Journal of Animal Research: v.13 n.05, p. 763-772. October 2023

DOI: 10.30954/2277-940X.05.2023.18

Significant Technological Dimensions in Dairy Based Integrated Farming Systems: A Perception Study from Kerala

Vani Chandran[1*], Subhash Kumar Saurav[2] and Ritu Chakravarty[3]

[1]Department of Agricultural Extension Education, College of Agriculture, Padannakkad, Kerala Agricultural University, Kerala, INDIA
[2]Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi, INDIA
[3]Dairy Extension Division, ICAR-National Dairy Research Institute, Karnal, Haryana, INDIA

**Corresponding author: V Chandran; E-mail: vaniagri93@gmail.com*

Received: 26 Aug., 2023 **Revised:** 27 Sept., 2023 **Accepted:** 30 Sept., 2023

ABSTRACT

The characteristics of a technology play an important role in its adoption. Farmers accept technology that has traits which are perceived to be important by them. A study was conducted among 180 IFS units in Kerala to understand the technological dimensions perceived as important by both IFS farmers and officials. Various dimensions that seemed to be connected with IFS were enlisted and the selected dimensions were examined by IFS farmers and the selected experts in this field, such as agricultural officers, veterinary surgeon and officials from ATMA and KVK. Ranking method had been used to evaluate the relevance of each dimension separately for all respondents. The analysis of the results revealed some disparity in priorities between IFS farmers and officials. Some of the dimensions that were important to farmers were deemed unimportant by the other group of respondents. Economic dimensions were found to be the most important dimensions among all.

HIGHLIGHTS

- Analyzed various technological dimensions perceived as important by the IFS farmers and officials.
- Economic dimensions were found to be the most important dimensions among the considered dimensions.

Keywords: Farmers, Officials, Perception, Technological dimension, Integrated Farming System

Integrated farming system (IFS) is a promising option for enhancing productivity and farmers' income. Through the proper integration of various enterprises into a single unit, maximum utilization of available resources is possible. It also helps to reduce the cost of cultivation to a greater extent and improves the management of farm waste in a better way. IFS offers efficient use of available land and human resources (Nair *et al.,* 2019; Chandana *et al*., 2023). Along with these advantages, IFS also aids in minimizing the shortcomings of monocropping and increases job opportunities. Thus, establishing an IFS unit significantly influences the standard of living of the farm families. Especially for small and marginal farmers with limited resources, IFS appears to be a potential answer to the continuously rising need for food supply, income stability and nutrition enhancement. Using crop activity as the foundation, integration of several agriculturally connected firms will offer opportunities to reuse products and waste materials from one component as inputs through a linked component and lower production costs, which will ultimately increase the farm's overall profitability (Korikanthimath and Manjunath, 2009). Establishing an IFS unit is not an end but only a means to ensure sustainable production. For getting higher yield from various components adopted, more scientific production

How to cite this article: Chandran, V., Saurav, S.K. and Chakravarty, R. (2023). Significant Technological Dimensions in Dairy Based Integrated Farming Systems: A Perception Study from Kerala. *J. Anim. Res.,* **13**(05): 763-772.

Source of Support: None; **Conflict of Interest:** None

practices should also be followed. It is very important to adopt the appropriate technology to maximize productivity and profitability (Challa and Tilahun, 2014; Joshi and Varshney, 2022).

Technological advancement is taking place at a rapid pace. A new technology in the agriculture system is considered as any new item in the farming system, including different commodities, farm operations, equipment and other services (Raju, 1982). Governments and development organizations have long pushed agricultural technologies as an efficient means of raising farm production and reducing poverty (Ruzzante *et al.,* 2021). The development of user-friendly technologies is the main goal of agricultural research (Thomas and Kumar, 2015). Thus, sustainable production is an important aspect inagricultural innovation (Lencsés *et al.,* 2014). There are certain factors that influence the adoption of technology. According to Loevinshon *et al.* (2013) the decision of farmers to adopt or reject a technology is influenced by the dynamic interaction between the traits of that technology and their situations. Thus, identifying the factors that influence the decision to adopt a technology is very critical especially for those who create and disseminate such technologies (Mwangi and Kariuki, 2015). Farmers accept technology that has certain traits which are perceived to be important by them. This highlights the significance of need-based technical development. Many studies have brought to light the importance of target-based approaches for the rapid diffusion and adoption of the available technologies. In India, the public sector research system is mainly accountable for the development and the distribution of improved technologies. While developing technology, there is a need to develop a network of scientists as well as farmers, in order to understand the preferences and needs of end users (Joshi and Varshney, 2022). This will help to increase the rate of adoption of those technologies. Nowadays, the IFS concept is getting more acceptance among the people in Kerala, however in the recent times not many studies have been conducted to evaluate the technological need of the existing IFS units and the perception of farmers towards various technological dimensions. So there is paucity of data in this regard and it is required to conduct a detailed study on above mentioned areas that can drive Kerala's agricultural sector on the path of high growth in future. Keeping this in view, an attempt was made to find out the important technological dimensions perceived as important by the IFS farmers as well the officials related to IFS.

MATERIALS AND METHODS

The study was conducted in Kollam, Thrissur and Kannur districts of Kerala. The respondents group consisted of both IFS farmers and officials associated with IFS in the selected districts. 180 IFS units were selected randomly (60 from each district) and sixty officials (20 officials from each district), which include Agriculture Officers, Veterinary surgeons of the selected panchayats, block level and district level officials from ATMA and KVK of the respective blocks and districts, were selected purposively as the respondents for the study, thus making the total sample size 240 respondents.

Various dimensions that seemed to be connected with IFS were enlisted by following review of literatures and discussions with experts. The selected dimensions were examined by all the IFS farmers as well as the selected experts in this field, such as agricultural officers, veterinary surgeon and officials from ATMA and KVK. They were requested to closely analyze these dimensions and, if necessary, add new dimensions or modify existing ones. The judges were asked to rate the relevance of each dimension on a 3-point scale ranging from most relevant to least relevant, with weightages ranging from "3"' to "1". Responses were gathered from all IFS farmers as well as 60 officials, thus a total of two hundred and forty responses were collected. The total score of each dimension and mean total were computed for both farmer and official respondents. The dimensions that exceeded the mean total were considered as important for each category. Ranking method had been used to evaluate the relevance of each dimension separately for all respondents. Besides that, the relevance of selected dimensions were analyzed district wise on the basis of mean and ranking method.

RESULTS AND DISCUSSION

At the field level, different characteristics of technology can significantly influence its rate of adoption. Six dimensions were taken into account. It had been rated based on the evaluation by IFS farmers and officials associated with IFS in the study area.

Techno- Socio-economic Dimensions perceived as important by the IFS farmers and officials of Kollam district

Twenty officials and sixty IFS farmers were selected from Kollam district and their perceptions under various dimensions were recorded separately. The findings revealed that the relevancy pattern varied for both farmers and experts. Some characteristics viewed as relevant by the IFS farmers were not a priority for experts and vice versa. The figures in Table 1 indicated that a total of 14 dimensions were felt to be important by both categories of respondents. Those dimensions were E1 - E2 - E5 from the economic dimension, T1 - T2 - T6 -T9 -T10 of technological dimension, En2 -En 3 of Environmental dimension, S1 from socio cultural dimension, P1 - P3 of psychological dimension and H3 from human resource dimension.

Under the economic dimension, the dimensions that were felt important by both the categories were regularity of returns (E5), income generation potential (E2) and initial cost (E1). Economic dimensions were essential for farmers since they affected the profitability of their units. Farmers may have viewed commercialization (E4) as a significant dimension since they included many components in their units for profit. IFS farmers perceived income generation potential more than initial cost due to the fact that, without continuous income generation, the specialization will be vague and of no use.

Under the technical dimension, the dimensions that were considered as important by both categories include physical compatibility (T1), efficiency (T2), flexibility (T6), availability of supplies (T9) and time saving (T10). Meanwhile, the factors considered essential by farmers but not by officials include complexity (T4). Which implied that they were interested in more user-friendly technologies. Similarly, for officials, desirability (T8) was found to be significant. Desirability and availability of supplies were found to be vital because, unless there is resource availability, one cannot continue farm activities. Sustainability (En3) and local resource utilization (En2) were ranked as important under the environmental dimension by both categories. Sustainability, which has become a policy-maker's buzzword, is not a new concept in agriculture. So, it was unequivocally favoured by both categories of respondents.

Table 1: Techno- Socio- Economic dimensions perceived as important in Kollam district

Dimensions	IFS Farmers (n= 60)				Officials (n=20)			
	Total Score	Mean total score	Rank over class	Over all rank	Total Score	Mean total Score	Rank over class	Over all rank
Economic Dimension								
Initial cost (E1)	150	2.50	II	V	49	2.45	III	V
Income generation potential (E2)	161	2.68	I	I	53	2.65	II	III
Employment generation potential (E3)	90	1.50	VI	XVII	45	2.25	IV	VIII
Commercialization (E4)	135	2.25	IV	VIII	44	2.20	V	IX
Regularity of returns (E5)	140	2.33	III	VII	55	2.75	I	I
Rapidity of returns (E6)	120	2.00	V	XIV	40	2.00	VI	XIII
Mean Total	132.67	2.21			47.67	2.38		
Technical Dimension								
Physical compatibility (T1)	129	2.15	VI	XI	45	2.25	V	VIII
Efficiency (T2)	153	2.55	II	III	54	2.70	I	II
Trialability (T3)	90	1.50	VII	XVII	39	1.95	VIII	XIV
Complexity (T4)	130	2.17	V	X	42	2.10	VII	XI
Predictability (T5)	72	1.20	X	XXII	33	1.65	IX	XIX
Flexibility (T6)	140	2.33	IV	VII	49	2.45	III	V
Viability (T7)	81	1.35	VIII	XIX	43	2.15	VI	X

Desirability (T8)	79	1.32	IX	XX	45	2.25	V	VIII
Availability of supplies (T9)	143	2.38	III	VI	47	2.35	IV	VI
Time saving (T10)	160	2.67	I	II	50	2.50	II	IV
Mean Total	117.7	1.96			44.7	2.24		
Environment Dimensions								
Energy saving potential (En1)	75	1.25	III	XXI	35	1.75	III	XVII
Local resource utilization/recycling capacity (En2)	151	2.52	I	IV	42	2.10	II	XI
Sustainability (En3)	132	2.20	II	IX	46	2.30	I	VII
Mean Total	119.33	1.99			41.00	2.05		
Socio-Cultural Dimensions								
Social acceptability (S1)	121	2.02	I	XIII	38	1.90	I	XV
Social approval (S2)	66	1.10	II	XXIV	20	1.00	III	XXIII
Cultural compatibility (S3)	65	1.08	III	XXV	21	1.05	II	XXII
Mean Total	84.00	1.40			26.33	1.31		
Psychological Dimensions								
Attitude (P1)	115	1.92	II	XV	34	1.70	II	XVIII
Perceived social status (P2)	70	1.17	III	XXIII	30	1.50	III	XX
Level of satisfaction (P3)	125	2.08	I	XII	37	1.85	I	XVI
Mean Total	103.33	1.72			33.67	1.68		
Human Resource Dimensions								
Family labour (H1)	86	1.43	IV	XVIII	28	1.40	IV	XXI
Hired labour (H2)	140	2.33	I	VII	35	1.75	III	XVII
Skilled labour requirement (H3)	129	2.15	II	XI	43	2.15	I	X
Physical labour requirement (H4)	100	1.67	III	XVI	41	2.05	II	XII
Mean Total	113.75	1.90			36.75	1.84		

The appropriate use of available local resources may boost profit and also aid in product diversification. Under the socio-cultural aspect, both groups found social acceptability (S1) as the most relevant. Generally, any components that are introduced symbolically should fit within the sociocultural framework of the society for its better adoption. Attitude (P1) and level of satisfaction (P3) were two psychological dimensions that were significant to both groups of respondents. Attitude and level of satisfaction are the two key factors that influence the adoption of a technology. A positive attitude combined with a high satisfaction level can enhance the adoption.

Skilled labour requirement (H3) was found to be the most relevant human resource dimension for officials as well as farmers. In an IFS unit several components are there, so requires additional skilled labour to deal with the complex technology. Hired labour (H2) was perceived as important by IFS farmers whereas for officials it was physical labour requirement (H4). Labour shortage was a serious constraint expressed by the farmers in Kerala. In that context, these dimensions seemed to be very important. The results highlighted that before technology application, farmers consider different aspects of that technology. Generally, we can conclude that IFS farmers in the Kollam district prefer socially acceptable technologies which assured optimum utilization of local resources in a sustainable way and had minimum skilled labour requirement. They also insisted that the technology should provide a high level of satisfaction and a stable income to their units. Similar findings were reported by Mulyono *et al.* (2021), who found that on the basis of various technological traits, farmer's perceptions towards SITT technologies were financially profitable, compatible with societal values and demands, observability and ease of understanding and usage.

Techno- Socio-economic dimensions perceived as important by the IFS farmers and officials of Thrissur district

The preferences for various dimensions by the IFS farmers and officials of Thrissur district were collected and evaluated separately (Table 2). According to the findings, there existed some differences in preferences between farmers and experts. It is worth noting that, out of the selected dimensions, a total of 13 characteristics were found to be relevant based on the perceptions of both categories of respondents. The selected dimensions were E1 and E2 from economic dimension; T2-T4-T6-T9-T10 under technical; En2 and En3 from environmental; S1 under socio cultural; P1 and P3 from psychological and finally H3 from human resource dimension.

Under economic dimension, the dimensions that were felt important by the IFS farmers and officials were initial cost (E1) and income generation potential (E2). Some difference in preferences can also be noted in case of economic dimension, as in addition to the common dimensions selected farmers preferred regularity of returns and officials preferred commercialization. According to the officials, commercialization capacity was an important factor to be considered while designing a technology. Since IFS contains many components, the officials realized the potential for commercialization of various farm output, allowing farmers to increase their profits. So, despite certain differences between farmers and officials, both backed the initial cost and income generation potential of a technology, which cannot be overlooked as considering the significance of profit-oriented functions in IFS. They

Table 2: Techno- Socio-economic dimensions perceived as important in Thrissur district

Dimensions	IFS Farmers (n= 60)				Officials (n=20)			
	Total Score	Mean total score	Rank over class	Overall rank	Total Score	Mean total score	Rank over class	Overall rank
Economic Dimension								
Initial cost (E1)	143	2.38	III	VI	51	2.55	II	III
Income generation potential (E2)	161	2.68	I	I	54	2.70	I	I
Employment generation potential (E3)	85	1.42	VI	XX	44	2.20	VI	IX
Commercialization (E4)	110	1.83	IV	XV	50	2.50	III	IV
Regularity of returns (E5)	147	2.45	II	V	46	2.30	IV	VII
Rapidity of returns (E6)	105	1.75	V	XVI	45	2.25	V	VIII
Mean Total	125.16	2.08			48.33	2.42		
Technical Dimension								
Physical compatibility (T1)	127	2.12	VI	X	41	2.05	VI	XI
Efficiency (T2)	140	2.33	III	VII	50	2.50	II	IV
Trialability (T3)	96	1.60	VII	XVII	36	1.80	IX	XV
Complexity (T4)	128	2.13	V	IX	44	2.20	V	IX
Predictability (T5)	75	1.25	X	XXIV	35	1.75	X	XVI
Flexibility (T6)	148	2.47	II	IV	47	2.35	IV	VI
Viability (T7)	82	1.37	VIII	XXII	40	2.00	VII	XII
Desirability (T8)	81	1.35	IX	XXIII	38	1.90	VIII	XIV
Availability of supplies (T9)	160	2.67	I	II	48	2.40	III	V
Time saving (T10)	135	2.25	IV	VIII	53	2.65	I	II
Mean Total	117.20	1.95			43.2	2.16		
Environment Dimensions								
Energy saving potential (En1)	64	1.07	III	XXVII	39	1.95	III	XIII
Local resource utilization/recycling capacity (En2)	156	2.60	I	III	45	2.25	I	VIII

Sustainability (En3)	128	2.13	II	IX	42	2.10	II	X
Mean Total	116.00	1.93			42.00	2.10		
Socio-Cultural Dimensions								
Social acceptability (S1)	117	1.95	I	XIII	42	2.10	I	X
Social approval (S2)	69	1.15	III	XXVI	29	1.45	II	XX
Cultural compatibility (S3)	71	1.18	II	XXV	28	1.40	III	XXI
Mean Total	85.67	1.43			33.00	1.65		
Psychological Dimensions								
Attitude (P1)	120	2.00	I	XII	35	1.75	II	XVI
Perceived social status (P2)	84	1.40	III	XXI	31	1.55	III	XVIII
Level of satisfaction (P3)	112	1.87	II	XIV	38	1.90	I	XIV
Mean Total	105.33	1.76			34.67	1.73		
Human Resource Dimensions								
Family labour (H1)	90	1.50	IV	XIX	30	1.50	IV	XIX
Hired labour (H2)	95	1.58	III	XVIII	47	2.35	I	VI
Skilled labour requirement (H3)	125	2.08	II	XI	45	2.25	II	VIII
Physical labour requirement (H4)	135	2.25	I	VIII	34	1.70	III	XVII
Mean Total	111	1.85			39	1.95		

will adopt those technologies only when it is economically feasible to them and could generate more income.

In case of technical dimension, efficiency (T2), complexity (T4), flexibility (T6), availability of supplies (T9) and time saving (T10) were found to be the most preferred dimensions by both categories. Meanwhile, physical compatibility was found to be important to farmers but not for officials. Farmers and officials in the Thrissur district put less attention on characteristics such as trialability, desirability, predictability and viability. The results also revealed that in Kollam district, complexity was not an important dimension but in Thrissur district, under technical dimensions both farmers and officials equally preferred complexity of a technology. In terms of technical advancement and climate-related challenges, the agriculture sector is changing dramatically. In this changing scenario, the sustainability of available technologies has been called into doubt. As a result, farmers and the authorities recognized the need for more flexible technologies that could be used in a sustainable manner.

With respect to environmental aspect, both farmers and officials supported local resource utilization (En2) and sustainability (En3). IFS farmers preferred to limit dependency on outside sources by making the best use of existing resources within the same unit, such as waste recycling. As a result, the technologies implemented in IFS units must promote local resource utilization, otherwise profitability may be affected. Irrespective of the system, sustainability was essential in ecological and production perspective. It was noteworthy that both farmers and officials are aware of this and they took these factors into account when dealing with technology adoption.

In case of socio-cultural dimension, both considered social acceptability (S1) as an important aspect rather than social approval and cultural compatibility. They opined that social status and adoption were not parallel. From the result it was clear that, social acceptance was a process rather than an end product. A new technology might be economically and environmentally viable, yet it might not be adopted if it is socially unacceptable. Whereas in case of psychological factors preference was given to both attitude (P1) and satisfaction level (P3). Now farmers were more practical in adopting various components and technologies in their unit. They were not interested in adopting something new just to increase their social status, rather a positive attitude towards the technology and high level of satisfaction can boost adoption rates. With respect to human resource dimension, both preferred skilled labour requirement (H3). At the same time officials also considered hired labour requirement as important while for farmers concern was reported for physical labour requirement.

From the study conducted in Thrissur district, it was evident that for better adoption, the technology should have high income generation potential along with easy accessibility. It also should have high recycling capacity and flexibility and can be used in a sustainable manner. In the study area more acceptance will be given to less complex, highly efficient, flexible technologies with high accessibility and less time requirement. They preferred more technologies that help in risk management and increase profits at the same time it must be socially acceptable. Since, labour shortage is a serious concern for both farmers and officials, they also considered the skilled labour requirement of a technology before adopting it. The results were on par with those of Krishnan (2013), who conducted a study in three districts of central Kerala. According to the findings, initial and continuing cost, income generation capacity, requirement of skilled labour and local resource utilization were the top ranked dimensions by homestead growers and scientists in the study area.

Techno- Socio-economic Dimensions perceived as important by the IFS farmers and officials of Kannur district

Table 3 indicated that in Kannur district, out of the selected dimensions a total of 14 characteristics were found to be relevant based on the perceptions of both categories

Table 3: Techno- Socio-economic dimensions perceived as important in Kannur district

Dimensions	IFS Farmers (n= 60)				Officials (n=20)			
	Total score	Mean total score	Rank over class	Over all rank	Total score	Mean total score	Rank over class	Over all rank
Economic Dimension								
Initial cost (E1)	152	2.53	II	III	54	2.7	I	I
Income generation potential (E2)	146	2.43	III	V	53	2.65	II	II
Employment generation potential(E3)	100	1.67	VI	XIX	46	2.30	V	VIII
Commercialization (E4)	109	1.82	IV	XVI	49	2.45	IV	VI
Regularity of returns (E5)	163	2.72	I	I	50	2.50	III	V
Rapidity of returns (E6)	106	1.77	V	XVIII	39	1.95	VI	XIII
Mean Total	129.33	2.16			48.5	2.42		
Technical Dimension								
Physical compatibility (T1)	118	1.97	VI	XIV	40	2.00	VII	XII
Efficiency (T2)	156	2.60	I	II	52	2.60	I	III
Trialability (T3)	90	1.50	VII	XX	34	1.70	VIII	XVI
Complexity (T4)	126	2.10	V	XI	49	2.45	IV	VI
Predictability (T5)	80	1.33	X	XXIV	28	1.40	X	XX
Flexibility (T6)	145	2.42	III	VI	46	2.30	V	VIII
Viability (T7)	88	1.47	VIII	XXI	33	1.65	IX	XVII
Desirability (T8)	84	1.40	IX	XXII	41	2.05	VI	XI
Availability of supplies (T9)	140	2.33	IV	VIII	50	2.50	III	V
Time saving (T10)	150	2.50	II	IV	51	2.55	II	IV
Mean Total	117.7	1.96			42.4	2.12		
Environment Dimensions								
Energy saving potential (En1)	72	1.20	III	XXVI	37	1.85	III	XIV
Local resource utilization/recycling capacity (En2)	144	2.40	I	VII	43	2.15	II	X
Sustainability (En3)	120	2.00	II	XIII	48	2.40	I	VII
Mean Total	112.00	1.87			42.67	2.13		

Socio-Cultural Dimensions								
Social acceptability (S1)	113	1.88	I	XV	32	1.60	I	XVIII
Social approval (S2)	70	1.17	II	XXVII	25	1.25	III	XXI
Cultural compatibility (S3)	68	1.13	III	XXVIII	30	1.50	II	XIX
Mean Total	83.67	1.39			29.00	1.45		
Psychological Dimensions								
Attitude (P1)	107	1.78	II	XVII	39	1.95	I	XIII
Perceived social status (P2)	77	1.28	III	XXV	33	1.65	II	XVII
Level of satisfaction (P3)	130	2.17	I	X	30	1.50	III	XIX
Mean Total	104.67	1.74			34.00	1.70		
Human Resource Dimensions								
Family labour (H1)	83	1.38	IV	XXIII	33	1.65	IV	XVII
Hired labour (H2)	130	2.17	II	X	40	2.00	II	XII
Skilled labour requirement (H3)	122	2.03	III	XII	35	1.75	III	XV
Physical labour requirement (H4)	138	2.30	I	IX	44	2.20	I	IX
Mean Total	118.25	1.97			38	1.90		

of respondents. The selected dimensions were E1- E2-E5 from economic dimension; T2-T4-T6-T9-T10 under technical; En2 and En3 from environmental; S1 under socio cultural, P1 from psychological and finally H2 and H4 under human resource dimension.

When farmers learn about a new technology, those who rely solely on agriculture are deeply concerned about the economic dimension of the same. Similar to Kollam district, the economic dimensions felt important by both the categories in Kannur district were regularity of returns (E5), income generation potential (E2) and initial cost (E1). In addition to these three dimensions, the officials had seen the commercialization capacity of the technology also as an important aspect to be taken in to consideration. In terms of technical dimension, both categories preferred efficiency (T2), complexity (T4), flexibility (T6), availability of supplies (T9) and time saving (T10). Similarly, for farmers, physical compatibility (T1) of the technology was also found to be significant. Similar to other districts, officials and farmers in Kannur district also prioritized local resource use and sustainability as far as the environment dimension is concerned. These two elements could not be avoided when picking a technology for IFS units, since IFS models rely on the linkage between various resources available in a unit.

Regarding socio cultural dimension, both considered social acceptability (S1) as an important aspect rather than social approval but officials had opined that cultural compatibility of a technology can also determine its adoption. With respect to psychological factors, common preference was identified for attitude (P1) towards the technology. For farmers their level of satisfaction also seemed to be important. Both groups focused on hired (H2) and physical labour requirements (H4) while evaluating the human resource dimension. Besides these two aspects, farmers were also concerned about the skilled labour requirement. Since labour shortage and lack of skilled labours were very serious issue in Kerala, it was quite natural that they were more concerned about the hired labour than family labour.

By analysing the results of three districts, it was found that generally both IFS farmers and officials associated with IFS in Kerala preferred socially accepted low-cost technologies with high income generation capacity, efficiency, flexibility, easy accessibility, time saving capacity and permitting sustainable as well as maximum utilization of local resources with minimum labour requirements. If such technology is introduced in Kerala, it helps to develop a favourable attitude towards that technology and the rate of adoption will be more.These findings concurred with those from Thomas (2004) who found that, initial and continuous cost of a technology, its income generation capacity and regularity of returns were the most important economic dimensions and other important traits identified were profitability, observability, simplicity and local resource utilization capacity of the

Table 4: Distribution based on mean average scores of all dimensions

Dimensions	Kollam	Thrissur	Kannur	Total	Rank
Economic	2.29	2.25	2.29	2.28	I
Technical	2.10	2.06	2.04	2.07	II
Environmental	2.02	2.01	2.00	2.01	III
Human Resource	1.87	1.90	1.94	1.90	IV
Psychological	1.70	1.75	1.72	1.72	V
Socio Cultural	1.36	1.54	1.42	1.44	VI

technology. Additionally, it also agreed with the findings of Basheer (2016) who found that majority of the bitter gourd growers in Thiruvananthapuram district of Kerala were preferring low cost, sustainable and effective technologies in their field.

Distribution based on mean average scores of all dimensions

Previous section dealt with different aspects perceived as important by both farmers and officials. For the study, six major dimensions of technologies were considered, such as economic, technical, environmental, socio-cultural, psychological and human resource dimension. Furthermore, in order to acquire a full grasp of the subject, an attempt was made to determine the most important dimension among the selected dimensions. The details are given in table 4.

District wise distribution of dimensions of technology based on mean average scores in the decreasing ranking order were as follows- economical dimensions (2.28) followed by technical dimension (2.07), environmental dimension (2.01), human resource dimension (1.90), psychological dimension (1.72) and socio-cultural dimension (1.44).

From the table (4), it can be therefore inferred that economic dimension has the highest importance. As the specialisations require more complex technologies that are remunerative, economic dimensions needs to be given importance. However, technical dimension also gains importance among farmers because of the adoption of different specialisations. Furthermore, it can be found that IFS farmers were more concerned about environmental aspects than human resource dimension. The findings were in line with those of Sreelakshmi (2018), who found that among various technological dimensions, homestead growers of Thiruvananthapuram district preferred economical dimension as the most important one followed by technical and human resource dimension.

CONCLUSION

At the time of field level application, a technology will pass through different types of evaluations. The final decision to adopt the technology may be affected by its characteristics. So, it is very important to ensure that the technology can fulfil the needs of farmers. In general, IFS farmers of Kerala prefer socially accepted low-cost technologies with high income generation capacity. It should be efficient, flexible and time saving along with high availability of supplies and minimum requirement of skilled labour. By the effective utilization of local resources, technology should permit sustainable production in the units. Since farmers gave more emphasis to the economic aspect of a technology, while developing technology more attention should be given to that area. Scientists should consider farmers' perception towards various technologies for developing more farmer friendly technologies which will ultimately increase the acceptance of that technology among the farming community.

ACKNOWLEDGEMENTS

The authors would like to thank the respondents from Kerala for providing the relevant information for the study and the Dairy Extension Division, ICAR-National Dairy Research Institute (Karnal), for providing facilities for carrying out this research.

REFERENCES

Basheer, N. 2016. Technology utilisation of bittergourd in Thiruvananthapuram district. M.Sc. (Agri.) Thesis, Kerala Agricultural University, Thrissur, pp. 204.

Challa, M. and Tilahun, U. 2014. Determinants and impacts of modern agricultural technology adoption in West Wollega: The Case of Gulliso District. *J. Biol. Agric. Health.,* **4**(20): 63-77.

Chandana, T.S., Praveena, P.L.R.J., Lakshmi, T., Subramanyam, D. and Reddy, B.R. 2023 Sustainable livelihood security of integrated farming systems practicing farmers through different enterprise combinations in Andhra Pradesh. *Indian J. Ext. Educ.*, **59**(1): 101-106.

Joshi, P.K. and Varshney, D. 2022. Agricultural Technologies in India: A Review. NABARD Research and Policy Series No. 5, Department of Economic Analysis and Research, NABARD, pp. 92.

Korikanthimath, V.S. and Manjunath, B.L. 2009. Integrated farming systems for sustainability in agricultural production. *Indian J. Agron.*, **54**(2): 140-148.

Krishnan, R. 2013. Techno socio-economic characterization of specialized home gardens: A dominance-diversity approach. M.Sc. (Agri.) Thesis, Kerala Agricultural University, Thrissur, pp. 155.

Lencsés, E., Takács, I. and Takács-György, K. 2014. Farmers' perception of precision farming technology among Hungarian Farmers. *Sustainability*, **6**(12): 8452-8465.

Loevinsohn, M., Sumberg, J., Diagne, A. and Whitfield, S. 2013. Under What Circumstances and Conditions Does Adoption of Technology Result in Increased Agricultural Productivity? A Systematic Review. Department for International Development, pp. 39.

Mulyono, J., Suryana, A.T. and Suryana, E.A. 2021. Perception and innovativeness level of farmers on the integration system of rice and cattle farming. IOP Conf. Series: *Earth Environ. Sci.*, **892**(1): 120-126.

Mwangi, M. and Kariuki, S. 2015. Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *J. Econ. Sustain. Dev.,* **6**(5): 208-216.

Nair, M.G., Jayalekshmi, G. and Kumar, N.K. 2019. Utility of integrated farming systems: A perception study from Kuttanad. *Agric. Sci. Digest*, **39**(4): 332-334.

Raju, V.T. 1982. *Impact of New Agricultural Technology on Farm Income Distribution and Employment*. National Publishing House, New Delhi, pp. 260.

Ruzzante, S., Labarta, R. and Bilton, A. 2021. Adoption of agricultural technology in the developing world: A meta-analysis of the empirical literature. *World Dev.,* **146**: 1-16.

Sreelakshmi, C. 2018. Technology needs and risks assessment of specialized home gardens. M.Sc. (Agri.) Thesis, Kerala Agricultural University, Thrissur, pp. 136.

Thomas, A. 2004. Technology assessment in home garden systems. Ph. D Thesis, Kerala Agricultural University, Thrissur, pp. 266.

Thomas, A. and Kumar, N.K. 2015. Technology needs assessment in the homegarden systems. *J. Ext. Educ.*, **27**(4): 5556 -5563.