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Instrument Validation for Measuring Socio-Economic Upliftment through Dairy Cooperatives: Insights from a Pilot Study in Gujarat

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Abstract
The dairy cooperative movement has historically contributed to rural development by fostering inclusive economic growth, improving household livelihoods, and enhancing community social status. This pilot study aims to develop and validate a structured survey instrument for assessing the socio-economic impacts of dairy cooperative participation. The study examines the perceptions of dairy farmers regarding the contribution of cooperative membership to their social and economic upliftment. The instrument is designed to capture perceptions across multiple dimensions, including income generation, standard of living, education, access to healthcare, livelihood enhancement, asset accumulation, and women empowerment. A sample of 100 respondents was selected using a non-probability convenience sampling technique from regions actively engaged in dairy cooperative activities. The study employed rigorous statistical procedures to assess the reliability and validity of the measurement tool. Internal consistency was evaluated using Cronbach's alpha, with results indicating high levels of reliability across all constructs. Convergent validity was assessed through Average Variance Extracted (AVE) and Composite Reliability (CR), both of which met the recommended thresholds, indicating that the items within each construct appropriately represent the underlying theoretical concepts. Discriminant validity was tested using the Fornell-Larcker criterion, confirming that each construct is empirically distinct from others in the model. The findings validate the robustness of the measurement instrument and confirm its suitability for deployment in a full-scale study. Additionally, the data reflect a strong positive perception among respondents regarding the socio-economic benefits of cooperative membership, particularly in relation to standard of living and women empowerment. This study provides a sound methodological basis for further empirical research and contributes to the broader discourse on the developmental potential of dairy cooperatives in rural contexts.
Keywords: *Dairy cooperatives, Socio economic Condition, Socio economic upliftment, Reliability, Convergent Validity, Discriminant validity etc.*

INTRODUCTION

Dairy cooperatives in India, particularly those modeled after AMUL, have significantly advanced rural development by modernizing the dairy sector and creating employment (Rajendran, 2004; Raja, 2015). They have improved the economic well-being and quality of life in rural communities (Chandrashekhar, 2022). In Gujarat, where rural poverty and inequality persist, dairy farming remains a vital source of livelihood. Since the establishment of Amul in the 1940s, cooperatives have driven notable socio-economic change by empowering small-scale farmers through collective marketing. While cooperative movements are widely regarded as tools for community empowerment, region-specific empirical studies remain limited. Although national-level studies highlight their benefits, there is a research gap concerning the impact of dairy cooperatives in Northeast Gujarat. Addressing this gap is crucial for designing effective policies to combat rural poverty and promote sustainable development (Khamkar, 2014). Despite the growth of cooperatives, many remain small in scale. Regional disparities in performance persist (Bardhan et al., 2012). Research by Kumar and Sharma (2012), Meena (2009), and Singh&Datta (2013) confirms economic gains for members, yet some farmers still opt out. Understanding the factors behind participation decisions is therefore essential.

This pilot study is designed to address a significant research gap by developing and validating a structured survey instrument to assess the socio-economic outcomes associated with participation in dairy cooperatives. In social science research, pilot studies are essential as they serve as preliminary investigations that aid in refining research methodologies, evaluating the feasibility of the study, and establishing rapport with respondents (Leon et al., 2011). This study seeks to capture dairy farmers' perceptions regarding the impact of cooperative participation on various dimensions of socio-economic advancement, including household education, income generation, economic wellbeing, standard of living, livelihood enhancement, social status, and patterns of savings, investments, and asset accumulation.

The constructs incorporated in the survey instrument were informed by an extensive review of existing literature and supplemented by insights obtained from preliminary fieldwork. These constructs were subsequently examined for internal consistency and construct validity. The design and validation of data collection instruments are critical to ensuring the production of high-quality empirical evidence. Validity and reliability represent fundamental criteria for evaluating measurement instruments (Ishtiaq&Ishtiaq, 2021). While validity concerns the accuracy and appropriateness of the instrument in measuring the intended constructs, reliability pertains to the consistency and stability of the measurements, and the minimization of random error (Ishtiaq&Ishtiaq, 2021).

In line with established methodological standards, researchers ensured proper selection and calibration of instruments, as well as rigorous assessment of their validity and reliability prior to data collection (Ganesha&Aithal, 2022). Reliability was examined using Cronbach's alpha, whereas convergent validity was assessed through the Average Variance Extracted (AVE) and Composite Reliability (CR). Discriminant validity was evaluated using the Fornell-Larcker Criterion to verify the statistical distinctiveness of each construct. The results confirmed the adequacy of the measurement model, thereby establishing the validity and reliability of the developed survey instrument. This study not only demonstrates the robustness of the proposed conceptual framework but also lays a strong empirical foundation for subsequent large-scale investigations. It contributes meaningful insights to the scholarly discourse on rural development, particularly through the lens of cooperative movements in the dairy sector.

LITERATURE REVIEWS

India's dairy sector, largely sustained by smallholder farmers and informal markets, has undergone significant modernization through cooperatives. Kumar et al. (2019) emphasize the positive role cooperatives play in enhancing food security and farmer incomes. Yet, this potential is constrained by limited awareness, socio-economic barriers, and lack of access to modern information. This foundational challenge is echoed by Bala et al. (2023), who found that low levels of education, poor training, and minimal extension contact among dairy farmers directly impact productivity. The interlink between knowledge gaps and cooperative participation suggests that enabling access to information could be transformative. Dairy cooperatives also serve broader developmental purposes. Chaudhary and Upadhyaya (2013) stress their role in promoting social cohesion and women's empowerment, a theme further reinforced by Moorthi&Gurunathan (2023) who underline dairying's ability to generate rural employment and reduce income inequality. Talukdar et al. (2023) add a regional nuance from Mizoram, where livestock's multifunctional utility is acknowledged, although they call for scientific support to sustain this growth—resonating with the earlier concerns about technical awareness and extension services raised by Bala et al. (2023).

While the benefits of cooperative membership are clear, structural challenges persist. Gaillard &Dervillé (2022) point to caste and geography as significant barriers to inclusivity, even when cooperative members earn more. This observation is echoed in Upadhyay et al. (2023)'s study in Madhya Pradesh, where cooperatives improved profitability and employment, but lacked sufficient services and training—linking back to the issues of limited outreach and capacity-building seen by Bala et al. (2023) and Kumar et al. (2019). From a governance perspective, Singh and Pundir (2000) recognize the vital developmental role of cooperatives but warn that outdated governance and lack of professionalism hinder their effectiveness—suggesting a gap between policy intention and ground-level execution. The socio-economic impact of dairying, especially on women and marginal farmers, is reinforced by Preethi&Channal (2022) and Khalangre&Suryawanshi (2024), who also stress the need for improved marketing, infrastructure, and support services. These concerns resonate with Raj (2021), who showed that proximity to cooperative milk collection centers in Bihar boosted returns, especially for those with larger herds and better procurement structures. Mandi et al. (2022) confirmed similar outcomes in Jharkhand, revealing that cooperative members had superior yields and income compared to non-members—thus reinforcing the argument that structured cooperative frameworks enhance both productivity and rural livelihoods.

Adding depth, Tanwar and Kumar (2014) highlighted how cooperative families in Rajasthan exhibited better literacy, landholding, and livestock quality than their non-cooperative counterparts—signaling the broad social upliftment resulting from cooperative engagement. Prabakaran (2015) adds a historical and macroeconomic dimension, noting the long-term benefits of dairy development post-Operation Flood while cautioning about

dairying's capital intensity compared to crop farming—echoing Singh and Pundir (2000)'s concern about structural preparedness and long-term sustainability. The inclusive potential of dairy cooperatives is further discussed by Nath (2012), who explored DCSs under the NDP-I in Bihar, highlighting their contribution to women's empowerment and decision-making in rural households. This empowerment dimension aligns with Priscilla and Chauhan (2019), who, although finding limited yield and income gains from cooperatives in Manipur, noted an uptick in rural employment—underscoring the value of cooperatives in employment generation even when productivity benefits are muted.

Expanding the regional analysis, Saxena et al. (2017) identified crossbreeding and buffalo farming as major income drivers and advocated for cooperative-led milk marketing in underperforming regions. This is extended by Gupta et al. (2020), who in tribal settings identified key behavioral determinants—like attitudes towards feeding and management—that shape dairy entrepreneurship, emphasizing the same socio-economic factors that earlier studies flagged as critical. In a reinforcing loop, Singh et al. (2025) found that participation in COMPFED in Bihar led to increased milk production, better clean milk practices, and higher daily milk sales—empirical validation of the socio-economic and productivity gains reported by Raj (2021) and Mandi et al. (2022). A similar trajectory is seen in Rahman and Gupta (2015)'s study in Assam, where SHG members demonstrated better knowledge and adoption of dairy practices, linking back to the role of extension and training underscored by Bala et al. (2023) and Upadhyay et al. (2023).

From Gujarat, Chaudhari and Minampati (2021) documented how Banas Dairy transformed rural livelihoods through integration with education, health, and welfare, curbing migration and enhancing women's empowerment. This development model finds complementarity in Sorathiya et al. (2020), who observed regional disparities in commercial dairy performance across north and south Gujarat, attributing differences to policy and subsidy structures—echoing Choudhary et al. (2016), who identified landholding size as key to DCS participation, further stressing the role of regional and structural factors. The empowerment narrative continues with Ghasura and Bhatt (2023), who found that education and income significantly shaped young women's perception of animal husbandry as a livelihood—aligning with Chaudhary and Upadhyaya (2013) and Chaudhari and Minampati (2021) on the gender dimension of dairy development. Meanwhile, Ram et al. (2018) provide a grounded picture from Junagadh, where unorganized dairy farmers, though engaged in agriculture and dairying, suffered income and information limitations, pointing again to the persistent gap that organized cooperatives like Banas aim to fill.

Echoing this, Prajapati et al. (2022) and Prajapati (2021) both showed that dairy cooperative membership in Banaskantha and Mehsana improved income, assets, and access to education and healthcare, reinforcing earlier insights from Singh et al. (2024) and Raj (2021). Sabapara et al. (2013) add a tribal perspective, noting that cooperatives act as support systems in marginalized regions with limited mechanization, further reinforcing the inclusive development potential. From a critical angle, Daftary (2019) argues that market reforms in Gujarat have overlooked the emotional and ethical aspects of livestock care, adding a socio-cultural critique that complements the economic outcomes recorded by Singh et al. (2019), who documented milk output and income gains while cautioning against unsustainable capital investments. This aligns with Sharma et al. (2021) who compared DCS and non-DCS members, noting better feed and service access among the former, but calling for enhanced veterinary and marketing infrastructure to bridge gaps. Finally, reiterating these themes, Ram et al. (2018) confirm the vulnerability of unorganized dairy farmers due to limited exposure to modern practices, reinforcing the sustained need for cooperative structures as mechanisms for inclusive, knowledge-driven rural development.

METHODOLOGY AND DATA COLLECTION

This pilot study adopts a quantitative research approach, utilizing a cross-sectional survey design to explore the perceived impact of dairy cooperative movements on the socio-economic upliftment of dairy farmers in Gujarat. A cross-sectional design facilitates the collection of data from multiple respondents at a single point in time, enabling the identification of patterns and relationships among key variables (Bryman& Bell, 2011).In line with the descriptive nature of the research, the survey method was deemed most appropriate for gathering quantifiable data capable of revealing associations and supporting model development (Saunders et al., 2012). Among available survey techniques—including structured observations, personal interviews, and telephone surveys—this study employed a self-administered, physically distributed questionnaire. This method enabled respondents to

independently complete the survey, promoting clarity and consistency in responses (Churchill, 1995; Blumberg et al., 2008).

The data was collected from a sample of 100 dairy farmers based in the Banaskantha district of Gujarat, a region known for its robust dairy cooperative presence. These respondents provided insights into how cooperative involvement has influenced various aspects of their lives. The questionnaire comprised 27 structured statements designed to assess farmers' perceptions across several interconnected areas such as improvements in household education, enhancement of income generation capacity, advancement in economic wellbeing, upliftment in standard of living, strengthening of livelihood security, changes in social status, and better access to savings, investments, and asset creation. These dimensions were framed cohesively to capture the holistic socio-economic impact of dairy cooperative participation.

The primary objective of this pilot study is to examine the reliability and validity of the questionnaire for use in a future large-scale study. Cronbach's alpha was used to evaluate internal consistency, ensuring that the measurement items reliably captured the intended constructs with minimal error (Kline, 2005; Hair et al., 2010).For construct validity, both convergent and discriminant validity were assessed (Hair et al., 2003). Convergent validity was tested through factor loadings, average variance extracted (AVE), and composite reliability to verify that related items shared significant variance (Hair et al., 2010). The study further employed Exploratory Factor Analysis (EFA) to uncover latent constructs and Confirmatory Factor Analysis (CFA) to validate the measurement model and assess the goodness-of-fit.

RESULTS AND DISCUSSION

- **Overview of Dairy farmers' perception**

This study explored dairy farmers' perceptions regarding the impact of the dairy cooperative movement on their socio-economic upliftment. Participants were asked to indicate their level of agreement with 27 statements across various dimensions, including improvements in household education, enhanced income-generating capacity, economic well-being, standard of living, livelihood security, social status, and access to savings, investments, and asset creation. Responses were recorded using a five-point Likert scale, where 1 indicated 'strongly disagree' and 5 indicated 'strongly agree'.

Table 1: Dairy farmers' perception towards impact of the dairy cooperative movement on their socio-economic upliftment

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
Education of household members	100	1.67	5.00	4.47	0.75
Income generation	100	1.67	5.00	4.50	0.79
Economic wellbeing	100	1.33	5.00	4.50	0.83
Standard of living	100	2.00	5.00	4.53	0.79
Livelihood Improvement	100	1.67	5.00	4.46	0.85
Social status	100	1.67	5.00	4.49	0.80
Savings and Investments/ Asset creation	100	2.00	5.00	4.50	0.78
Access to healthcare services	100	1.33	5.00	4.46	0.85
Women Empowerment	100	1.33	5.00	4.53	0.81
Valid N (listwise)	100				

(Source: Structured questionnaire)

The analysis of dairy farmers' perceptions affirms the widely acknowledged role of dairy cooperatives in fostering socio-economic upliftment, as also established by a breadth of literature. The consistently high mean scores (all above 4.4 on a five-point Likert scale) across indicators such as income generation, economic wellbeing, standard of living, and women empowerment indicate that farmers perceive substantial benefits from cooperative participation. The prominence of standard of living and women empowerment (mean = 4.53 each) particularly supports the findings of Chaudhary and Upadhyaya (2013) and Chaudhari and Minampati (2021), who

emphasized cooperatives' role in improving gender equity and household welfare. Similarly, positive perceptions regarding education, healthcare, and asset creation align with Prajapati et al. (2022) and Singh et al. (2025), who demonstrated that cooperative membership enhances access to essential services and supports household development. These outcomes echo Kumar et al. (2019) and Mandi et al. (2022), who highlighted income growth and livelihood stability among cooperative members. However, while the present study reinforces the cooperative model's developmental potential, it also indirectly reflects the structural gaps noted by Bala et al. (2023) and Upadhyay et al. (2023), wherein extension services and awareness remain critical to sustaining these gains. In sum, the findings validate the broader academic consensus that dairy cooperatives serve as effective vehicles for rural transformation, contributing to inclusive growth and improved quality of life when supported by appropriate institutional and infrastructural mechanisms.

- **Reliability Assessment**

Reliability refers to the extent to which measurement items consistently reflect the intended variable over time and are free from errors (Kline, 2005). It can be assessed using three main methods: test-retest, which evaluates consistency over time; split-half, which examines the internal consistency by dividing the data into two halves; and Cronbach's alpha, which measures the internal consistency of the entire scale. While the split-half method is relatively easy to apply, its accuracy can be influenced by how the data is split (Field, 2005). Consequently, Cronbach's alpha is the most commonly used approach for assessing reliability, as it evaluates the consistency across all items in the scale (Hair et al., 2010).At this stage, it is essential to assess the reliability of the new data collected from the main survey using the refined (purified) measurement items. This step helps ensure that the results are not due to random chance and minimizes errors arising from sampling or external influences such as personal factors, thereby contributing to the development of content-valid measures (Churchill, 1979). Importantly, reliability testing precedes the assessment of validity, forming a critical foundation for further analysis (Churchill, 1979; Hair et al., 2010).

Table 2: Reliability Assessment

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.989	.990	27

Construct	Items	Labels	Cronbach's Alpha Value	Corrected item correlation	Cronbach's Alpha if Item Deleted	Level of Reliability
Education of household members	The dairy cooperative has facilitated access to educational resources for household members.	EDU_1	0.842	0.639	0.871	Excellent
	Membership in the dairy cooperative has positively impacted the educational opportunities for our household.	EDU_2		0.787	0.743	
	The dairy cooperative's initiatives have enhanced the literacy rate among household members.	EDU_3		0.750	0.737	
Income generation	Participation in the dairy cooperative has	IGN_1	0.921	0.798	0.927	Excellent

	significantly increased our household income.					
	The membership of dairy cooperative has resulted into an additional and regular source of income	IGN_2		0.860	0.871	
	Our involvement with the dairy cooperative has led to a noticeable improvement in our overall financial earnings.	IGN_3		0.871	0.864	
Economic wellbeing	Membership in the dairy cooperative has improved our household's economic stability.	ECW_1	0.936	0.912	0.872	Excellent
	The dairy cooperative's initiatives have contributed to a better economic outlook for our family.	ECW_2		0.868	0.909	
	The dairy cooperative's support has helped us in maintaining a stable financial position.	ECW_3		0.829	0.937	
Standard of living	Our standard of living has improved since becoming members of the dairy cooperative.	SOL_1	0.951	0.908	0.918	Excellent
	The dairy cooperative's efforts have positively impacted our quality of life.	SOL_2		0.881	0.940	
	Membership in the dairy cooperative has elevated our standard of living compared to before.	SOL_3		0.901	0.925	
Livelihood Improvement	Participation in the dairy cooperative has led to a substantial improvement in our livelihood.	LIM_1	0.951	0.927	0.905	Excellent
	The dairy cooperative's interventions have directly contributed to the enhancement of our livelihood opportunities.	LIM_2		0.897	0.927	
	Our livelihood prospects have significantly improved since joining the dairy cooperative.	LIM_3		0.868	0.948	

Social status	Membership in the dairy cooperative has positively influenced our social status within the community.	SST_1	0.934	0.858	0.909	Excellent
	The dairy cooperative's activities have elevated our social standing among peers and neighbors.	SST_2		0.891	0.883	
	We feel a sense of pride in our improved social status resulting from our affiliation with the dairy cooperative.	SST_3		0.847	0.921	
Savings and Investments/ Asset creation	Our ability to save and invest has increased due to our involvement with the dairy cooperative.	SIA_1	0.922	0.873	0.862	Excellent
	The dairy cooperative's programs have encouraged us to save and invest in assets for the future.	SIA_2		0.832	0.896	
	We have been able to create valuable assets through the opportunities provided by the dairy cooperative.	SIA_3		0.824	0.901	
Access to healthcare services	Membership in the dairy cooperative has improved our access to healthcare services.	AHS_1	0.957	0.907	0.939	Excellent
	The dairy cooperative's initiatives have made it easier for us to avail healthcare facilities when needed.	AHS_2		0.902	0.942	
	We feel more secure about our healthcare needs being met because of the support from the dairy cooperative.	AHS_3		0.919	0.930	
Women Empowerment	Participation in the milk cooperative society has improved the social status of women in the village.	WEM_1	0.943	0.906	0.899	Excellent
	Membership of a milk cooperative has improved the economic	WEM_2		0.871	0.925	

	well-being of village women					
	Women actively involved in milk cooperatives feel empowered to make decisions in their homes and communities	WEM_3		0.869	0.928	

Based on the reliability analysis provided in Table 2, the internal consistency of the overall scale and individual constructs was found to be exceptionally high, indicating robust reliability across all measurement items. The overall Cronbach's alpha for the scale, comprising 27 items, was 0.989, and 0.990 when standardized. These values are well above the conventional threshold of 0.70, suggesting that the instrument demonstrates excellent internal consistency and that the measurement items are highly reliable in capturing the intended constructs (Hair et al., 2010).

Each construct was individually assessed using Cronbach's alpha values, all of which exceeded 0.84, confirming the high reliability of each domain. For instance, constructs such as Access to Healthcare Services (α = 0.957), Standard of Living (α = 0.951), Livelihood Improvement (α = 0.951), and Women Empowerment (α = 0.943) exhibited very strong reliability. These values reflect a high degree of internal consistency among the items within each construct, indicating that the items consistently measure their respective domains. The corrected item-total correlations for all items were above the acceptable threshold of 0.60, further reinforcing the relevance and consistency of individual items within their respective scales. Moreover, the "Cronbach's Alpha if Item Deleted" values were consistently lower than the overall alpha values for each construct, indicating that no item unduly weakened the scale. This implies that all items contribute meaningfully to the reliability of their respective constructs and should be retained.

In terms of interpretation, these findings validate the reliability of the measurement tool employed to assess the socio-economic impacts of membership in the dairy cooperative. High reliability ensures that the data collected are consistent, stable, and free from random error, thereby strengthening the credibility of the subsequent analysis. It also supports the content validity of the scale by confirming that the constructs are being measured accurately through coherent and interrelated items (Churchill, 1979). In conclusion, the reliability assessment confirms that the instrument is well-constructed and highly suitable for further statistical analysis, including validity testing and structural modeling. The results bolster confidence in the findings derived from this survey and affirm the robustness of the measurement framework used in assessing the impact of dairy cooperatives on various dimensions of rural livelihoods.

- **Validity Assessment**

In research, the validity assessment of data collection instruments is a critical process that ensures the tool accurately measures what it is intended to measure (Creswell & Creswell, 2018). Validity determines the degree to which empirical evidence and theoretical rationale support the interpretations of test scores for their intended purposes (Messick, 1995). A valid instrument enhances the credibility and generalizability of research findings by minimizing measurement errors and ensuring the relevance and appropriateness of the data collected (Heale&Twycross, 2015). Without adequate validity, the conclusions drawn from the data may be misleading, thereby undermining the overall integrity of the research (Bolarinwa, 2015).The two fundamental types of construct validity are convergent validity and discriminant validity, which together help determine the degree to which a measurement instrument accurately reflects the theoretical constructs it intends to assess (Campbell & Fiske, 1959).

- **Convergent Validity**

Convergent validity refers to the extent to which multiple indicators of the same construct are correlated, thereby confirming that they effectively capture the underlying theoretical concept. It is demonstrated when theoretically

related items exhibit strong inter-correlations, signifying consistency in measurement (Hair et al., 2019). Convergent validity is commonly assessed using Average Variance Extracted (AVE) and Composite Reliability (CR). AVE measures the proportion of variance captured by the construct relative to the variance due to measurement error, with a threshold value of 0.5 or higher indicating acceptable validity (Fornell&Larcker, 1981). CR evaluates the internal consistency of the indicators, with values of 0.7 or above reflecting satisfactory reliability of the construct measurement (Fornell&Larcker, 1981).

Table 3: Convergent Validity

Construct	Codes	Items	γ	γ^2	$(1-\gamma^2)$	AVE	Composite Reliability
Education of household members	EDU_1	The dairy cooperative has facilitated access to educational resources for household members.	0.640	0.409	0.591	0.620	0.828
	EDU_2	Membership in the dairy cooperative has positively impacted the educational opportunities for our household.	0.810	0.657	0.343		
	EDU_3	The dairy cooperative's initiatives have enhanced the literacy rate among household members.	0.891	0.794	0.206		
Income generation	IGN_1	Participation in the dairy cooperative has significantly increased our household income.	0.866	0.750	0.250	0.803	0.924
	IGN_2	The membership of dairy cooperative has resulted into an additional and regular source of income	0.890	0.792	0.208		
	IGN_3	Our involvement with the dairy cooperative has led to a noticeable improvement in our overall financial earnings.	0.931	0.866	0.134		
Economic wellbeing	ECW_1	Membership in the dairy cooperative has improved our household's economic stability.	0.931	0.866	0.134	0.845	0.942
	ECW_2	The dairy cooperative's initiatives have contributed to a better economic outlook for our family.	0.929	0.863	0.137		
	ECW_3	The dairy cooperative's support has helped us in maintaining a stable financial position.	0.897	0.805	0.195		
Standard of living	SOL_1	Our standard of living has improved since becoming	0.921	0.848	0.152	0.842	0.955

	SOL_2	members of the dairy cooperative. The dairy cooperative's efforts have positively impacted our quality of life.	0.947	0.898	0.102		
	SOL_3	Membership in the dairy cooperative has elevated our standard of living compared to before.	0.884	0.781	0.219		
	LIM_1	Participation in the dairy cooperative has led to a substantial improvement in our livelihood.	0.917	0.840	0.160	0.822	0.933
Livelihood Improvement	LIM_2	The dairy cooperative's interventions have directly contributed to the enhancement of our livelihood opportunities.	0.932	0.868	0.132		
	LIM_3	Our livelihood prospects have significantly improved since joining the dairy cooperative.	0.871	0.758	0.242		
	SST_1	Membership in the dairy cooperative has positively influenced our social status within the community.	0.933	0.871	0.129	0.839	0.940
Social status	SST_2	The dairy cooperative's activities have elevated our social standing among peers and neighbors.	0.918	0.843	0.157		
	SST_3	We feel a sense of pride in our improved social status resulting from our affiliation with the dairy cooperative.	0.895	0.802	0.198		
	SIA_1	Our ability to save and invest has increased due to our involvement with the dairy cooperative.	0.880	0.774	0.226	0.705	0.878
Savings and Investments/ Asset creation	SIA_2	The dairy cooperative's programs have encouraged us to save and invest in assets for the future.	0.812	0.659	0.341		
	SIA_3	We have been able to create valuable assets through the opportunities provided by the dairy cooperative.	0.826	0.683	0.317		
Access to healthcare services	AHS_1	Membership in the dairy cooperative has improved our access to healthcare services.	0.911	0.829	0.171	0.843	0.942

	AHS_2	The dairy cooperative's initiatives have made it easier for us to avail healthcare facilities when needed.	0.922	0.850	0.150		
	AHS_3	We feel more secure about our healthcare needs being met because of the support from the dairy cooperative.	0.922	0.850	0.150		
Women Empowerment	WEM_1	Participation in the milk cooperative society has improved the social status of women in the village.	0.898	0.806	0.194	0.809	0.927
	WEM_2	Membership of a milk cooperative has improved the economic well-being of village women	0.855	0.731	0.269		
	WEM_3	Women actively involved in milk cooperatives feel empowered to make decisions in their homes and communities	0.944	0.891	0.109		

The results presented in Table 3 provide strong evidence supporting the convergent validity of the constructs used to assess the socio-economic outcomes of dairy cooperative participation. Each construct—ranging from education and income generation to women empowerment—exceeds the recommended threshold values of AVE (≥ 0.50) and Composite Reliability (CR ≥ 0.70), as suggested by Fornell and Larcker (1981). This indicates that a substantial proportion of variance in each set of observed variables is explained by the underlying latent construct, and that the indicators are internally consistent and reliable (Hair et al., 2019). Constructs such as *Economic Wellbeing*, *Standard of Living*, and *Access to Healthcare Services* exhibit particularly high AVE and CR values, reflecting excellent convergent validity and suggesting that the associated items are robust measures of these dimensions. Even the construct with the lowest AVE, *Education of Household Members* (AVE = 0.620), still comfortably meets the criterion, reinforcing the measurement model's adequacy. Overall, the instrument demonstrates sound convergent validity, confirming that the developed items successfully capture the intended theoretical concepts and providing a reliable basis for further empirical investigation into the socio-economic effects of cooperative participation.

- **Discriminant Validity**

Discriminant validity refers to the extent to which a construct is truly distinct from other constructs, both conceptually and empirically. It ensures that each construct in a measurement model captures unique aspects of a phenomenon, without significant overlap with other constructs (Campbell & Fiske, 1959; Henseler, Ringle, &Sarstedt, 2015). Establishing discriminant validity is crucial for confirming that the indicators of a particular construct are not excessively correlated with those of different constructs, thereby maintaining clear conceptual boundaries between variables (Kline, 2016). Without adequate discriminant validity, the theoretical distinctiveness of constructs is compromised, leading to ambiguous interpretations of empirical findings. It plays a vital role in ensuring the credibility of measurement models by verifying that the constructs under investigation measure what they are intended to (Hair et al., 2019; Fornell&Larcker, 1981).

Table 4: Discriminant Validity

	EDU	IGN	BCW	SOL	LIM	SST	SIA	AHS	WEM

EDU	0.828								
IGN	.825**	0.924							
BCW	.824**	.912**	0.942						
SOL	.829**	.934**	.942**	0.955					
LIM	.798**	.921**	.930**	.924**	0.933				
SST	.834**	.920**	.955**	.951**	.919**	0.940			
SIA	.768**	.823**	.847**	.840**	.805**	.866**	0.878		
AHS	.839**	.893**	.916**	.887**	.882**	.919**	.870**	0.942	
WEM	.801**	.886**	.920**	.866**	.876**	.904**	.884**	.927**	0.927
**. Correlation is significant at the 0.01 level (2-tailed).									

Discriminant validity was evaluated using the Fornell-Larcker criterion, which requires that the square root of the Average Variance Extracted (AVE) for each construct (represented along the diagonal of the matrix) must be greater than the corresponding inter-construct correlations (Fornell&Larcker, 1981). This criterion ensures that each latent construct shares more variance with its own indicators than with other constructs in the model.
The values presented in Table 4 indicate that all constructs satisfy this criterion. The square root of AVE for each construct exceeds its highest correlation with any other construct, thereby confirming discriminant validity. For instance, the construct Education of Household Members (EDU) has a square root of AVE value of 0.828, which is greater than its correlations with other constructs such as Income Generation (0.825), Economic Wellbeing (0.824), and Standard of Living (0.829). Similar patterns are observed across the other constructs, including Economic Wellbeing (0.942), Standard of Living (0.955), Access to Healthcare Services (0.942), and Women Empowerment (0.927), all of which demonstrate higher diagonal values relative to their respective inter-construct correlations.
Although certain constructs exhibit relatively high inter-correlations—such as between Social Status and Economic Wellbeing, and between Women Empowerment and Access to Healthcare Services—the square roots of their AVEs remain higher, thereby upholding the requirement for discriminant validity. These findings confirm that each construct in the measurement model is empirically distinct and measures a unique theoretical concept.Thus, the results establish adequate discriminant validity for all constructs under investigation, thereby reinforcing the construct validity and robustness of the measurement model.

- **Conclusion**

Based on the comprehensive findings of this study, it can be concluded that dairy cooperatives play a pivotal role in the socio-economic development of rural households. The perceptions of dairy farmers reflect a strong positive impact of cooperative membership across various dimensions, including income generation, economic wellbeing, standard of living, access to healthcare, education, savings and investments, and particularly women empowerment. The high mean scores across all indicators suggest that cooperative initiatives are effectively contributing to improvements in household welfare and rural quality of life.
The reliability analysis confirmed that the measurement instrument used in the study is highly consistent and dependable, with Cronbach's alpha values well above the accepted threshold for all constructs. This internal consistency strengthens the credibility of the collected data and affirms the robustness of the survey design. Furthermore, the convergent validity results demonstrated that the items within each construct are well-aligned with the theoretical dimensions they were intended to measure, as reflected in satisfactory AVE and Composite Reliability values. Similarly, the discriminant validity analysis confirmed that each construct is distinct and does not significantly overlap with others, ensuring clear conceptual boundaries within the measurement model.
The high level of validity and reliability of the data collection instrument suggests its suitability for conducting a comprehensive study on the socio-economic impacts of dairy cooperatives. These findings not only validate the effectiveness of cooperative models in rural upliftment but also reinforce the appropriateness of the methodological framework employed in the research.

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