensitive dairy practices, and the efficient use of resources. The TBL framework thus describes how contemporary dairy enterprise systems will lead to a balanced and sustainable rural business development with regards to operational and sustainability-based management practices (Alam et al., 2026). The Diffusion of Innovation Theory explains how technological innovations and modern operational practices are gradually adopted within enterprise systems over time. In dairy enterprise management, the adoption of automation technologies, digital monitoring systems, precision feeding mechanisms, and scientific dairy management practices depends significantly on awareness levels, institutional support, extension services, training exposure, and perceived enterprise benefits. Government subsidies, cooperative business networks, digital extension systems, and financial support mechanisms play an important role in accelerating enterprise modernization and strategic technology adoption among dairy entrepreneurs (Knapp et al., 2014).

The technology adoption, digital transformation, strategic resource optimization and sustainable enterprise theory together suggest that technology adoption, digital transformation, adoption of strategic resources and sustainable enterprise practices significantly improve operational efficiency, enterprise competitiveness, entrepreneurial performance and enterprise sustainability in technology-driven dairy enterprises. Earlier research has emphasized the increasing importance of current dairy farming as a sustainable route to rural entrepreneurship, livelihood improvement and environmental control. Economic studies in drought prone areas in Maharashtra indicated that scientific feeding, better management of herds, and collaborative marketing systems can greatly enhance the profitability and sustainability of dairy farms. Meanwhile, increasing feed prices, water shortage, and insufficient veterinary facilities were found to be significant limiting factors to dairy entrepreneurship and long-term rural livelihood growth (Sapkal et al., 2025).

A study that specifically targeted Ahmednagar district revealed that educational attainment, exposure to training, social participation and extension contact are very strong determinants of entrepreneurial behaviour among dairy farmers. The paper stressed the fact that capacity-building programmes and good information networks are

essential in changing dairy farming into a good rural enterprise model (Avhad et al., 2015). Likewise, the need to intensify productivity, manage value-chain efficiently, and in an ecologically sustainable manner have been highlighted in sustainable dairy sector development literature as key to enhancing the long term sustainability of dairy business. The application of a triple-bottom-line model that combines economic development, social integration, and environmental conservation has been suggested as a good solution to sustainable dairy entrepreneurship in developing economies.

Another significant concern in the production systems in dairy production is environmental sustainability. The carbon footprint analysis of smallholder dairy farms in India found the fecal management behavior and enteric release of methane to be the key contributors to environmental destruction. The results indicated that a better feeding efficiency and an increase in herd productivity will be able to reduce greenhouse gas emissions dramatically without lowering farm profitability, thus contributing to climate-smart dairy farming (Mech et al., 2023). Similarly, predictive modelling research on methane emissions in Indian dairy cattle highlighted the value of scientific monitoring system, and current nutritional practices in facilitating policy planning and environmental sustainability ambitions without undermining production efficiency.

The Life Cycle Assessment (LCA) systems have also enhanced the knowledge of sustainability in the dairy production systems. A review of studies on the greenhouse gas assessment methods in milk production revealed that resource-use efficiency, emission monitoring, and waste management practices are essential in assessing environmental sustainability and defining sustainable production pathways in contemporary dairy farming systems (Mohini et al., 2016). Moreover, the research on the methods of enteric methane reduction proved that the most effective approach to reducing environmental effects is improved nutrition, feed supplements, and livestock management approaches that can boost long-term farm productivity and profitability.

Institutional and collaborative frameworks have also been identified as significant factors in dairy entrepreneurship and modernization. A study of Milk Producer Companies in India discovered that institutional frameworks through collective institutions enhance the bargaining power of farmers, the provision of veterinary and financial services, and value-added activities in dairy, leading to rural entrepreneurship and income steadiness (Thakur, 2020). Similarly, the extension interventions and policy-oriented research highlighted the fact that through the cooperation between government agencies and cooperatives and the extension networks, technological adoption and

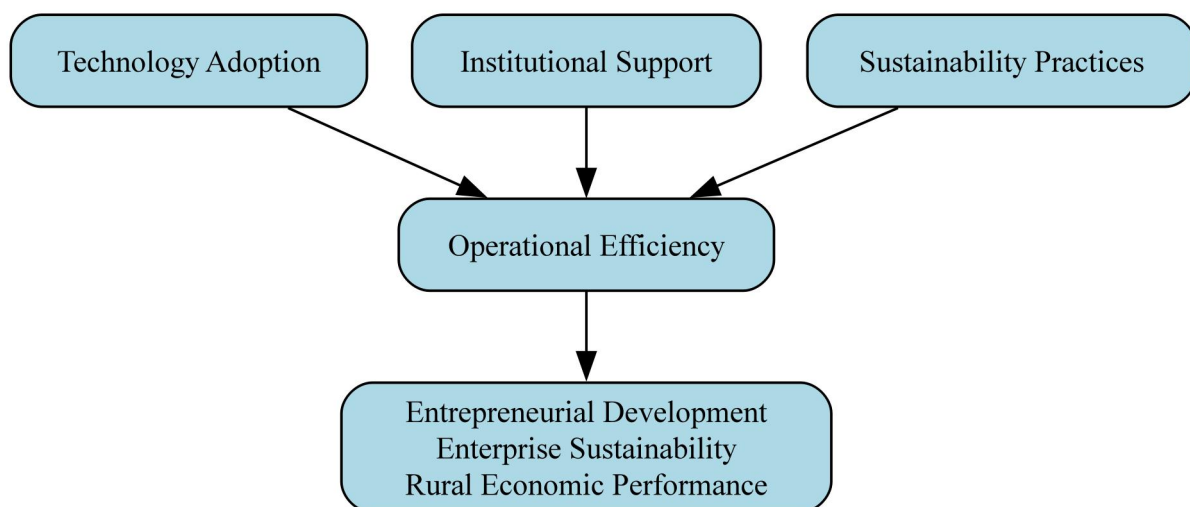
entrepreneurial development among dairy farmers are possible. It was found that training programmes and digital extension services played an important role in modernizing dairy farming practices.

Precision dairy farming and technological innovation has come up as a revolutionary change in the livestock industry. Precision dairy technologies studies have shown the potential to provide a higher level of herd health monitoring, reproductive efficiency, and management of the farm using data-driven decision-making systems. Nevertheless, expenses of implementation and lack of skills were found to be significant obstacles in the adoption of such technologies by smallholder farmers in developing nations (Ponnusamy et al., 2021). The entrepreneurial and business management approaches in dairying also highlighted that effective dairy business enterprises need technical skills, financial acumen, market knowledge, and sound enterprise planning in order to ensure sustainable generation of income and business development (R. Kumar & Kumar, 2026).

Environmentally sustainable livestock production approaches on a global scale have emphasized resource efficiency, minimization of wastes, and livestock production methods that are climate-friendly in ensuring long-term agricultural

sustainability (Leinonen, 2019). On the same note, the management of dairy farms business literature revealed the importance of production planning, cost control, and risk management plan in enhancing financial performance and efficiency in operations in dairy enterprises (Knapp et al., 2014). The studies focused on climate changes also highlighted the increasing importance of adaptive management to heat stress, better breeding systems, and nutritional optimization to support a dairy entrepreneurship in the shifting environmental conditions (Sejian et al., 2021). Additionally, larger-scale studies of livestock production systems in climate variability highlighted how technology innovation and policy support were necessary to sustain rural livelihoods and sustainable agricultural development (Tribst et al., 2019).

Overall, the literature indicates that technology-driven dairy enterprises significantly improve rural entrepreneurship, operational efficiency, and sustainable business development through technological innovation and institutional support. However, limited studies have examined and shown in Figure 1 the integrated relationship between enterprise modernization, sustainability practices, and entrepreneurial performance specifically in Ahmednagar District.



**Figure 1: Conceptual Framework of Technology-Driven Dairy Enterprise Modernization**

### 3. Research Methodology

#### 3.1 Research Design

The current research is founded on exploratory and descriptive research designs. In order to learn about the new trends, sustainability, technology adoption, and entrepreneurship possibilities related to modern dairy farming, the exploratory approach was chosen. The research design employed was descriptive design which was applied to systematically explore the perceptions, operational practices and sustainability outcomes among dairy farmers in Ahmednagar District.

#### 3.2 Sources of Data Collection

In the study, both primary and secondary sources of data collection were used to have comprehensive and reliable findings. Primary data were gathered by directly interviewing, administering questionnaires, discussing with and observing the dairy farmers. Quantitative information connected with technology adoption, sustainability practices, entrepreneurial development and institutional support were gathered using structured questionnaires. Qualitative data were provided by personal interviews and discussions, which included experiences, challenges and opportunities of the

farmers in current dairy farming. Field methods of observation were also used to learn about reality in farming methods, herd management systems and the application of technology on the field.

Books, research journals, and published articles, government reports, and websites, pertaining to dairy farming, sustainability, livestock management, and rural entrepreneurship were used to gather secondary data. These references assisted in shaping out the theoretical and conceptual background of the research.

### 3.3 Sample Design

The research was carried out in the Ahmednagar District of Maharashtra that was chosen based on the following factors; conducive dairy culture, developed milk collection systems and a growing uptake of modern dairy technology in the District. The sample population was comprised of dairy farmers who were involved in the dairy farming activities in the district. One hundred dairy farmers were identified to take part in the study. To reduce selection bias, the respondents were selected through simple random sampling technique that would ensure equal representation.

### 3.4 Sampling Instruments

Data collection instruments that were utilized in the study were structured questionnaires, personal interviews and observation. These tools allowed the researcher to gather quantitative and qualitative data on the current dairy farming practices, sustainability and entrepreneurship development.

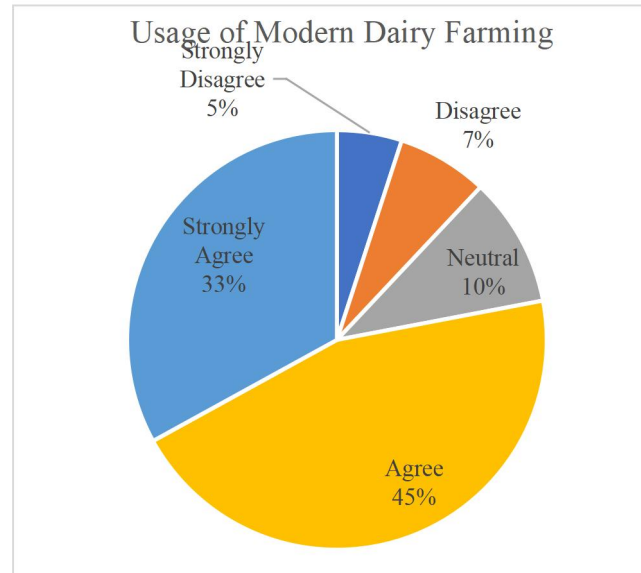
### 3.5 Statistical Tools Used for the Study

The data gathered was categorized, tabulated and examined with the help of suitable statistical instruments. Data interpretation was done using descriptive statistical methods including percentage analysis, mean, standard deviation, coefficient of variation and graphical representation. Moreover, a One-Sample t-test was used to test the hypothesis on the role of modern dairy farming to sustainable development among the farmers.

## 4. RESULT

### 4.1 Data Analysis and Interpretation

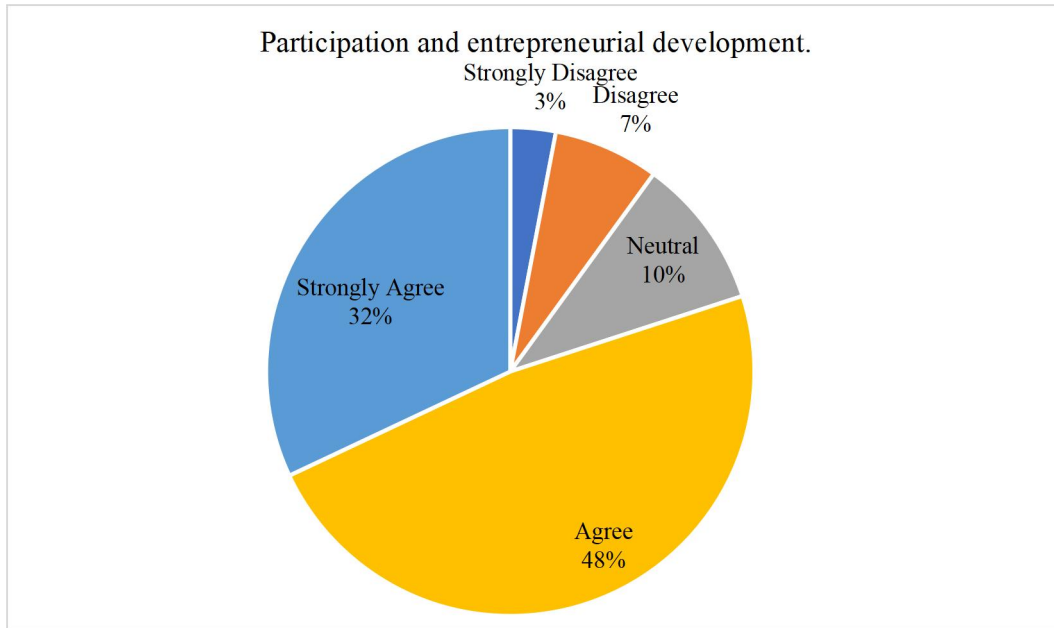
The majority of respondents (approx. 78%) agreed or strongly agreed that they use modern technologies including automated systems and improved breeds. This represents a critical level of adoption of technology by dairy farmers, which is indicative of the modernization in the agriculture sector. The trend of modern dairy technologies adopted by the respondents is shown in Figure 2.



**Figure 2: Adoption Level of Modern Dairy Farming Technologies among Dairy Farmers in Ahmednagar**

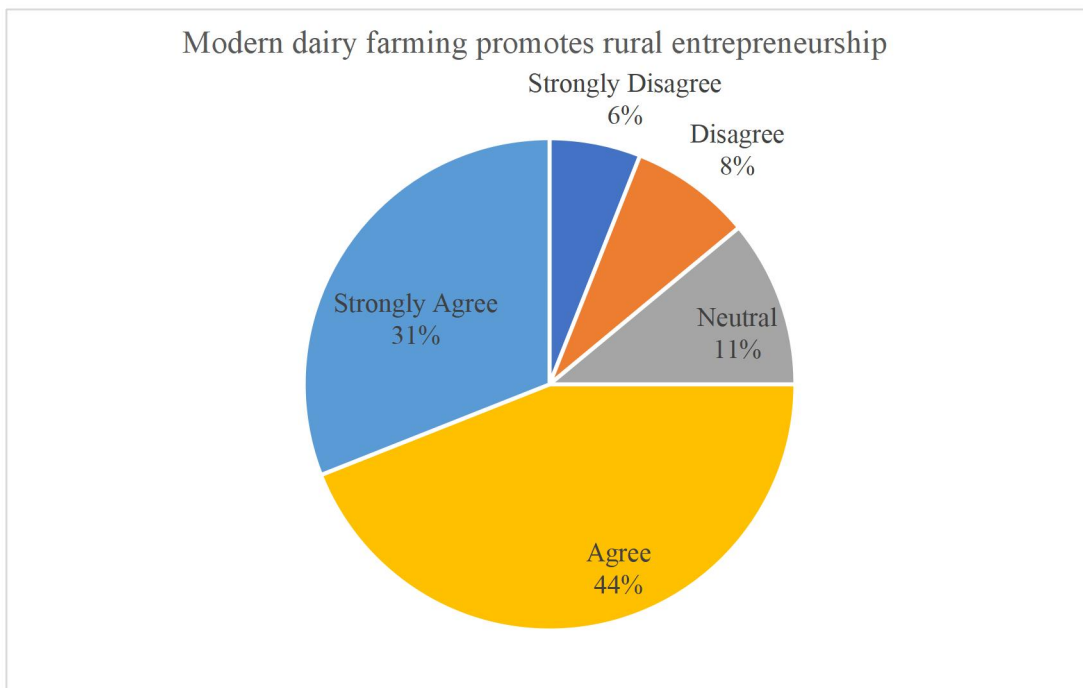
### District

Majority of the participants (around 75%) agreed that modern dairy farming has opened new entrepreneurial opportunities in rural areas. The finding highlights the sector's potential to promote self-employment and diversify income sources. The perception of dairy farmers about opportunities to be an entrepreneur as a result of the modern dairy farming is presented in Figure 3.



**Figure 3: Perception of Dairy Farmers regarding Rural Entrepreneurship Opportunities Generated through Modern Dairy Farming**

Approximately 80% of the respondents felt that innovations in dairy farming encouraged youth and local entrepreneurs to initiate dairy-based businesses. This implies that modernization serves to enhance economic dynamism and the growth of entrepreneurship in rural areas. Figure 4 shows the impact of dairy farming innovations on youth involvement and entrepreneurial growth.



**Figure 4: Influence of Dairy Farming Innovations on Youth Participation and Entrepreneurial Development**

Most of the respondents (85 percent) reported that contemporary dairy farming enhanced household earnings and financial stability. The outcome suggests that it has high economic payoffs and helps to maintain the livelihoods based on dairy. The impact of modern dairy farming on household income and economic sustainability is shown in Figure 5.

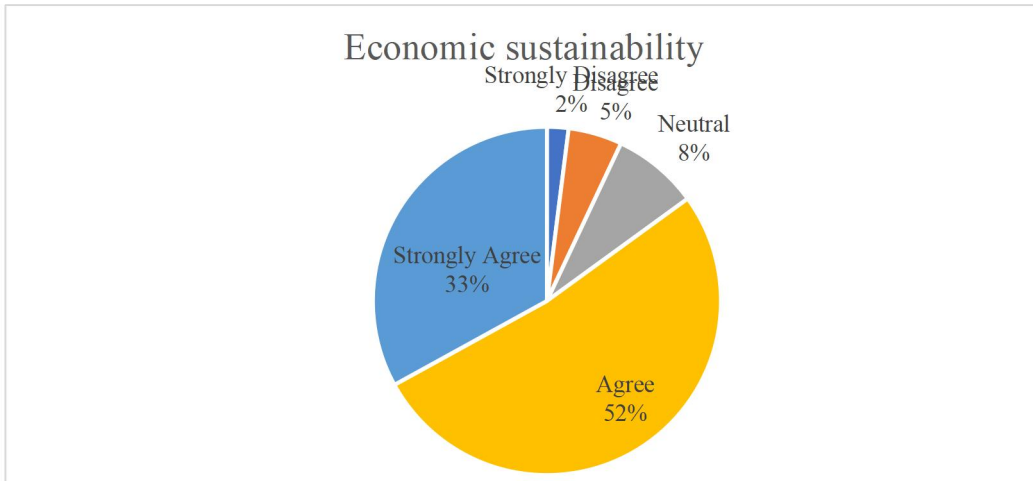


Figure 5: Impact of Modern Dairy Farming on Household Income and Economic Sustainability

Two-thirds of the respondents (almost 77 percent) recognized how contemporary practices are addressing environmental sustainability by managing waste, green fodder and animal welfare. This is an indication of increased awareness of environmentally friendly farming methods. Figure 6 presents environmental sustainability practices related to the modern dairy farming systems.

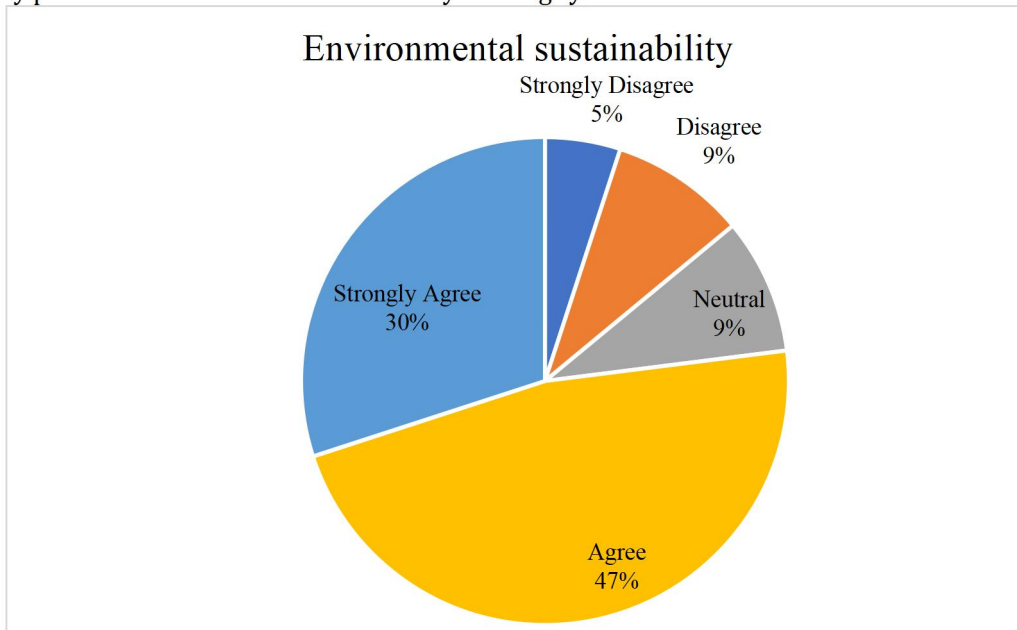
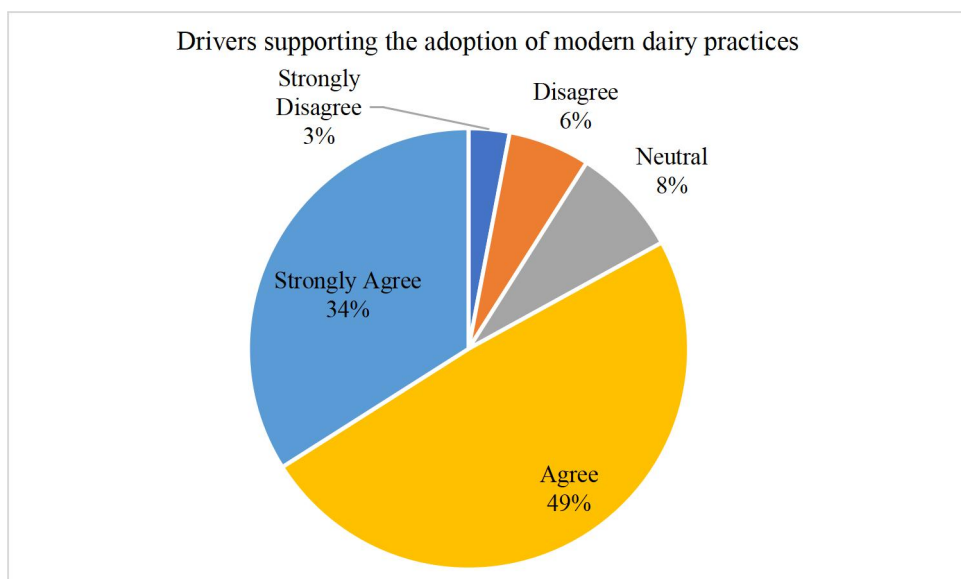


Figure 6: Perception of Environmental Sustainability Practices in Modern Dairy Farming

Approximately 83% of the respondents mentioned that government subsidy, training and access to finance were the factors that promote the use of modern dairy practices. This indicates the role of institutions in the diffusion of technology. Figure 7 shows some of the key institutional factors that enable the uptake of modern dairy farming practices.



**Figure 7: Institutional Drivers Supporting the Adoption of Modern Dairy Farming Practices**

#### 4.2 Descriptive statistics

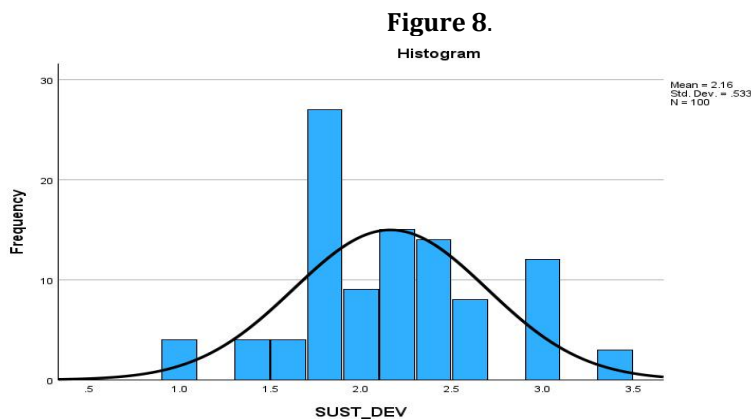
The descriptive statistics of SUST\_DEV show that the dairy farmers, who responded to the survey (100), have a positive attitude towards the outcomes of sustainable development. The mean score of 2.16 is near the category of "Agree" indicating that in general respondents agree that modern dairy farming is good for the economy, social and environmental sustainability. The second median value of 2.20 and mode of 2 also support the idea that most farmers chose "Agree", indicating a positive sentiment about the advantages of modernization in dairy farming. A relatively low standard deviation (0.533) indicates that the responses are fairly similar, suggesting that there is a common positive perception among the sample. The histogram shows an approximate normal

distribution with a slight positive skew (0.241), indicating that the majority of responses are clustered on the agreement end of the scale. The kurtosis value (-0.062) suggests that the distribution is stable and not highly skewed. A coefficient of variation of 24.65% indicates a moderate level of variation and a general consensus among the respondents. In conclusion, the findings suggest that, on the whole, dairy farming modernization is regarded as a positive enabler for sustainable development among farmers in Ahmednagar district, which supports the alternative hypothesis that modernization in dairy farming positively affects sustainable development outcomes of farmers. The descriptive statistical analysis of sustainable development indicators is presented in Table 1.

**Table 1: Descriptive Statistics of Sustainable Development Variable (SUST\_DEV)**

Statistics		
SUST_DEV		
N	Valid	100
	Missing	0
Mean		2.16
Std. Error of Mean		.053
Median		2.20
Mode		2
Std. Deviation		.533
Variance		.284
Skewness		.241
Std. Error of Skewness		.241
Kurtosis		-.062
Std. Error of Kurtosis		.478
Range		2
Minimum		1
Maximum		3
Sum		216
CV		24.658

Based on the results of figure 8, most of the dairy entrepreneurs indicated positive perception of the outcomes of sustainable development produced by sustainable production good practice in dairy enterprise management. The distribution pattern exhibits a normal distribution with slight positive skewness, suggesting a general consensus among respondents about the contribution of technologically oriented dairy enterprises to economic, social and environmental sustainability. The statistical distribution of sustainable development perceptions among dairy farmers is represented in



**Figure 8: Distribution of Sustainable Development Responses among Dairy Farmers**

One-Sample t-test results for SUST\_DEV indicate that the mean score of sustainable development (Mean = 2.16, SD = 0.533, N = 100) is statistically significant, as compared with the test value of zero. The calculated t-value ( $t = 40.555$ ,  $df = 99$ ,  $p < .001$ ) shows that the observed mean difference (2.162) is highly significant at the 0.05 level. Because the significance value is less than 0.001, the null

hypothesis is rejected and it can be concluded that modern dairy farming practices have a meaningful and statistically significant contribution towards sustainable development among farmers. Table 2 provides a summary of the statistics of the dairy farmer's responses to sustainable development. Table 3 shows the outcomes of the One-Sample t-test analysis for sustainable development.

**Table 2: One-Sample Statistics for Sustainable Development among Dairy Farmers**

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
SUST_DEV	100	2.16	.533	.053

**Table 3: One-Sample t-Test Results for Sustainable Development Outcomes**

One-Sample Test							
	Test Value = 0						
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
SUST_DEV	40.555	99	<.001	<.001	2.162	2.06	2.27

**4.3 Hypothesis Testing**

The empirical results of One-Sample t-test show that the entrepreneurial sustainability of the dairy farmers and sustainable rural business development is significantly affected by the technology based

dairy enterprise management ( $t = 40.555$ ;  $p < 0.001$ ). The statistical result showed that the null hypothesis cannot be accepted and the alternative hypothesis, "Modernization in dairy enterprise systems has positive impact on sustainable

development outcomes, operational performance and rural enterprise transformation is valid.

## 6. Discussion

The results of the current study indicate that technology based management of the dairy enterprises has become an important mechanism to improve the efficiency of operations, performance of the entrepreneur, and sustainability of rural business in Ahmednagar District. The growing use of modern dairy technologies including automation systems, scientific feeding methods, better cattle breeds and online farm management systems indicate a slow shift in subsistence farming to rural enterprise system with the use of technology. The findings have shown that dairy entrepreneurs are gradually incorporating strategic operational practices into their business operations to enhance productivity, resource utilization and business sustainability in the long term. These results are in line with the past researches that have pointed out that technological innovation, management abilities, and institutional endorsement play a significant role in terms of modernizing enterprise and entrepreneurial development in the rural business sector (GAJANAN, 2021).

The research also shows that the contemporary dairy enterprise systems are very instrumental in facilitating the rural entrepreneurship and self-employment. Scientific and technology-based dairy operations have promoted the involvement of youths, diversification of enterprises and value-added business operations in the dairy sector by the rural economies. Business management: In terms of business approaches, the contemporary dairy businesses help to establish sustainable micro-enterprise ecosystems which aid in generating incomes, creating local jobs, and stabilizing economies. The results are consistent with the Triple Bottom Line (TBL) model, which focuses on the co-realization of economic performance, social development, and environmental sustainability in the management systems of enterprises (Sarkar et al., 2024). The results of the current research lend credence to this view by showing that the respondents have positive perceptions towards entrepreneurship generation and livelihood diversification with dairy farming (Panwar & Vyas, 2022).

One of the most significant consequences of the use of technology in the management of dairy enterprises became the operational efficiency. The technologies of automation, dairy precision, scientific feeding, and digital monitoring had a great influence on the productivity of the enterprise, the coordination of operations among dairy entrepreneurs. The contemporary dairy management systems can help entrepreneurs to maximize the production processes, minimizing the operational inefficiencies, minimizing the wastage of

resources, and enhancing herd management performance. Previous research on precision dairy farming also indicated that technology integration improves decision making, reproductive performance, livestock tracking, and efficiency of the enterprise (Rathod & Dixit, 2020). therefore, technological modernization can be viewed as a strategic operational management tool that strengthens enterprise competitiveness and long-term business sustainability in rural dairy sectors (Mandi, 2022; Padhiary et al., 2024).

The findings also suggest that technology-driven dairy enterprises contribute significantly toward financial stability and business sustainability among rural entrepreneurs. Respondents reported improvements in household income, enterprise productivity, and long-term economic security due to modernization in dairy operations. From a business economics perspective, modern dairy enterprises function as sustainable rural business models that facilitate regular cash flow generation, business continuity, and entrepreneurial resilience. The study supports earlier research indicating that sustainable agribusiness systems integrating operational efficiency, scientific management, and resource optimization contribute positively to enterprise profitability and economic sustainability (R. Kumar & Kumar, 2026). Thus, dairy modernization not only improves production efficiency but also enhances strategic enterprise performance within rural markets.

Another key dimension found to exist in the study was environmental sustainability. Environmental friendly enterprise practices like waste management systems, green fodder growing, water management and animal welfare management were increasingly adopted by dairy entrepreneurs. The operational measures, which include measures on sustainability, help to reduce environmental degradation and increase the longterm efficiency of enterprises and resource productivity. Business sustainability literature indicates that systems that are climate smart and are based on sustainable resource management are essential to resilient business performances and sustainable environmental outcomes (Arif et al., 2025; PUROHIT, 2025). Therefore, modern dairy enterprises in Ahmednagar District are gradually integrating sustainability into their operational management strategies to improve both ecological and business outcomes (Tribst et al., 2019).

Digital transformation has additionally emerged as a transformative factor in contemporary dairy enterprise management. The integration of digital information systems, automated monitoring tools, and technology-enabled communication platforms has improved operational coordination, enterprise decision-making, supply-chain management, and market accessibility among dairy entrepreneurs. The growing use of digital systems demonstrates

how business information technologies can strengthen operational performance and enhance strategic enterprise management in rural sectors. Research on digital transformation in cooperative enterprises also highlights that digital integration significantly improves enterprise efficiency, sustainability performance, and organizational competitiveness (Lakshmi & Unny, 2025). Therefore, digitalization can be considered a major strategic enabler of modern dairy enterprise sustainability and operational modernization (Al-Naeem et al., 2023; Verma, 2026). The integration of digital monitoring systems, automated operational tools, and technology-enabled information systems reflects the growing role of business intelligence in rural enterprise management. Data-driven decision-making systems improve operational coordination, productivity monitoring, enterprise efficiency, and strategic resource optimization among dairy entrepreneurs. These technology-enabled enterprise systems further strengthen long-term business competitiveness, operational sustainability, and enterprise resilience in emerging rural business environments.

Previous business and management research has not sufficiently explored the role of technology-driven enterprise systems in improving operational efficiency, business intelligence capabilities, entrepreneurial performance, and sustainable rural enterprise management. The results suggest that the introduction of technology, institutional support, modernization of operation and sustainable business practices contribute to better entrepreneurial performance and rural economic development. The study findings overall validate that technology-based dairy enterprise management is an efficient approach to achieve high operational efficiency, sustainable and rural entrepreneurship and socio-economic transformation of the enterprises in a long-term perspective in Ahmednagar District. The study has a cross sectional design with data collected from 100 respondents from Ahmednagar District and does not provide scope for generalizability and for better interpretation of strategic business use, comparative regional analysis of the study design, longitudinal design and advanced business analytics model can be added in future studies.

## 7. Conclusion

The present study concludes that technology-driven dairy enterprise management has emerged as an effective mechanism for promoting sustainable rural entrepreneurship, operational efficiency, and socio-economic development in Ahmednagar District. The results show that enterprise productivity, resource utilization and income stability of dairy farmers have significantly improved as a result of the adoption of modern dairy technologies, such as automation systems,

scientific feeding practices, improved cattle breeds and digital management tools. The study also finds that modernization of dairy enterprises facilitates entrepreneurial development and fosters value added dairy business activities in rural areas, youth participation and self-employment opportunities. The study further emphasizes the significance of practicing environmental sustainability in enterprises like waste management, green fodder cultivation, efficient utilization of resources and animal welfare management in sustaining business in the long run. Government subsidy, cooperative network, financial support, trainings and extension services were identified as essential institutional support mechanisms that play a key role in facilitating technology adoption and enterprise modernization among the dairy entrepreneurs. The statistical results reflect that modern systems of dairy enterprises make a valuable positive contribution to sustainable development objectives. In general, the study concludes that technology based enterprise management in dairy sector can improve operational and entrepreneurial performance and also play a significant role in sustainable rural enterprise transformation, resilience and enterprise sustainability in Ahmednagar District.

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