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MULTIDIMENSIONAL IMPACT OF DAIRY COOPERATIVES ON FARMERS' SOCIO-ECONOMIC CONDITIONS AND MEMBERSHIP CONTINUITY: A STRUCTURAL EQUATION MODELLING APPROACH

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ABSTRACT

India's dairy sector plays a pivotal role in the global agricultural economy, contributing nearly 22% of the world's total milk production and serving as an important livelihood source for rural households. This achievement is supported by a vast network of small-scale dairy farmers and cooperative institutions that facilitate collective marketing, equitable pricing, and improved market access. Dairy cooperatives modeled on the AMUL framework have significantly contributed to rural development and socio-economic transformation, particularly in Gujarat. Despite their importance, empirical studies examining the multidimensional socio-economic impact of dairy cooperatives at the regional level remain limited. This study investigates dairy farmers' perceptions regarding the socio-economic impact of dairy cooperatives and examines how these perceptions influence their intention to continue cooperative membership. The study adopts a quantitative cross-sectional research design using primary data collected from 715 dairy farmers in the Banaskantha district of Gujarat through a structured questionnaire. Structural Equation Modeling (SEM) with Maximum Likelihood estimation was employed to analyze the relationships among financial well-being, quality of life, social development, and intention to continue cooperative membership. The results indicate that perceived improvements in financial well-being exert the strongest positive and statistically significant influence on farmers' intention to continue cooperative membership, followed by quality of life, while standard of living does not demonstrate a statistically significant direct effect. The findings highlight the role of dairy cooperatives in enhancing rural livelihoods and socio-economic development. Future research may examine longitudinal impacts of dairy cooperatives across different regions and incorporate additional institutional and behavioral determinants of cooperative participation.

KEYWORDS: Dairy Cooperatives; Socio-Economic Development; Financial Well-Being; Quality of Life; Structural Equation Modeling; Farmers' Perception; Cooperative Membership Continuity; Rural Livelihoods.

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1. INTRODUCTION

The dairy sector plays a significant role in the agricultural economies of developing countries by contributing to food security, employment generation, and rural livelihood sustainability. Dairy farming provides a regular source of income and nutritional security for rural households and acts as an important means of risk diversification in agriculture-dependent economies (Talukadar et al., 2023; Moorthi & Gurunathan, 2023). It also generates year-round employment and supports the livelihoods of women, youth, and landless laborers in rural areas (Upadhyay et al., 2019; Preethi & Channal, 2022; Khalangre & Suryawanshi, 2024).

India is the world's largest milk producer, contributing nearly 22 percent of global milk production. This growth has been driven mainly by small and marginal farmers who integrate livestock activities with crop cultivation (Prabakaran, 2015; Gaillard & Dervillé, 2022). Unlike developed countries dominated by large-scale dairy farms, the Indian dairy sector is characterized by smallholder production systems supplying milk through both formal and informal channels (Babu et al., 2023; Bala et al., 2023). The sector supports nearly 70 million rural households and plays an important role in poverty alleviation and income diversification (Gaillard & Dervillé, 2022; Saxena et al., 2017).

The development of the dairy sector in India has been strongly supported by cooperative institutions that provide small farmers with organized marketing channels and access to essential services (Kumar et al., 2015; Singh & Pundir, 2000). The cooperative movement expanded significantly with the implementation of Operation Flood, which created a nationwide milk procurement and marketing network (Prabakaran, 2015). Typically, this system operates through a three-tier structure consisting of village-level societies, district milk unions, and state federations responsible for procurement, processing, and marketing activities (Yadav & Grover, 2009).

Among cooperative models, the Gujarat dairy cooperative system, particularly the AMUL model, is widely recognized for its success in cooperative-led rural development. It enables farmers to access veterinary services, feed supply, extension support, and fair pricing mechanisms (Upadhyay et al., 2023; Kumar et al., 2019). By strengthening farmers' bargaining power and reducing dependence on intermediaries, cooperatives improve income stability and market participation (Mandi et al., 2022; Tanwar & Kumar, 2014). Participation in modern dairy marketing channels has also been associated with higher net returns and improved household consumption expenditure among farmers (Kumar et al., 2019).

In addition to economic benefits, dairy cooperatives contribute to broader socio-economic development outcomes such as improved income levels, education and health awareness, and social well-being (Chaudhary & Upadhyaya, 2013; Nath, 2012). They also promote social inclusion and empower marginalized groups, particularly women (Rathinam & Victor, 2014; Nath, 2012). Participation in dairy-based Self-Help Groups has been linked with improvements in household assets, milk production, and income among rural women (Rathinam & Victor, 2014).

Several studies highlight that dairy farmers typically maintain small herd sizes and rely on both agriculture and livestock for livelihood security (Babu et al., 2023; Bala et al., 2023), while cooperative members often earn higher income from milk sales compared to non-members (Das et al., 2017). However, farmers also face challenges such as high feed costs, limited veterinary services, and inefficiencies in milk collection systems (Bala et al., 2023; Sana & Mukherjee, 2020; Popker & Guntur, 2014). Factors such as distance from milk collection centers and institutional challenges may also influence farmers' participation in cooperative marketing channels (Raj, 2021; Sana & Mukherjee, 2020; Singh & Pundir, 2000).

Research further indicates that cooperative membership improves farmers' socio-economic outcomes, including higher income opportunities, better productivity, and increased milk consumption (Tanwar & Kumar, 2014; Mandi et al., 2022). However, the impact may vary across regions; for instance, Priscilla and Chauhan (2019) found that dairy cooperatives in Manipur generated employment but did not significantly improve milk yield or income. Despite extensive literature on economic impacts, limited studies examine the multidimensional socio-economic effects of dairy cooperatives from farmers' perception-based perspectives and their influence on continued cooperative membership. Therefore, the present study examines dairy farmers' perceptions regarding the socio-economic impact of dairy cooperatives and their intention to continue cooperative membership using primary data collected from 715 dairy farmers in the Banaskantha district of Gujarat.

2. LITERATURE REVIEW

The dairy sector plays a crucial role in rural livelihoods and agricultural development, particularly in developing countries where livestock

farming supports employment, income diversification, and food security (Talukadar et al., 2023; Moorthi & Gurunathan, 2023). Livestock activities contribute significantly to household income and daily expenditure needs in rural areas (Talukadar et al., 2023). Similarly, Moorthi and Gurunathan (2023) reported that dairy farming generates about 180 days of employment annually and contributes around 20 percent to farmers' total income, highlighting its role in strengthening rural livelihoods and improving income distribution.

Several studies highlight the socio-economic characteristics of dairy farmers. Babu et al. (2023) and Bala et al. (2023) found that most dairy farmers are middle-aged, have moderate education levels, maintain small to medium herd sizes, and combine agriculture with dairying as their primary livelihood strategy. Comparable findings were reported by Shivagangavva (2022), who observed that dairying remains an important occupation in rural areas and contributes significantly to employment generation and poverty reduction. Gangasagare and Karanjkar (2009) further noted that farmers from different social groups, including landless farmers, actively participate in dairying, demonstrating the inclusive nature of the sector.

Research has also examined dairy farmers' socio-economic conditions in relation to cooperative participation. Das et al. (2017) found that members of the West Bengal Milk Producers' Cooperative Society earned higher income from milk sales than informal dairy farmers. Similar conclusions were drawn by Tanwar and Kumar (2014), who observed that cooperative member households had higher literacy levels, larger herd sizes, and greater earning capacity than non-members. Supporting this evidence, Mandi et al. (2022) reported that cooperative members experienced higher dairy yields, increased income, and greater household milk consumption compared to non-members, demonstrating the positive economic impact of cooperative participation.

The importance of cooperative institutions in agricultural and rural development has been widely recognized. Singh and Pundir (2000) emphasized that cooperatives support rural economies by providing credit, inputs, and marketing services. Similarly, Kumar et al. (2015) highlighted that major cooperative institutions such as AMUL, IFFCO, KRIBHCO, and Self-Help Groups have contributed significantly to agricultural productivity, employment generation, and rural development. Yadav and Grover (2009) described the three-tier structure of dairy cooperatives consisting of village societies, district unions, and state federations, which facilitate milk procurement and marketing. The role of dairy development programs such as Operation Flood in strengthening cooperative systems and rural livelihoods has also been highlighted by Prabakaran (2015).

Beyond economic benefits, dairy cooperatives contribute to broader social development outcomes. Chaudhary and Upadhyaya (2013) reported that dairy cooperatives in Nepal improved farmers' income while also promoting social interaction and community cohesion. Rathinam and Victor (2014) found that participation in dairy-based Self-Help Groups significantly increased household income, milk production, and asset ownership among women farmers. Similarly, Preethi and Channal (2022) observed that women play an important role in dairy farming, while Khalangre and Suryawanshi (2024) reported that dairying serves as a supplementary livelihood activity for rural households.

However, several studies also highlight challenges in dairy farming. Feed management remains a major cost component, accounting for nearly 60–70 percent of total production expenses (Bala et al., 2023). Sana and Mukherjee (2020) similarly identified high feed costs, limited technical facilities, and inefficiencies in milk collection systems as major operational challenges for dairy farmers. The study also found that participation in milk collection systems declines with increasing distance from collection centers, which aligns with the findings of Raj (2021), who emphasized the importance of accessible cooperative infrastructure for sustaining farmer participation.

Operational constraints within cooperative systems have also been discussed in the literature. Popker and Guntur (2014) observed that although farmers were generally satisfied with dairy farming, many expressed dissatisfaction with services such as fodder supply, veterinary support, and extension services. Swathirekha and Kuriachan (2019) similarly highlighted the important role of milk cooperative societies in organizing milk collection while also identifying operational challenges faced by farmers. Institutional issues such as weak management structures and excessive government intervention have also been identified as factors affecting cooperative efficiency (Singh & Pundir, 2000).

Technological adoption and market linkages have also been emphasized in several studies. Kumar et al. (2019) found that participation in modern dairy value chains significantly increases farmers' net returns and household consumption expenditure. The study also identified factors such as education, training,

farm size, and access to technical information as important determinants of participation in organized dairy markets. Similarly, Gupta et al. (2020) identified feeding management, scientific livestock practices, and socio-economic factors as key determinants of dairy entrepreneurship among tribal farmers.

Several studies also focus on the broader development of the dairy sector. Shah and Dave (2010) reported that Gujarat has maintained a leading position in milk production in India, with milk contributing a major share of livestock output in the state. Complementing this perspective, Sinha (2019) emphasized the importance of efficient supply chain coordination among farmers, cooperatives, processors, and retailers for sustaining the growth of the dairy industry. At the national level, Gurjar et al. (2022) highlighted that India contributes about 20 percent of global milk production and that institutional initiatives by the National Dairy Development Board have played a significant role in improving dairy productivity, infrastructure, and sustainability.

Despite the overall positive impact of dairy cooperatives, regional variations in outcomes have been observed. Priscilla and Chauhan (2019) found that dairy cooperatives in Manipur contributed to employment generation but did not significantly improve milk yield or farmers' income. Similarly, Saxena et al. (2017) emphasized the importance of improving livestock productivity and strengthening cooperative marketing networks to enhance farmers' income.

Overall, the literature suggests that dairy cooperatives play a vital role in improving farmers' income, supporting rural livelihoods, and strengthening agricultural development. While cooperative participation generally enhances income, productivity, and access to institutional services, challenges such as high production costs, infrastructure gaps, and institutional limitations remain significant concerns. These findings highlight the need for further research examining farmers' perceptions of the socio-economic impacts of dairy cooperatives and the factors influencing their continued participation in cooperative systems.

3. DATA AND METHODOLOGY

The present study is based on primary data collected from dairy farmers associated with dairy cooperative societies in Gujarat, India, one of the leading milk-producing states with a well-established cooperative dairy structure. The study focuses on farmers actively engaged in dairy farming and supplying milk to cooperative societies, as dairying forms an important component of rural livelihoods and income generation in the state. Primary survey methods are widely used in socio-economic and rural development studies to capture farmers' perceptions, attitudes, and behavioural responses toward institutional mechanisms such as cooperatives (Creswell, 2014; Kothari, 2004; Bryman, 2016).

A total of 1,000 questionnaires were distributed among dairy farmers affiliated with dairy cooperative societies. Out of these, 715 valid responses were received and used for analysis, resulting in a response rate of 71.5 percent, which is considered satisfactory for questionnaire-based studies in social sciences and organizational research (Baruch & Holtom, 2008; Dillman et al., 2014). The respondents were selected using a multi-stage sampling technique, which is particularly useful when the study population is geographically dispersed and requires systematic selection across multiple administrative levels (Creswell, 2014; Kothari, 2004; Etikan & Bala, 2017). In the first stage, districts with significant dairy cooperative activity were identified, followed by the selection of villages with active dairy cooperative societies. In the final stage, individual dairy farmers were randomly selected from the membership lists of the cooperatives to ensure unbiased representation and enhance the generalizability of the findings (Sekaran & Bougie, 2016).

Primary data were collected through a structured questionnaire, which is widely employed in quantitative social science research to obtain standardized responses and facilitate statistical analysis (Malhotra, 2019; Bryman, 2016). The questionnaire was designed to obtain information on the socio-economic characteristics of respondents, farm-related attributes, and their perceptions regarding the impact of dairy cooperatives. It included questions related to demographic characteristics such as age, education, family size, occupation, landholding size, herd size, milk production, and dairy farming experience. Additionally, the instrument contained items related to cooperative participation, services received from dairy cooperatives, and the perceived economic and social benefits derived from dairy farming.

To measure the perceived socio-economic impact of dairy cooperatives, respondents were asked to indicate their level of agreement with several statements using a five-point Likert scale ranging from strongly disagree to strongly agree. Likert-type scales are widely recognized as effective tools for

measuring attitudes, perceptions, and behavioral intentions in social science research (Likert, 1932; DeVellis, 2017; Boone & Boone, 2012). The use of multiple items to measure latent constructs also enhances the reliability and validity of attitudinal measurement (Nunnally & Bernstein, 1994). The collected data were initially analyzed using descriptive statistical techniques such as frequency distributions, percentages, mean values, and standard deviations, which are commonly used to summarize respondent characteristics and provide preliminary insights into survey responses (Field, 2018; Pallant, 2020).

In addition to descriptive analysis, Structural Equation Modeling (SEM) was employed as the primary analytical technique to examine the relationships between dairy cooperative participation and various socio-economic outcomes. SEM is widely used in social science and behavioral research because it allows simultaneous estimation of multiple relationships among observed and latent variables while accounting for measurement error (Hair et al., 2019; Kline, 2016; Byrne, 2016). The technique is particularly suitable for testing theoretical models that involve complex interrelationships among constructs (Schumacker & Lomax, 2016). The analysis involved two stages. First, the measurement model was evaluated through Confirmatory Factor Analysis (CFA) to assess the reliability and validity of the constructs (Brown, 2015). Second, the structural model was estimated to test the hypothesized causal relationships among key latent variables such as financial well-being, quality of life, social development, and farmers' intention to continue cooperative membership.

Prior to SEM analysis, several preliminary statistical tests were conducted to ensure the adequacy of the measurement scales. These included reliability analysis using Cronbach's alpha, correlation analysis, and validity assessment procedures. Cronbach's alpha is widely used to evaluate the internal consistency of measurement items (Cronbach, 1951), while reliability values above 0.70 are generally considered acceptable in social science research (Nunnally & Bernstein, 1994; Hair et al., 2019). The questionnaire was also pre-tested with a small group of dairy farmers to ensure clarity, relevance, and comprehensibility of the items, and necessary modifications were made before administering the final survey (Malhotra, 2019; Sekaran & Bougie, 2016).

Data were collected through face-to-face interactions with respondents to ensure accurate responses and reduce the likelihood of missing data, which is often recommended in rural survey research (Dillman et al., 2014). Participation in the study was voluntary, and respondents were informed about the purpose of the research prior to data collection. Ethical considerations such as confidentiality and anonymity of respondents were strictly maintained throughout the data collection and analysis process in accordance with standard research ethics practices (Bryman, 2016; Creswell, 2014).

4. RESULTS AND DISCUSSION

This section presents the empirical findings and discusses them in relation to the conceptual framework examining dairy farmers' perceptions of the socio-economic impact of dairy cooperatives and their intention to continue cooperative membership. The analysis was conducted using Structural Equation Modeling (SEM), enabling simultaneous assessment of measurement and structural relationships among latent constructs. Initially, Confirmatory Factor Analysis (CFA) was applied to evaluate the reliability, validity, and model fit of the constructs. Subsequently, the structural model was estimated to test the relationships between key dimensions of perceived cooperative impact—financial well-being, quality of life, and social development—and farmers' continuation intentions. The findings provide insights into how perceived socio-economic benefits of cooperative participation influence farmers' willingness to maintain long-term association with cooperative institutions.

4.1. The Measurement Model

The validity of the measurement model hinges on two key assessments: evaluating the model's goodness of fit and assessing its validity. Hence, the evaluation of measurement-model validity was carried out through two distinct steps: examining goodness of fit and conducting a validity assessment.

Table 1: Perception towards the impact of dairy cooperatives on socio economic condition- CFA Model Summary.

Method	**Maximum Likelihood**
Total Number of Variables in Model	70
Number of observed variables	30

Number of exogenous variables	40
Number of endogenous variables	30
Number of latent constructs	10

Table 2: Perception towards the impact of dairy cooperatives on socio economic condition- Description of Latent Constructs in the model.

Abbreviation	**Latent Construct**
EDU	Perceived Impact on Education of Household Members
IGN	Perceived Impact on Income Generation
ECW	Perceived Impact on Economic Well-being
SOL	Perceived Impact on Standard of Living
LIM	Perceived Impact on Livelihood Improvement
SST	Perceived Impact on Social Status
SIA	Perceived Impact on Savings, Investment and Asset Creation
AHS	Perceived Impact on Access to Healthcare Services
WEM	Perceived Impact on Women Empowerment
INT	Intention to Continue Association with Dairy Cooperative Society

The first run of the measurement is depicted in below figure with initial results yielding acceptable standardized loading of all factors above the threshold of 0.5, as recommended by Bagozzi and Li (1988) and Hair et al. (2003).

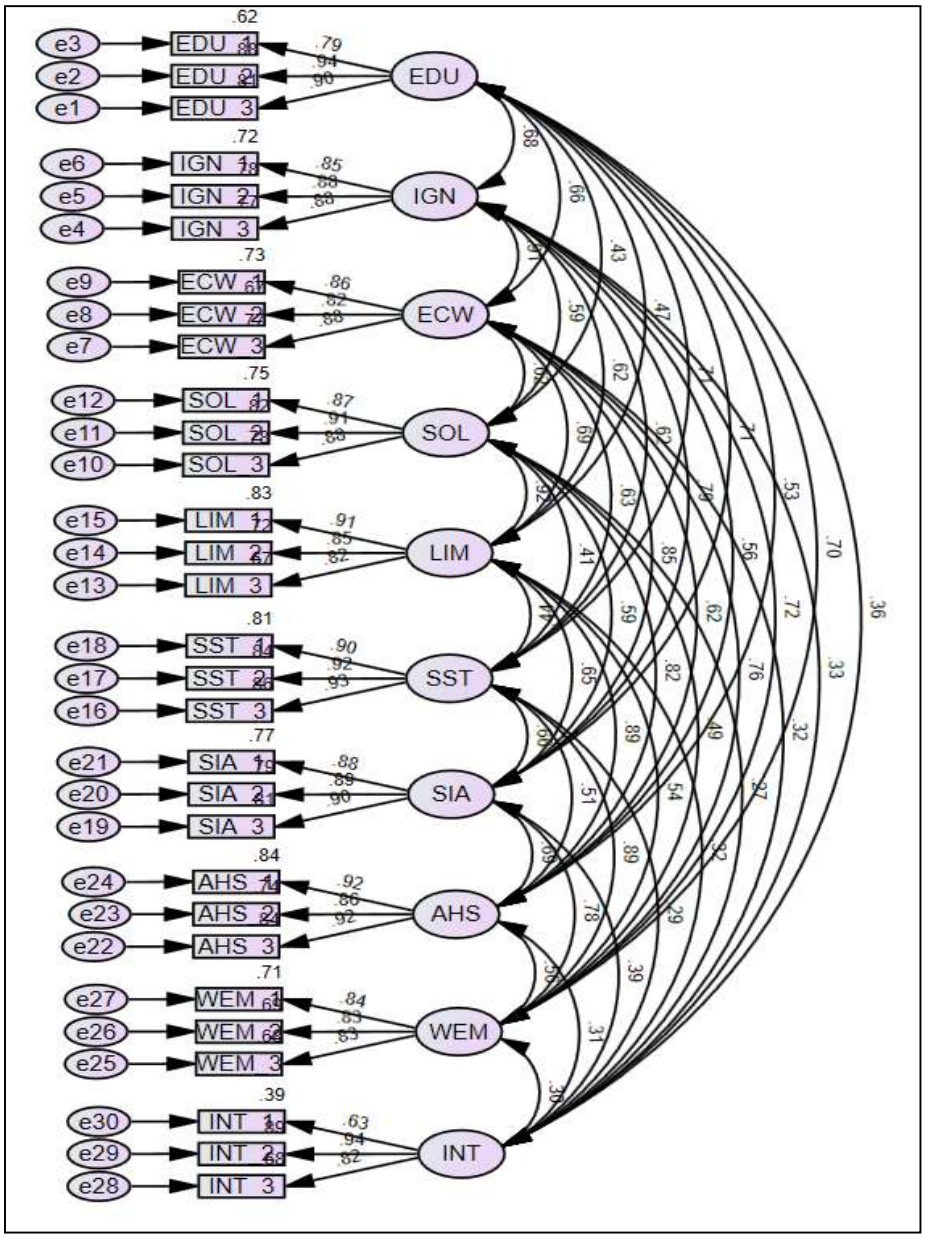


Figure 1: Perception towards the impact of dairy cooperatives on socio economic condition - Measurement Model.

The measurement model was evaluated using Confirmatory Factor Analysis (CFA) with Maximum Likelihood estimation. It consisted of ten latent constructs measured by thirty observed indicators. The standardized factor loadings ranged from 0.63 to 0.92, all exceeding the acceptable threshold of 0.50, with most above 0.70, indicating strong indicator reliability. The items loaded significantly on their respective constructs, confirming that the observed variables adequately represent the underlying latent constructs and that the measurement model demonstrates a satisfactory factor structure.

Table 3: Perception towards the impact of dairy cooperatives on socio economic condition - CFA Model Fitment Indices.

Fit Indices	Authors	Recommended Value	Actual Value
X2	Meyers et al., 2016	P Value > 0.05	1520.95(P value: 0.000)

CMIN/DF	Marsh & Hocevar, 1985	< 5.0	4.225
	Bentler,1990	< 5.0 Reported if n>200	
	Hair et al., 2009	< 3.0 Good; <5.0 sometimes permissible	
CFI	Bentler,1990	> 0.9	0.941
	Hatcher, 1996	> 0.9	
RMSEA	Byrne,2001	< 0.08	0.067
	Hu & Betler,1999	< 0.05	
	Meyers et al., 2016	< 0.08	
NFI	Bentler & Bonett, 1980	> 0.9	0.925
RFI	Meyers et al., 2016	> 0.9	0.903
IFI	Meyers et al., 2016	> 0.9	0.942
PNFI	Meyers et al., 2016	> 0.5	0.716
PCFI	Meyers et al., 2016	> 0.5	0.729

(Source: Data collected from respondents).

The model fit indices for the Confirmatory Factor Analysis (CFA) of Perception towards the Impact of Dairy Cooperatives on Socio-Economic Condition are presented in Table 5.82. The obtained values include Chi-square (χ^2 = 1520.95, p = 0.000), normed chi-square (CMIN/DF = 4.225), Comparative Fit Index (CFI = 0.941), Root Mean Square Error of Approximation (RMSEA = 0.067), Normed Fit Index (NFI = 0.925), Relative Fit Index (RFI = 0.903), Incremental Fit Index (IFI = 0.942), Parsimony Normed Fit Index (PNFI = 0.716), and Parsimony Comparative Fit Index (PCFI = 0.729).

Although the Chi-square statistic is significant ($p < 0.05$), it is well documented that the χ^2 statistic is highly sensitive to large sample sizes and complex models, often leading to model rejection even when other fit indices suggest acceptable fit (Bagozzi and Yi, 1988). Therefore, reliance solely on the Chi-square test is not recommended in large-sample studies. The normed chi-square (CMIN/DF) value of 4.225 falls below the upper permissible threshold of 5.0 suggested by Marsh and Hocevar (1985), Bentler (1990), and Hair et al. (2009), indicating an acceptable model fit, although values below 3.0 are considered ideal.

The RMSEA value of 0.067 lies within the recommended range of 0.05 to 0.08, indicating a reasonable and acceptable fit of the model (Hair et al., 2003). Furthermore, the CFI value of 0.941 exceeds the recommended threshold of 0.90 (Bentler, 1990; Hatcher, 1996), demonstrating good incremental fit. The CFI is regarded as an improved version of the Normed Fit Index (NFI), while the IFI is considered an improved version of the Non-Normed Fit Index (NNFI), overcoming variability issues (Tabachnick and Fidell, 2008). The IFI value of 0.942 is greater than 0.90, thereby indicating good model fit (Bagozzi and Yi, 1988; Hair et al., 2003; Kline, 2013). Lacobucci (2010) further suggests that values of IFI, CFI, or TLI greater than 0.90 provide evidence of acceptable model fit. Additionally, the NFI (0.925) and RFI (0.903) exceed the recommended threshold of 0.90, further supporting the adequacy of the model. The parsimony-adjusted indices, PNFI (0.716) and PCFI (0.729), are also above the recommended minimum value of 0.50, indicating that the model achieves satisfactory fit while maintaining parsimony.

Overall, the majority of the fit indices fall within the acceptable or recommended range. Despite the significant Chi-square value, which is expected in large samples, the combination of absolute, incremental, and parsimony fit indices demonstrates that the measurement model exhibits a good and acceptable fit to the data. Therefore, the CFA model

for perception towards the impact of dairy cooperatives on socio-economic conditions is considered statistically adequate and suitable for further structural model analysis.

Table 4: Perception towards the impact of dairy cooperatives on socio economic condition - CFA Regression weights.

			Estimate	S.E.	C.R.	P	Label
EDU_3	<---	EDU	1				
EDU_2	<---	EDU	1.019	0.027	37.868	***	par_1
EDU_1	<---	EDU	0.895	0.033	27.155	***	par_2
IGN_3	<---	IGN	1				
IGN_2	<---	IGN	0.973	0.031	31.614	***	par_3
IGN_1	<---	IGN	0.965	0.033	29.509	***	par_4
ECW_3	<---	ECW	1				
ECW_2	<---	ECW	0.923	0.033	27.713	***	par_5
ECW_1	<---	ECW	0.962	0.032	30.162	***	par_6
SOL_3	<---	SOL	1				
SOL_2	<---	SOL	1.005	0.029	34.486	***	par_7
SOL_1	<---	SOL	0.976	0.031	31.408	***	par_8
LIM_3	<---	LIM	1				
LIM_2	<---	LIM	1.14	0.043	26.441	***	par_9
LIM_1	<---	LIM	1.231	0.042	29.656	***	par_10
SST_3	<---	SST	1				
SST_2	<---	SST	0.974	0.024	41.324	***	par_11
SST_1	<---	SST	0.924	0.024	39.202	***	par_12
SIA_3	<---	SIA	1				
SIA_2	<---	SIA	0.948	0.028	34.158	***	par_13
SIA_1	<---	SIA	0.882	0.026	33.288	***	par_14
AHS_3	<---	AHS	1				
AHS_2	<---	AHS	0.876	0.026	33.613	***	par_15
AHS_1	<---	AHS	0.927	0.024	39.332	***	par_16
WEM_3	<---	WEM	1				
WEM_2	<---	WEM	0.946	0.037	25.68	***	par_17
WEM_1	<---	WEM	0.965	0.037	26.154	***	par_18
INT_3	<---	INT	1				
INT_2	<---	INT	1.257	0.055	23.013	***	par_19
INT_1	<---	INT	0.694	0.04	17.282	***	par_20

(Source: Data collected from respondents).

The unstandardized regression weights from the Confirmatory Factor Analysis (CFA) are presented in Table 5.83. In CFA, one indicator per latent construct is fixed at unity to establish the measurement scale. The remaining indicators show substantial regression coefficients with small standard errors, indicating stable parameter estimates. The Critical Ratio (C.R.), analogous to a z-statistic, exceeds the threshold of ±1.96 for all parameters, confirming statistical significance at the 0.001 level ($p < 0.001$). This indicates that each observed variable significantly contributes to its respective latent construct and supports the adequacy of the measurement structure.

4.2. Validity Assessment

One of the main objectives of using CFA is to assess construct validity, which refers to the ability of measurement items to represent the latent constructs (Hair et al., 2003). Construct

validity is examined through convergent validity and discriminant validity (Hair et al., 2003). Convergent validity indicates that indicators measuring a particular construct share a high proportion of variance in common (Hair et al., 2003) and is assessed using factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). As a rule, factor loadings should exceed 0.5. The results show that all standardized loadings are above this threshold, with the lowest value being 0.606, and all critical ratios (t-values) exceed ±1.96 ($p < 0.001$), indicating statistical significance. AVE represents the average variance explained by a construct in its indicators relative to the total variance, and a value of 0.5 or higher is generally considered acceptable (Hair et al., 2003).

$$AVE = \frac{\sum_{i=1}^{n} Li^2}{n}$$

Where,
L: Standardized Factor loadings
i: the number of items

Construct reliability (CR), also known as composite reliability, measures the internal consistency of a construct (Bagozzi & Yi, 1988). It is calculated in SEM using the squared sum of factor loadings and the sum of error variances for each construct (Hair et al., 2003). A CR value of 0.7 or higher is generally considered good, although values of 0.6 may be acceptable when other constructs in the model demonstrate adequate reliability (Hair et al., 2009). Composite reliability values above 0.6 are also considered acceptable (Bagozzi & Yi, 1988).

$$CR = \frac{(\sum_{i=1}^{n} Li)^2}{(\sum_{i-1}^{n} Li)^2 + (\sum_{i-1}^{n} ei)}$$

Where,
L: the standardised factor loading
i: the number of items
e: error variance

Table 5: Perception towards the impact of dairy cooperatives on socio economic condition - CFA Construct and Discriminant Validity.

	CR	AVE	MSV	MaxR(H)	EDU	IGN	ECW	SOL	LIM	SST	SIA	AHS	WEM	INT
EDU	0.911	0.773	0.503	0.932	**0.879**									
IGN	0.903	0.756	0.831	0.904	0.683***	**0.869**								
ECW	0.888	0.725	0.831	0.891	0.663***	0.912***	**0.852**							
SOL	0.916	0.784	0.849	0.918	0.433***	0.587***	0.620***	**0.885**						
LIM	0.894	0.738	0.849	0.904	0.473***	0.621***	0.685***	0.922***	**0.859**					
SST	0.939	0.838	0.787	0.941	0.709***	0.621***	0.631***	0.408***	0.435***	**0.915**				
SIA	0.918	0.789	0.715	0.918	0.706***	0.787***	0.846***	0.590***	0.648***	0.663***	**0.888**			
AHS	0.926	0.807	0.787	0.931	0.528***	0.565***	0.620***	0.822***	0.887***	0.514***	0.690***	**0.898**		
WEM	0.873	0.696	0.787	0.873	0.705***	0.721***	0.763***	0.487***	0.537***	0.887***	0.781***	0.557***	**0.834**	
INT	0.847	0.654	0.15	0.917	0.357***	0.325***	0.323***	0.271***	0.323***	0.293***	0.387***	0.306***	0.296***	**0.809**

(Source: Data collected from respondents).

4.3. Reliability

Composite Reliability (CR) assesses the internal consistency of indicators measuring each latent construct. In this study, CR values range from 0.847 to 0.939, all exceeding the recommended 0.70 threshold, indicating strong reliability. Constructs such as Social Status (0.939), Access to Healthcare Services (0.926), Standard of Living (0.916), and Savings and Investment (0.918) show particularly high internal consistency, while Intention to Continue Association (0.847) also demonstrates adequate reliability. Overall, these results confirm that the indicators consistently measure their respective latent constructs and strengthen the credibility of the measurement model.

4.4. Convergent Validity

Convergent validity refers to the extent to which indicators of a construct share a high proportion of variance. In this study, all standardized factor loadings exceed 0.50 and are statistically significant, confirming that each indicator contributes meaningfully to its construct. The Average Variance Extracted (AVE) values range from 0.654 to 0.838, exceeding the recommended 0.50 threshold, indicating that each construct explains more than half of the variance in its indicators. Additionally, CR

values are greater than AVE values for all constructs, further supporting convergent validity. These findings confirm that the constructs are well represented by their observed variables.

4.5. Discriminant Validity

Discriminant validity ensures that constructs are empirically distinct and not excessively correlated (Hair et al., 2003). It was assessed using AVE–MSV comparison and the Fornell–Larcker criterion, which requires the square root of AVE to exceed inter-construct correlations (Fornell & Larcker, 1981). The results indicate satisfactory discriminant validity for most constructs; however, strong correlations are observed between Income Generation and Economic Well-being and between Standard of Living and Livelihood Improvement. In some cases, MSV exceeds AVE, suggesting potential overlap among these related constructs. Nevertheless, such correlations are theoretically justified as they represent interconnected dimensions of socio-economic improvement within dairy cooperative participation. Overall, the model demonstrates acceptable discriminant validity while reflecting the inherent interrelationships among socio-economic constructs.

4.6. Structural Model and Hypotheses Testing

The purpose of conducting Confirmatory Factor Analysis (CFA) is to strengthen the validity of the measurement model by ensuring good model fit and establishing construct validity. Subsequently, the measurement model is extended to the structural model to examine the hypothesized relationships among constructs, as suggested by Hair et al. (2003). In Structural Equation Modeling (SEM), covariances between constructs are transformed into path estimates representing causal relationships. Exogenous constructs act as independent predictors with fixed interrelationships, while endogenous constructs represent outcomes with error terms included to account for unexplained variance.

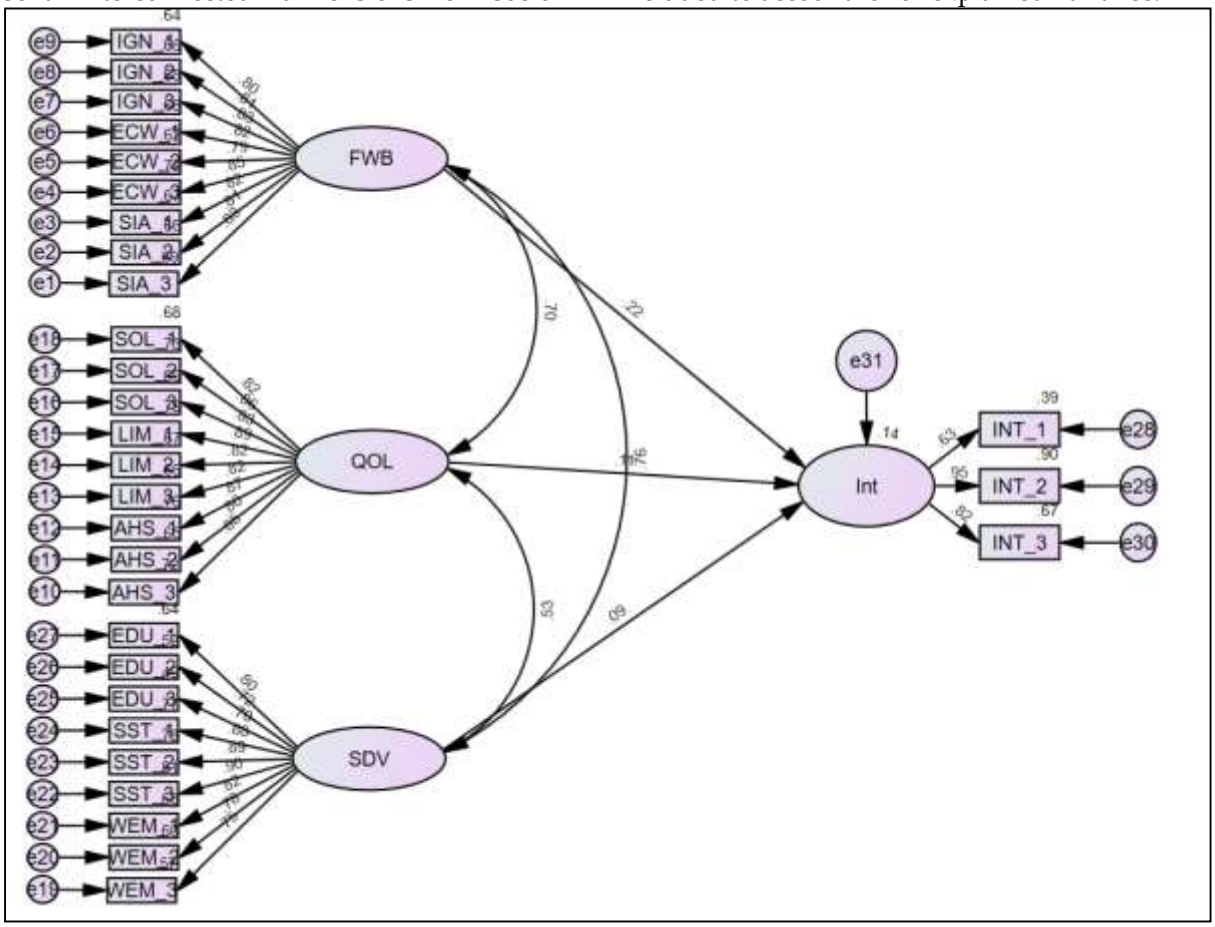


Figure 2: Perception towards the impact of dairy cooperatives on socio economic condition-Structural Model.
(Source: Data collected from respondents).

The present study employed Structural Equation Modelling (SEM) using the Maximum Likelihood estimation method in SPSS AMOS to examine the relationship between dairy farmers' perceptions of

the socio-economic impact of dairy cooperatives and their intention to continue cooperative membership. The model integrates measurement and structural components and includes 30 observed and 35 unobserved variables, resulting in 65 variables. A total of 96 parameters were estimated from 495 sample moments, yielding 399 degrees of freedom. The model comprises four latent constructs: Perceived Impact on Financial Well-Being (FWB), Quality of Life (QOL), Social Development (SDV), and Intention to Continue Membership (INT). FWB, QOL, and SDV are specified as exogenous constructs, while INT is the endogenous construct, with covariances estimated among the exogenous variables.

The measurement model operationalizes FWB through income generation, economic well-being, and saving and investment, with standardized loadings ranging from 0.790 to 0.849 and R^2 values between 0.625 and 0.721, indicating strong indicator reliability. QOL, represented by standard of living, livelihood improvement, and access to healthcare services, shows loadings from 0.804 to 0.887 and R^2 values from 0.647 to 0.786, reflecting strong convergent validity. SDV, comprising education, social status, and women empowerment, records loadings between 0.699 and 0.897 with R^2 values from 0.489 to 0.805, indicating acceptable construct representation. The endogenous construct INT is measured using three indicators with loadings ranging from 0.628 to 0.946 and R^2 values between 0.394 and 0.895, confirming adequate reliability.

The structural model specifies direct effects of FWB, QOL, and SDV on INT. The results indicate that FWB has the strongest positive influence on INT (β = 0.221), followed by QOL (β = 0.111) and SDV (β = 0.090). Together, these constructs explain 14.4% of the variance in continuation intention (R^2 = 0.144). The exogenous constructs are positively correlated, with FWB–QOL (0.699), FWB–SDV (0.763), and QOL–SDV (0.532), indicating that financial improvement, quality of life, and social development are interrelated dimensions of perceived cooperative impact. Overall, the model demonstrates how multidimensional socio-economic perceptions influence farmers' intention to sustain cooperative membership.

Table 6: Perception towards the impact of dairy cooperatives on socio economic condition - SEM Model Fitment Indices.

Fit Indices	Authors	Recommended Value	Actual Value
X2	Meyers et al., 2016	P Value > 0.05	3,505.138
PCMIN/DF	Marsh & Hocevar, 1985	< 5.0	8.75
	Bentler,1990	< 5.0 Reported if n>200	
	Hair et al., 2003	< 3.0 Good; <5.0 sometimes permissible	
CFI	Bentler,1990	> 0.9	0.843
	Hatcher, 1996	> 0.9	
RMSEA	Byrne,2001	< 0.08	0.104
	Hu & Betler,1999	< 0.05	
	Meyers et al., 2016	< 0.08	
NFI	Bentler & Bonett, 1980	> 0.9	0.827
RFI	Meyers et al., 2016	> 0.9	0.799
IFI	Meyers et al., 2016	> 0.9	0.844
PNFI	Meyers et al., 2016	> 0.5	0.710
PCFI	Meyers et al., 2016	> 0.5	0.724

(Source: Data collected from respondents).

Upon conducting the SEM analysis, the results indicate a reasonable and theoretically meaningful level of model fit, supported by several fit indices demonstrating acceptable performance. The Chi-square value (χ^2 = 3505.138), though statistically significant, is interpreted in light of its sensitivity to sample size. The normed chi-square (CMIN/DF = 8.75) reflects moderate model fit, particularly considering the complexity of the model and the number of parameters estimated. The incremental fit indices also demonstrate satisfactory model performance. The Comparative Fit Index (CFI = 0.843), Incremental Fit Index (IFI = 0.844), Normed Fit Index (NFI = 0.827), and Relative Fit Index (RFI = 0.799) indicate a substantial improvement of the proposed model over the independence model,

reflecting acceptable comparative fit given the multidimensional structure of the constructs.

Further, the Root Mean Square Error of Approximation (RMSEA = 0.104) suggests moderate approximation error, which is not uncommon in models incorporating a large number of observed indicators. Importantly, the parsimony-adjusted indices, including the Parsimony Normed Fit Index (PNFI = 0.710) and Parsimony Comparative Fit Index (PCFI = 0.724), are well above the minimum recommended threshold, demonstrating that the model achieves a good balance between explanatory power and parsimony. Overall, the collective pattern of fit indices suggests that the proposed structural model provides an acceptable and substantively meaningful representation of the underlying relationships among the constructs.

Hypotheses undergo testing through an examination of path estimates and consideration of their associated p-values. A p-value lower than 0.05 supports the hypothesis, indicating statistical significance. Conversely, p-values exceeding 0.05 render the hypothesis insignificant, thereby lacking support (Hair et al., 2003).

Table 7: Perception towards the impact of dairy cooperatives on socio economic condition - SEM Hypothesis Testing.

Constructs	**Hypothesis**	**Standardized path estimates**	**Direction of Relationship**	**P-Value**	**Significance**
Financial Well Being	Null: Dairy farmers' perception towards the impact of dairy cooperatives on their financial well being has statistically significant impact on their intention to continue their dairy cooperative membership	0.107	Positive	0.005	Significant
Quality of Life	Null: Dairy farmers' perception towards the impact of dairy cooperatives on their quality of life has statistically significant impact on their intention to continue their dairy cooperative membership	0.057	Positive	0.048	Significant
Standard of Living	Null: Dairy farmers' perception towards the impact of dairy cooperatives on their standard of livinh has statistically significant impact on their intention to continue their dairy cooperative membership	0.052	Positive	0.156	Not Significant

(Source: Data collected from respondents).

The structural model was examined to test the hypothesized relationships between dairy farmers'

perceptions of cooperative impact and their intention to continue dairy cooperative membership. The results indicate that Perceived Impact on Financial Well-Being has a positive and statistically significant influence on continuation intention ($\beta = 0.107$, $p = 0.005$). Since the p-value is below the conventional threshold of 0.05, the null hypothesis is rejected. This finding suggests that perceived improvements in income generation, economic stability, and savings capability increase farmers' likelihood of maintaining their association with the dairy cooperative. Although the magnitude of the effect is moderate, it remains statistically meaningful and highlights financial well-being as an important determinant of membership continuity. Similarly, Perceived Impact on Quality of Life shows a positive and statistically significant effect on continuation intention ($\beta = 0.057$, $p = 0.048$). As the p-value is slightly below 0.05, the null hypothesis is rejected for this relationship as well. This indicates that improvements in living conditions, livelihood opportunities, and access to essential services positively influence farmers' willingness to continue cooperative membership. Although the standardized coefficient is smaller than that of financial well-being, the relationship remains statistically significant.

In contrast, Perceived Impact on Standard of Living demonstrates a positive but statistically non-significant relationship with continuation intention ($\beta = 0.052$, $p = 0.156$). Since the p-value exceeds 0.05, the null hypothesis cannot be rejected. While the direction of the relationship is positive, the effect is not strong enough to be considered statistically significant within the model. Overall, the findings indicate that financial well-being is the most influential predictor of membership continuity, followed by quality of life, whereas standard of living does not show a statistically significant direct effect in the structural model.

5. CONCLUSION

The present study examined dairy farmers' perceptions regarding the socio-economic impact of dairy cooperatives and their influence on farmers' intention to continue cooperative membership in the Banaskantha district of Gujarat. India's dairy sector, which accounts for nearly 22% of global milk production, is strongly supported by cooperative institutions that integrate small-scale producers into organized markets. Within this context, dairy cooperatives—particularly those modeled on the AMUL framework—have emerged as important institutional mechanisms for promoting rural livelihood security, enhancing income opportunities, and facilitating socio-economic transformation in rural communities.

The empirical findings of this study confirm the multidimensional contribution of dairy cooperatives to the socio-economic development of dairy farmers. The measurement model results indicate strong reliability, convergent validity, and overall robustness of the constructs used to capture various dimensions of socio-economic improvement, including financial well-being, quality of life, and social development. These dimensions collectively represent the broader socio-economic outcomes associated with cooperative participation.

The structural model results highlight that perceived improvements in financial well-being constitute the most influential determinant of farmers' intention to continue their association with dairy cooperatives. Increased income generation opportunities, improved economic stability, and enhanced capacity for savings and investment significantly strengthen farmers' commitment to cooperative membership. Perceived improvements in quality of life, reflected through better livelihood conditions and access to essential services such as healthcare, also exert a positive and statistically significant influence on continuation intentions.

In contrast, perceived improvements in standard of living do not exhibit a statistically significant direct effect on membership continuity when examined independently within the structural model. This suggests that improvements in living standards may operate indirectly through broader socio-economic constructs such as financial well-being and overall quality of life rather than acting as an independent determinant of farmers' continuation decisions.

Overall, the study provides empirical evidence that dairy cooperatives function as effective institutional mechanisms for linking rural producers to markets and fostering inclusive economic development. By improving financial security, promoting social empowerment, and enhancing livelihood sustainability, dairy cooperatives contribute significantly to rural socio-economic transformation. The findings also address an important regional research gap by providing empirical insights into the functioning and impact of dairy cooperatives in the Northeast region of Gujarat.

From a policy perspective, the results underscore the need to strengthen cooperative institutions by enhancing financial services, promoting inclusive participation, encouraging women's empowerment, and expanding access to technology, training, and healthcare services. Strengthening these dimensions can further improve farmers' perceptions of

cooperative benefits and enhance long-term membership sustainability. Consequently, dairy cooperatives remain a powerful instrument for rural development and poverty alleviation, and their continued strengthening is essential for achieving sustainable and inclusive growth in dairy-based rural economies. Future research may examine longitudinal impacts of dairy cooperatives across different regions and incorporate additional institutional and behavioral determinants of cooperative participation.

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