

# Adoption of Recommended Management Practices for Dairy Development in Sri Lanka: A Preliminary Study

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## Abstract

Agricultural and livestock production development highly depends on the adoption of innovation. This study aimed to develop and validate a composite scale to measure the adoption of recommended dairy cattle management practices among livestock farmers. Data was collected using a questionnaire adapted from empirical studies and newly constructed. A subset of the population (n = 30) was selected using a multi-stage sampling technique. Instrument validation was performed using Exploratory Factor Analysis (EFA) across eight constructs relevant to the study. All constructs showed strong factor loadings (>0.60), indicating high construct validity. Bartlett's Test of Sphericity showed significant results for all items (P-value <0.05). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy exceeded the acceptable threshold (>0.5) for each construct. The reliability of the scale was assessed using Cronbach's alpha, an acceptable value (>0.7). The study concludes that the scale is reliable and valid for measuring the adoption of improved dairy management practices.

**Keywords:** Adoption, Scale, Small-Scale Dairy Farmer, Dairy Production, Sri Lanka

## Introduction

Dairy is a unique product among all agricultural commodities. It provides nutrients, health, income, and improved livelihood. More than 80 percent of the world's population regularly adds liquid milk or other dairy products to their diet (Bizzarri et al., 2019.). The dairy sector provides a sustainable income source for many smallholder farmers in developing countries by leveraging the rural economy. Sri Lanka has optimum climatic conditions for dairy farming.

However, the country's annual milk production is lower than that of other Asian countries. Total milk production in 2023 has been reported as 380 million Liters (Department of Animal Production and Health, 2023). Local dairy production has not yet achieved the desired level of self-sufficiency (Vyas et al., 2020a). The low adoption of scientific and recommended management practices is prominent in Sri Lankan dairy farming. The level of influence of dairy innovation on the farming community determines the degree of production improvement (Kapadiya et al., 2022). Adoption is “integrating new technology into existing practice”(Loevinsohn et al., 2013). In the adoption process, individuals or organizations accept and utilize innovation. This innovation should be a “practice” or a “technology”. Adoption is also explained in literature as an individual belief or mental process. In empirical studies on the adoption of agricultural technology, the population is categorized into adopters and non-adopters (Ayele et al., 2001). Adoption refers to the adjustments made in farming systems in response to changes in dairy management practices, taking advantage of opportunities while mitigating the adverse effects of current practices.

Small-scale farmers are hesitant to adopt recommended dairy cattle management practices and new technologies that could potentially increase their livelihoods (Kebebe, 2019). The majority of small-scale farmers are not utilizing these innovations and benefits (Kebebe, 2019), as well as opportunities exist between management practices and marketable production. Breeding and reproduction, feeding and fodder management, and clean milk production are key management practices that significantly influence dairy production. Animal feeding practices, breeding practices, and the methods of milking and storing are main focusing areas which are important for enhancing the livelihood of small-scale dairies (Duncan et al., 2013).

Knowledge is an essential tool in the innovation process in every domain (Bose, 2004). Knowledge can be defined as “a clear understanding of information and its associated patterns”(Bierly et al., 2000). Indeed, knowledge is the most important component in individual performance. Knowledge plays a significant role in considering resource utilization within a process that converts inputs into sound output (Harmon et al., 2018).

Attitude reflects a person's positive or negative response to a certain situation. It evaluates how much a person likes or dislikes a particular object. Attitude is “the way to perceive an individual’s specific behavior.” (Do et al., 2020). Attitude is a “physiological tendency expressed by evaluating a particular entity with some degree of favour or disfavour” (Eagly & Chaiken,1998). Furthermore, the author states that attitude is not directly observable but can be measured using observable indicators. It directly impacts individual behavior, which is formed by experience or social influences. Performance Expectancy is defined as “the degree to which an individual believes that using the system will help him or her to attain against in job performance” (Venkatesh et al., 2003). Effort expectancy is “the degree of ease associated with the use of the system” (Venkatesh et al., 2003). Further, it refers to the simplicity and ease of use of the system, which is associated with usability (Eweoya et al., 2021). Social influence is “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al., 2003). Social Influence explains the personal belief in using the system due to the influence and support of an important person or group. Individuals often feel pressure from society and their surroundings to make decisions that promote user acceptance. Therefore, the attitude of

other people in the surrounding area is also an external factor that determines the farmers' behavioral decisions (Li et al., 2021). Voluntariness refers to an individual's choice that is not influenced by external interference from another person (Nelson et al., 2002). Typically, users accept the system without external intervention once they understand the outcomes. Voluntariness refers to an individual's willingness to accept a non-mandatory condition (Malhotra et al., 2005). Facilitating condition is defined as "the degree to which an individual believes that an organization and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003). This includes access to credit, knowledge, technical assistance, and peer support. Support from government and non-government agencies also determined the farmer's adoption decision (Rathakrishnan et al., 2022).

When developing new scales or modifying existing scales, researchers must ensure that the scale has adequate psychometric properties (Johanson et al., 2010). Adopting Recommended Management Practices that have influenced the development of dairy production in Sri Lanka. Breeding and reproduction management practices, Feed and fodder management, and clean milk production, which concern market-oriented dairy development (Vyas et al., 2020b). The scale was developed based on Recommended Dairy Management Practices.

### **Materials and Methods**

This study used a quantitative research method. A detailed literature review was used to identify items for the scale. Constructed items were developed based on the Good Dairy Management Practices introduced by the FAO guidelines, management practices recommended by the local department, and from previous research (Godara et al., 2018; Kumawat et al., 2012; Quddus, 2013; Wang & Tao, 2020), and a literature review. All items were measured using a five-point Likert Scale, which was identified as an attitude scale. The attitude scale is designed to collect respondents' level of agreement, favourability, or similar perceptions (Desselle, 2005). Item validation was conducted using the Delphi method, which gathered opinions from an expert panel comprising specialists from breed management, feed and fodder management, and public health. Item selection was subjected to expert review, and 110 items were initially selected to collect data and establish measures for adopting recommended dairy management practices. This study was conducted in the central province of Sri Lanka. Respondents were selected using a multistage sampling method, and the questionnaire was self-administered using a cross-sectional research design. Data were collected from 30 small-scale dairy farmers (n = 30).

Exploratory Factor Analysis was carried out using IBM-SPSS version 25. Principal Component Analysis (PCA) is used to extract the maximum variance from the dataset, which helps to reduce many variables into fewer components (Gie Yong et al., 2013). Bartlett's Test for Sphericity examines whether the correlation matrix significantly differs from an identity matrix. Reliability of the scale was tested using Cronbach's alpha. Kaiser-Meyer-Olkin (KMO) measure was used to test the sampling adequacy (Kaiser, 1974). The correlations and commonalities among the variables were also tested (Plonsky, 2015).

Factor Analysis is used to identify the number of items for scale development (DeVellis, 2021). An Exploratory Factor Analysis (EFA) was performed for each construct to verify the dimensionality and identify the underlying constructs of the dataset. Different criteria were established to help decide the number of factors to retain in factor analysis. Keser criterion,

scree plot test, and variance extracted are widely used (Wadood et al., 2021.). After establishing the data's factorability, the principal component analysis was used as a factor extraction method.

## Findings

### *The EFA for the construct: Knowledge of Recommended Management Practices*

This construct was measured using 13 items, as listed in Table 1. Each item was measured using a 5-point Likert scale. The item, statement, and mean response for each item are provided. The results in Table 1 present the descriptive statistics for each item measuring the knowledge construct. The Table indicates that the mean value for every item ranged from 1.67 to 4.30, while the standard deviation ranged from 0.48 to 1.12.

Table 1

### *The Mean and Standard Deviation for the Item Measuring of the Construct - Knowledge*

Item	Mea	
	n	Std. Dev
I have the knowledge to identify the suitable breed	3.90	1.09
I have knowledge of the breeding plan	3.70	0.88
I have knowledge of heat detection to get the Artificial Insemination (AI) in time	4.17	0.65
I can select the suitable fodder varieties for the area	2.70	0.95
I have knowledge of the correct spacing of fodder planting	2.13	1.01
I have knowledge of the correct cutting stages of fodder	2.10	1.03
I have knowledge of chaffed fodder use for animal feeding	2.13	0.97
I have knowledge of concentrates	2.07	1.08
I have knowledge of Total Mixed Ration (TMR)	3.33	1.06
I have knowledge of giving 24-hour water	1.67	1.12
I have knowledge of correct udder preparation	4.30	0.60
I have knowledge of the proper cleaning method for utensils	1.97	0.81
I have knowledge of the environment cleanliness before milking	3.90	0.48

Table 2 indicates a KMO of 0.670, which is acceptable and implies the sample adequacy. Further, Bartlett's Test of Sphericity indicates 0.000, which  $P < 0.05$  and rejects the null hypothesis as not an identical matrix.

Table 2

### *The KMO and Bartlett's Test of Sphericity*

KMO Bartlett's Test	
Kaiser-Meyer-Olkin measure of sampling adequacy.	0.670
Bartlett's test of sphericity	Sig. 0.000

Table 3 indicates a higher extraction of items subjected to the PCA. A factor loading greater than 0.6 is acceptable for item retention (Shkeer et al., 2019). Furthermore, Table 3 indicates that each item achieved a loading value greater than 0.6 and belongs to a single component, exhibiting one dimension for each item. These observed variables indicate high communality through the principal component analysis. A particular set of factors is said to explain a lot of the variance of a variable if it has a high communality (Child, 2006).

Table 3

*Communality of Construct - Knowledge*

Item	Initial	Extraction
I have knowledge to identify the suitable breed	1	0.851
I have knowledge of the breeding plan	1	0.809
I have knowledge of heat detection to get the AI in time	1	0.838
I can select the suitable fodder varieties for the area	1	0.757
I have knowledge of the correct spacing of fodder	1	0.797
I have knowledge of the correct cutting stages	1	0.826
I have knowledge of chaffed fodder use for animal feeding	1	0.741
I have knowledge of concentrates	1	0.716
I have knowledge of TMR	1	0.644
I have knowledge of giving 24-hour water	1	0.644
I have knowledge of correct udder preparation	1	0.649
I have knowledge of the proper cleaning method for utensils	1	0.753
I have knowledge of the environment cleanliness before milking	1	0.910

Extraction Method: Principal component analysis

Keser's criterion is based on the eigenvalues for the correlation matrix data set that determine the cut-off point for the factors considered to be retained, which indicates an eigenvalue greater than 1 (Fabrigar et al., 1999). Based on the eigenvalue, the scree plot test is used to identify a point at which the curve bends and then flattens out and to determine the number of factors that occur above the break point. Figure 1 indicates that only one component is prominent in the EFA.

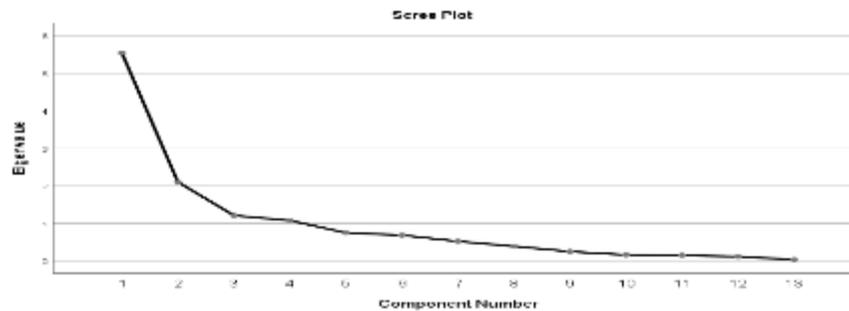


Figure 1: Scree Plot for Construct - Knowledge

Table 4 indicates Cronbach's alpha for knowledge. It is above 0.7, which is a good value in reliability assessment. Therefore, items belonging to the construct of knowledge indicate acceptable reliability.

Table 4

*Cronbach's Alpha for Construct - Knowledge*

Cronbach's Alpha	No of Item
0.834	13

*The EFA for the Construct: Attitude of Recommended Management Practices*

Table 5 indicates the measurement of 10 attitude items. The items, statements, responses of mean values, and standard deviation are given in Table 5. It indicates that the means of every item range from 1.967 to 4.3, while the standard deviation ranges from 0.583 to 1.155.

Table 5

*The Mean and the Standard Deviation of Measuring the Construct -Attitude*

No	Item	Mean	Std. Dev
1	Important to have a breeding plan	3.833	0.986
2	AI technique is important for productive animals	3.800	0.761
3	Mobile is important to have an immediate AI service	3.267	0.640
4	Cultivating recommended fodder is important	3.200	0.997
5	Correct spacing is important in fodder cultivation	2.667	1.155
6	Important to cut fodder at the correct cutting stage	2.767	1.040
7	Important to practice clean udder preparation	4.300	0.596
8	Important to practice the strip cup test before milking	1.967	0.809
9	Importance of the correct method of cleaning utensils	4.000	0.455
10	The importance of using a milking machine	4.267	0.583

Table 6 indicates a KMO of 0.623, which is acceptable and implies the sample adequacy. Furthermore, Bartlett's Test of Sphericity yields a p-value of 0.000, which is less than 0.05 and rejects the null hypothesis that the matrix is identical.

Table 6

*The KMO and Bartlett's Test of Sphericity*

KMO Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.623
Bartlett's Test of Sphericity	Sig.	0.000

Table 7 presents the communality values of the observed variables related to factor attitude. Further, it indicates that each item reached a >0.6 loading value and belongs to one component, showing one dimension of each item.

Table 7

*Communality of Construct- Attitude*

Item	Initial	Extraction
Important to have a breeding plan	1	0.863
AI technique is important for productive animals	1	0.859
Mobile is important to have an immediate AI service	1	0.743
Cultivating recommended fodder is important	1	0.810
Correct spacing is important in fodder cultivation	1	0.858
Important to cut fodder at the correct cutting stage	1	0.878
Important to practice clean udder preparation	1	0.666
Important to practice the strip cup test before milking	1	0.846
Importance of the correct method of cleaning utensils	1	0.697
The importance of using a milking machine	1	0.830

Based on the plotted graph of the eigenvalues of the construct attitude in Figure 2, the scree plot test implies that only one component is prominent in the EFA.

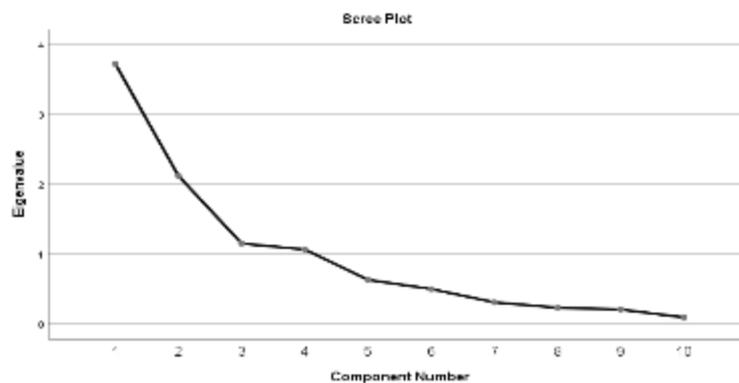


Figure 2: Scree Plot for Attitude

Table 8 presents Cronbach's alpha for attitude, which is above 0.7 (0.782), indicating a good value in reliability assessment. Therefore, items belonging to the attitude construct indicate acceptable reliability.

Table 8

*Cronbach's Alpha for Construct- Attitude*

Cronbach's Alpha	No of Items
0.782	10

*The EFA for the Construct: Performance Expectancy of Recommended Management Practices*  
Performance expectancy was measured using 11 items as given in Table 9. Accordingly, the mean value for every item ranged from 1.93 to 4.53, while the standard deviation ranged from 0.563 to 1.202.

Table 9

*The Mean and Standard Deviation for Items Measured Construct - Performance Expectancy*

No	Item	Mean	Std. Dev
1	AI provides productive animals	4.000	0.643
2	Recommended animal breeds provide higher milk production	4.400	0.563
3	Use of Mobile helps to have immediate AI service	3.933	0.640
4	Recommended fodder varieties help to increase milk yield	2.600	1.070
5	The correct cutting stage of fodder increases the animal feed intake	2.500	0.938
6	24-hour drinking water availability increases milk production	4.333	0.606
7	Correct udder preparation helps to harvest clean milk	3.967	0.964
8	Strip cup test before milking helps to clean the milk	2.367	0.964
9	Properly cleaned utensils help to keep the milk quality	1.933	1.202
10	Using the milk machine is a good milking route	4.033	0.765
11	Storing milk at a cool temperature (4°C) keeps milk quality	4.533	0.571

Table 10 indicates a KMO of 0.633, which is acceptable and suggests an adequate sample size. Furthermore, Bartlett's Test of Sphericity indicates a p-value of 0.000, which is less than 0.05 and rejects the null hypothesis as not an identical matrix.

Table 10

*The KMO and Bartlett's Test of Sphericity*

KMO Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.633
Bartlett's Test of Sphericity	Sig.	0.000

Table 11 indicates the communality values of the observed variables related to performance expectancy. Further, it indicates that each item reached  $>0.6$  loading value except three items, which range between 0.5 and 0.6 and belong to the one component showing one dimension for each item.

Table 11

*Communality for Construct: Performance Expectancy*

Item	Initial	Extraction
AI provides productive animals	1	0.549
Recommended animal breeds provide higher milk production	1	0.635
Use of Mobile helps to have immediate AI service	1	0.427
Recommended fodder varieties help to increase milk yield	1	0.821
The correct cutting stage of fodder increases the animal feed intake	1	0.835
24-hour drinking water availability increases milk production	1	0.631
Correct udder preparation helps to harvest clean milk	1	0.692
A strip cup test before milking helps to clean the milk	1	0.751
Properly cleaned utensils help to keep the milk quality	1	0.509
Using the milk machine is a good milking route	1	0.769
Storing milk at a cool temperature ( $4^{\circ}\text{C}$ ) keeps milk quality	1	0.536

The scree plot test, based on the plotted graph of the eigenvalues of the performance expectancy construct in Figure 3, suggests that only one component is prominent in the EFA.

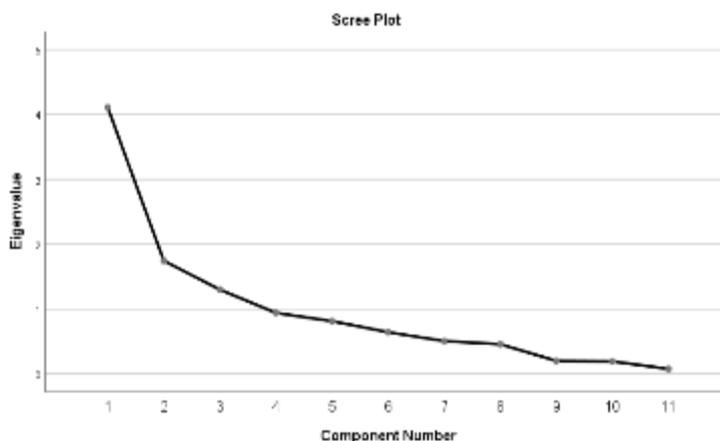


Figure 3: Scree Plot for Construct - Performance Expectancy

Table 12 indicates Cronbach's alpha for performance expectancy. It indicates 0.805, which is above 0.7, a good value in reliability assessment. Therefore, items belonging to the construct of performance expectancy indicate acceptable reliability.

Table 12

*Cronbach's Alpha for Construct - Performance Expectancy*

Cronbach's Alpha	No of Items
0.805	11

This construct consists of 9 items. Each item was measured using a 5-point Likert scale, 1 = strongly disagree to 5 = strongly agree. Table 13 indicates the item, measured statements, mean, and standard deviation. It indicates that the mean value for every item ranged from 2.533 to 3.467, while the standard deviation ranged from 0.498 to 0.900.

Table 13

*The Mean and Standard Deviation for Items Measuring Construct - Effort Expectancy*

No	Item	Mean	Std. Dev
1	Have enough money to purchase suitable animals	3.200	0.847
2	Enough money to get an AI service	2.833	0.834
3	Enough money to use the mobile phone	3.167	0.648
4	Have enough land available for fodder cultivation	3.467	0.507
5	Enough money to purchase a chopping machine	2.533	0.507
6	Money to purchase the daily required concentrate feed	2.867	0.900
7	Enough money to purchase a refrigerator	3.333	0.661
8	Enough money to purchase milk utensils	2.600	0.498
9	Enough labour to clean the farm environment	2.967	0.809

Table 14 presents the results of the KMO measure for sampling adequacy, which is 0.550. Bartlett's sphericity is significant as  $p < 0.05$ .

Table 14

*The KMO and Bartlett's Test of Sphericity*

KMO Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.550
Bartlett's Test of Sphericity	Sig. 0.000

Table 15 indicates the communality values of the observed variables related to factor effort expectancy. Furthermore, it indicates that each item has a loading value greater than 0.6 and belongs to a single component, indicating one dimension of each item.

Table 15

*Communality of Construct - Effort Expectancy*

Item	Initial	Extraction
Money to purchase the daily required concentrate	1	0.875
Enough labour to clean the farm environment	1	0.860
Have enough money to purchase suitable animals	1	0.779
Enough money to use the mobile phone	1	0.749
Enough money to purchase a refrigerator	1	0.748
Enough money to purchase a chopping machine	1	0.731
Enough money to get an AI service	1	0.696
Have enough land available for fodder cultivation	1	0.696
Enough money to purchase milk utensils	1	0.660

The scree plot test, based on the plotted graph of eigenvalues of construct effort expectancy, indicates in Figure 4 that only one component is prominent in the EFA.

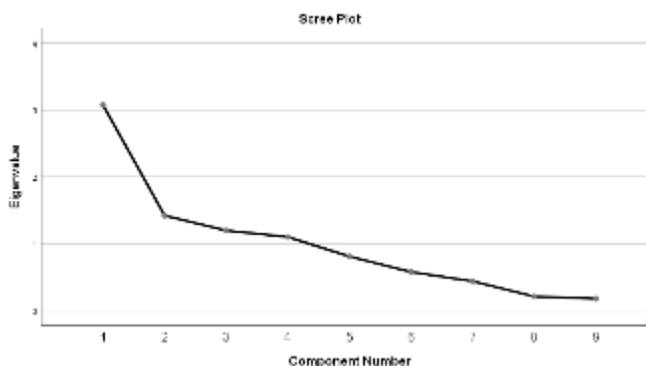


Figure 4: Scree Plot for Effort Expectancy

Table 16 indicates Cronbach’s alpha for effort expectancy. It is above 0.7, which is a good value in reliability assessment. Therefore, items belonging to the construct of effort expectancy indicate acceptable reliability.

Table 16  
*Cronbach’s Alpha for Construct - Effort Expectancy*

Cronbach's Alpha	No of Items
0.707	9

*The EFA for the construct: Social Influence of Recommended Management Practices*

The construct consists of 9 items, as shown in Table 17. The item, measured statement, response mean, and standard deviation are listed in Table 17. The government veterinary surgeon, livestock development instructor (LDI), government involvement through the Department of Animal Production and Health (DAPH), and milk collectors are selected categories that contribute to social influence among dairy farmers. The Table indicates that the mean value for every item ranged from 2.033 to 4.033, while the standard deviation ranged from 0.712 to 1.224.

Table 17  
*The mean and standard deviation for items measuring the construct: Social Influence*

No	Item	Mean	Std.Dev
1	LDI wants to see me practicing a breeding plan	3.100	0.712
2	LDI wants to see me practicing AI	3.567	0.774
3	The Veterinary Surgeon wants me to select suitable breeds	4.033	0.718
4	LDI wants me to keep drinking water for 24 hours on the farm	2.533	0.937
5	LDI wants me to practice cutting fodder at the correct time	2.433	0.774
6	LDI wants me to give concentrate feed to the animal	2.033	0.765
7	A veterinary surgeon wants me to practice the strip cup test	2.333	0.922
8	Milk collectors want me to practice storing in the refrigerator	2.867	1.224
9	LDI wants me to keep the clean farm environment.	2.767	0.728

Table 18 presents the results of the KMO measure for sampling adequacy, which is 0.729. Bartlett’s sphericity is significant, with  $p < 0.05$ , indicating a non-identical matrix.

Table 18

*The KMO and Bartlett’s test of Sphericity*

KMO Bartlett’s Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.729
Bartlett's Test of Sphericity	Sig.	0.000

Table 19 presents the communality values of the observed variables related to the factor of social influence. Further, it indicates that 4 items reached  $> 0.6$  loading value out of 9 items, and 5 items indicate between 0.3 and 0.6.

Table 19

*Communality of Construct: Social Influence*

Item	Initial	Extraction
LDI wants to see me practicing a breeding plan	1	0.495
LDI wants to see me practicing AI	1	0.772
The Veterinary Surgeon wants me to select suitable breeds	1	0.505
LDI wants me to keep drinking water for 24 hours on the farm	1	0.617
LDI wants me to practice cutting fodder at the correct time	1	0.330
LDI wants me to give concentrate feed to the animal	1	0.552
A veterinary surgeon wants me to practice the strip cup test	1	0.635
Milk collectors want me to practice storing in the refrigerator	1	0.645
LDI wants me to keep a clean farm environment.	1	0.387

Based on the plotted graph of the eigenvalues of construct social influence in Figure 5, the scree plot test implies that only one component is prominent in the EFA.

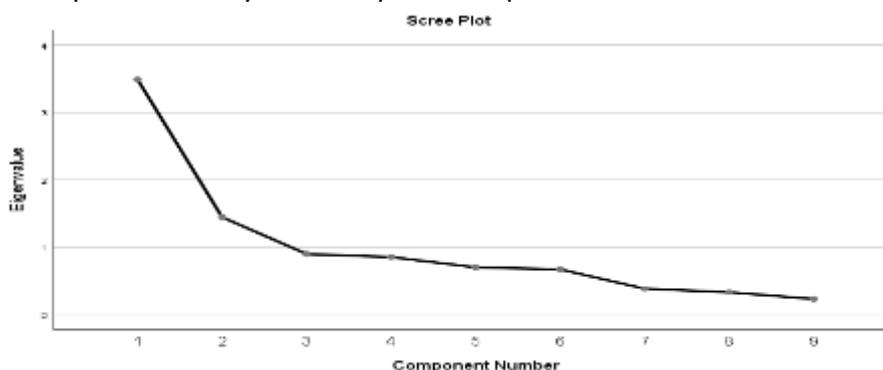


Figure 5: Scree Plot for Social Influence

Table 20 indicates Cronbach’s alpha for social influence. It indicates a value of 0.759, which is a good value in reliability assessment. Therefore, items belonging to the construct of social influence indicate acceptable reliability.

Table 20

*Cronbach’s alpha for Construct - Social Influence*

Cronbach's Alpha	No of Items
0.759	9

*The EFA for the construct: Facilitating Condition of Recommended Management Practices*

This construct was measured using 9 items. The item, measured statement, response mean, and standard deviation are listed in Table 21. The Table indicates that the mean value for each item ranged from 1.533 to 3.900, while the standard deviation ranged from 0.509 to 0.995.

Table 21

*The Mean and Standard Deviation for Items Measuring the Construct - Facilitating Condition*

No	Item	Mean	Std.Dev
1	The VS office provides sufficient training programmes	3.600	0.968
2	The veterinary office gives AI service at the correct time	3.900	0.995
3	The DAPH provides services to select the correct animals	3.500	0.509
4	The DAPH provides the required awareness of Fodder	3.833	0.791
5	LDI helps to acquire the required planting materials	2.967	0.669
6	The government provides credits to purchase a machine	1.667	0.758
7	Veterinary office, technical assistance for clean milk	3.933	0.740
8	The DAPH interferes with the purchase of the required milk	1.533	0.681
9	Milking companies facilitate the use of clean utensils for milk.	3.500	0.572

Table 22 presents the results of the KMO measure for sampling adequacy, which is 0.517. Bartlett's sphericity is significant with  $p < 0.05$ , indicating a non-identical matrix.

Table 22

*The KMO and Bartlett's Test*

KMO Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.517
Bartlett's Test of Sphericity	Sig.	0.000

Table 23 presents the communality values of the observed variables related to the factor facilitating condition. Further, it indicates that all items reached  $> 0.6$  loading value except "DAPH provides the required awareness of fodder" and belong to the one component showing one dimension of each item.

Table 23

*Communality of Construct - Facilitating Condition*

Item Code	Initial	Extraction
The VS office provides sufficient training programmes	1	0.753
The veterinary office gives AI service at the correct time	1	0.890
The government provides a service to select the correct animals	1	0.917
DAPH provides the required awareness of Fodder	1	0.418
LDI helps to acquire the required planting materials	1	0.811
The government provides credits to purchase machines	1	0.778
Veterinary offices provide technical assistance for clean milk	1	0.666
The government interferes in the purchase of the required milk	1	0.811
Milking companies facilitate the use of clean utensils for milk.	1	0.742

Based on the plotted graph of the eigenvalues of the construct facilitating condition in Figure 6, the scree plot test implies that only one component is prominent in the EFA.

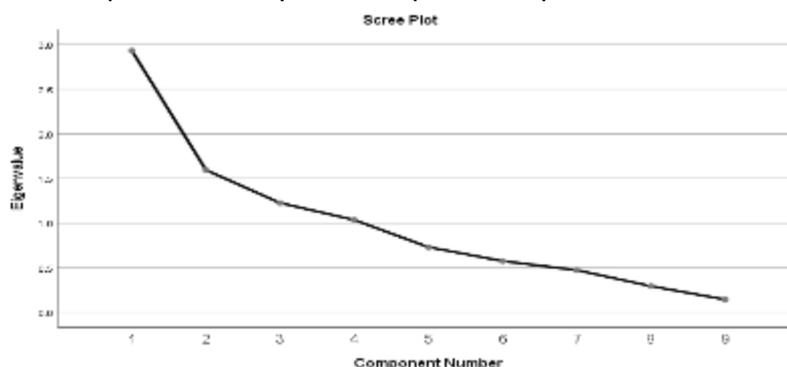


Figure 6: Scree Plot -Facilitating Condition

Table 24 indicates Cronbach's alpha for facilitating conditions. It indicates a value of 0.724, which is a good value in reliability assessment. Therefore, items belonging to the construct of facilitating conditions indicate acceptable reliability.

Table 24

*Cronbach's Alpha for Construct- Facilitating Condition*

Cronbach's Alpha	No of Items
0.724	9

*The EFA for the Construct – Voluntariness of Recommended Management Practices*

This construct was measured using 9 items. The items are rated on a Likert-type scale, where 1 = strongly oppose and 5 = strongly favour. The item, measured statement, response mean, and standard deviation are listed in Table 25. The Table indicates that the mean value for each item ranged from 1.167 to 4.133 while the standard deviation ranged from 0.629 to 1.358.

Table 25

*The Mean and Standard Deviation for Items Measuring the Construct - Voluntariness*

No	Item	Mean	Std.Dev
1	Voluntarily practice for the breeding plan	3.767	1.104
2	Voluntarily practice the AI service at the correct time of the heat	3.967	0.928
3	Voluntarily use mobile phones to contact VS for AI	4.133	0.629
4	Voluntarily practice recommended fodder cultivation	2.133	1.358
5	Voluntarily practice TMR for animal feeding	1.733	1.081
6	Voluntarily practice the recommended amount of concentration	1.300	0.702
7	Voluntarily practice correct udder preparation	3.933	1.112
8	Voluntarily practice the correct cleaning method of utensils	1.733	0.907
9	Voluntarily practice storing milk in refrigerators (4°C)	1.167	0.747

Table 26 presents the results of the KMO measure for sampling adequacy, which is 0.533. Bartlett's sphericity is significant with  $p < 0.05$ , which is not an identical matrix.

Table 26

*The KMO and Bartlett's Test of Sphericity*

KMO Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.533
Bartlett's Test of Sphericity	Sig.	0.000

Table 27 indicates the communality values of observed variables for the factor of voluntariness. Further, it indicates that all items reached  $>0.6$  loading value except two items, "voluntarily practice recommended fodder cultivation" (0.543) and "voluntarily practice correct udder preparation" (0.598), which belong to the one component showing one dimension of each item.

Based on the plotted graph of the eigenvalues of the construct of voluntariness in Figure 7, the scree plot test suggests that only one component is prominent.

Table 27

*Communality of Construct - Voluntariness*

Item code	Initial	Extraction
Voluntarily practice for the breeding plan	1	0.761
Voluntarily practice the AI service at the correct time of the heat	1	0.822
Voluntarily use mobile phones to contact VS for AI	1	0.793
Voluntarily practice recommended fodder cultivation	1	0.543
Voluntarily practice TMR for animal feeding	1	0.723
Voluntarily practice the recommended amount of concentration	1	0.698
Voluntarily practice correct udder preparation	1	0.598
Voluntarily practice the correct cleaning method of utensils	1	0.779
Voluntarily practice storing milk in refrigerators (4°C)	1	0.821

The scree plot test, based on the plotted graph of the eigenvalue of construct voluntariness in Figure 7, implies that only one component is prominent.

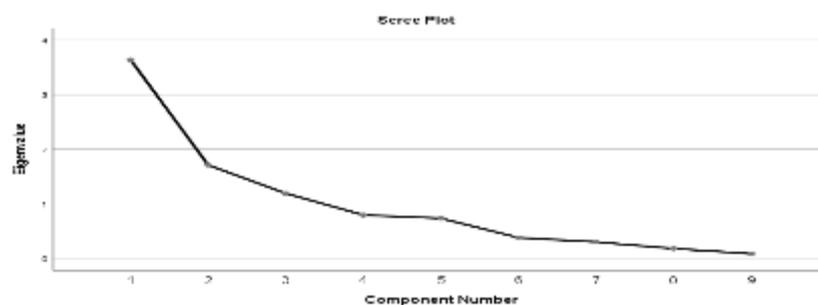


Figure 7: Scree Plot Voluntariness

Table 28 indicates Cronbach's alpha for voluntariness. It indicates a value of 0.722, which is a good value in reliability assessment. Therefore, items belonging to the construct of voluntariness indicate acceptable reliability.

Table 28

*The Internal Reliability for Constructs - Voluntariness*

Cronbach's Alpha	No of Items
0.722	9

*The EFA for the Construct: Adoption of Recommended Management Practices*

This construct was measured using 15 items. The item, measured statement, response mean, and standard deviation are listed in Table 29. It indicates that the mean value for each item ranged from 1.133 to 4.433, while the standard deviation ranged from 0.434 to 1.117.

Table 29

*The Mean and Standard Deviation for Items Measuring the Construct: Adoption*

No	Item	Mean	Std.Dev
1	Adopted recommended suitable breeds	4.433	0.679
2	Adopted a correct breeding plan that ensures	4.133	0.819
3	Adopted AI for farm animals	3.833	1.117
4	Adopting a mobile phone is useful for communication	4.367	0.615
5	Adopted to establish recommended fodder varieties	1.500	0.900
6	Adopted to correct spacing (agronomic) practices	1.433	0.858
7	Adopted to 24 hours of sufficient drinking water	2.833	0.834
8	Adopted the recommended amount of concentrate	3.400	0.932
9	Adopted to Total Mixed Ration (TMR) for animals	1.133	0.434
10	Adopted the correct udder preparation	3.600	1.037
11	Adopted to strip cup test before milking each animal	1.433	0.568
12	Adopting a milking machine is a good milking routine.	1.233	0.817
13	Adopted to milking at the correct times of the day	4.000	0.743
14	Adopted the correct cleaning method in cleaning utensils	3.633	0.718
15	Adopted to storing harvested milk in the refrigerator	4.667	0.802

Table 30 presents the communality values of the observed variables related to factor adoption. Further, it indicates that all items reached > 0. 6 loading value and belong to the one component, showing one dimension of each item.

Table 30

*Communality of Construct - Adoption*

Item	Initial	Extraction
Adopted recommended suitable breeds	1	0.714
Adopted a correct breeding plan that ensures	1	0.819
Adopted AI for my farm animals	1	0.757
Adopting a mobile phone is useful for communication	1	0.872
Adopted to establish recommended fodder varieties	1	0.938
Adopted to correct spacing (agronomic) practices	1	0.851
Adopted to 24 hours of sufficient drinking water	1	0.593
Adopted the recommended amount of concentrate	1	0.652
Adopted to Total Mix Ration (TMR) for animals	1	0.779
Adopted the correct udder preparation	1	0.643
Adopted to strip cup test before milking each animal	1	0.774
Adopting a milking machine is a good milking routine.	1	0.789

Adopted to milking at the correct times of the day	1	0.809
Adopted the correct cleaning method for cleaning utensils	1	0.793
Adopted to storing harvested milk in the refrigerator	1	0.832

Table 31 indicates the results of the KMO measured for sampling adequacy, 0.594. Bartlett’s sphericity is significant as  $p < 0.05$ , which is not an identical matrix.

Table 31  
*The KMO and Bartlett’s Test of Sphericity*

KMO Bartlett’s		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.594
Bartlett's Test of Sphericity	Sig.	0.000

Based on the plotted graph of the eigenvalue of construct adoption in Figure 8, the scree plot test implies that only one component is prominent in the EFA.

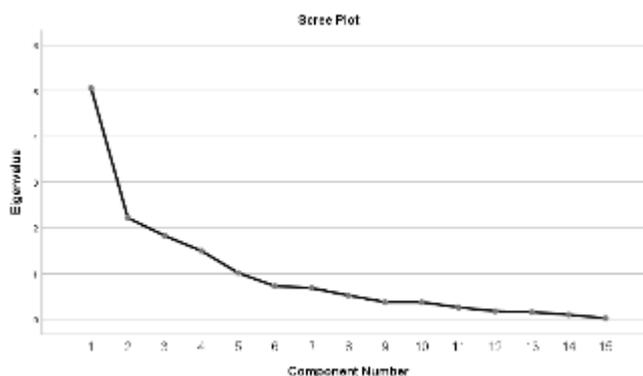


Figure 8: Scree Plot for Construct - Adoption

Table 32 indicates Cronbach’s alpha for 15 items of adoption. It indicates 0.823, which is a good value in reliability assessment. Therefore, items belonging to the construct of adoption indicate acceptable reliability.

Table 32  
*Cronbach’s Alpha for Construct - Adoption*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
0.823	0.823	15

**Conclusion**

This study presents the results of pilot testing and preliminary validation of items that adopt recommended dairy management practices. This study has found the reliability and validity of the new items for measuring the adoption of improved management practices. Some of the items were newly constructed. Therefore, the study findings suggest the need to enhance items related to social influence, attitude, and performance expectancy. Items belonging to social influence, attitude, and performance expectancy indicate low communality values. However, the study has demonstrated the acceptability of the validity and reliability of the items employed. This instrument can be used for technological adoption measures in livestock farms.

### Contribution

The study clearly illustrates the current status of adoption of recommended dairy management among small-scale dairy farmers and the practices they accept and reject. This study identifies the appropriate items to measure the adoption of recommended management practices. Hence, the study suggests that the factors influencing the adoption of recommended dairy management practices among small-scale dairy farmers can help policymakers and stakeholders better understand the issues in the dairy sector. It also provides a clear view of management practices that need more attention in future development. The study findings help to improve existing extension services and inform the development of the target training programme and policies. Furthermore, the findings contribute to necessary improvements in current management practices, increase dairy productivity, and enhance the sustainability and resilience of the dairy sector.

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