

CONSTRAINTS FACED IN USING MODERN ICT TOOLS: A STUDY OF DAIRY COOPERATIVE SOCIETIES IN UTTARAKHAND

Pratibha Singh*
D. Bardhan** and S.C.Tripathi*

ABSTRACT

The study sought to identify the constraints faced by the farmers in using information communication technology (ICT) in plain and hill areas of Nainital district of Uttarakhand. A total of 80 households were selected for the study, of whom, 44 and 36 households were members and non-members of Dairy Cooperative Societies (DCS), respectively. Factor analysis was used to identify the broader category of constraints that lie inherent in the set of 15 specific constraints that were presented before the respondents for their rankings on a three-point continuum. The results of the analysis revealed four major categories of constraints in the plains viz. respondents' capacity, accessibility to ICT services, mobile use and network coverage problems. The same categories of constraints were also identified in the hills in addition to another broad constraint category, viz. lack of training in hills. Likelihood of constraints faced in use of ICT decreased with increase in education level of respondents in plains. However, non-farm income showed negative influence on constraints faced indicating that greater dependence on farm income resulted in higher intensity of constraints faced by the households in using ICT tools. In hills, probability of constraints in operating ICT tools increased with decrease in contact with extension workers. The constraints faced by member and non-member households of DCS – as identified in this study - must be addressed adequately to enhance the efficacy of DCS in information dissemination through modern ICT tools.

Introduction

In India, dairying at micro level provides regular work, steady income and keep the rural population employed throughout the year. However, to meet the emerging demand for livestock based products, both in domestic and global

markets, information has been envisaged as a vital input in ensuring profitable and sustainable livestock farming. Information and Communication Technology (ICT) is one of the most effective means of information dissemination. Despite tremendous growth in telecommunication network, rural India is

* Department of Veterinary and AH Extension Education, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand.

** Division of Livestock Economics, Statistics and IT, Indian Veterinary Research Institute, Izatnagar-243 122, Bareilly (UP).

yet to witness a robust and seamless voice and data connectivity. ICT can play an important role in linking knowledge seekers to knowledge sources. However, in spite of the significant potential of modern ICT tools in bridging the information gap, there exist several constraints in their effective utilisation by the farming community. It thus becomes necessary to document such bottlenecks in ICT penetration so as to facilitate effective policy formulation towards maximum possible uptake of ICT technologies by the farming community. Several studies have been carried out earlier which have ascertained the various constraints faced by farmers in ICT utilisation. According to Girard (2003), absence of any public-access facilities for ICTs in rural areas is a huge barrier to use by small-scale farmers in rural areas. Dhaka and Chayal (2010) in a study in Bundi district of Rajasthan reported illiteracy, non-availability of relevant and localised contents in their languages, affordability, poor accessibility & awareness and un-willingness for adoption of new technologies as the major problems in adopting ICT by farmers. Patil et al. (2008) reported no perceived economic benefits, too hard to use/unfriendly, lack of technological infrastructure, cost of technology, fear of technology, not enough time to spend on using ICT, lack of awareness, lack of training, personal impediments (Illiteracy), lack of integration with other farm/other systems and lack of suitable ICT programmes as the major factors limiting use of ICT tools by farmers. Similar kinds of constraints were also reported by Mishra (2010). Ramaraju et al. (2011) reported that the major problems faced by farmers in adoption of ICT were lack of simplicity and acceptability of technology and no relevant

and in-time delivery of practical solutions - area/location wise - for all agricultural operations (ranging from the choice of inputs in the farming system up to the marketing of farm products).

However, focus on many individual constraints may throw up voluminous information in regard to problems and challenges in adoption and utilisation of ICT but might not lend itself to a meaningful analysis which will aid policy formulations. It becomes important that the underlying broader category of constraints be identified so that the real message pertaining to bottlenecks in ICT penetration can be delivered to the policymakers. This can be done by grouping the several related constraints into smaller groups of meaningful categories which can have identities of their own. Further, scant research attention has been given in ascertaining the major constraints faced by dairy farmers in utilising internet-based ICT tools in the State of Uttarakhand. The present study is an attempt to bridge this research gap. The specific objective of the study was to get an outline and information on ICT adoption and identify the broad constraints that act as bottlenecks in their use.

Materials and Methods

Sampling: The study was carried out in Uttarakhand State of India. Livestock activity specially, dairy husbandry, forms an important source of livelihood for almost all the households in the State, with each household possessing 1-2 milch animals. Over 80 per cent of all livestock species are owned by small holders (landless agricultural labourers, marginal and small farmers). Livestock is thus considered to have good

prospect to enhance the level of living of the poorest of the poor in the State.

Multi-stage stratified random sampling technique was adopted in selecting milk producing households in the study area. Uttarakhand has two administrative divisions, viz. Kumaon and Garhwal. Kumaon division was selected for the study due to higher livestock density (Bardhan et al, 2010). Nainital district was then selected from Kumaon division purposively as the district which is rich in livestock resources and accounts for about 8.81 and 10.04 per cent of the State's cattle and buffalo population, respectively (Uttarakhandstat.com, 2013). The district of Nainital is also unique in the sense that it comprises a range of different agro-climatic regions, viz. Tarai and Bhabar areas which are located in the plains and the hilly region which consist of both mid-hills and high hills. Keeping this in view, this study aimed to compare the constraints faced by member and non-member households of Dairy Cooperative Societies (DCS) in utilising modern Internet-based ICT tools in the plains (Bhabar) vis-à-vis the hills of the district. Out of total eight blocks in the district, Haldwani located in the plains (Bhabar) and Bhimtal located in the hills were selected. Both the blocks have extensive coverage of the dairy cooperative network and because of the good performance of the cooperative system in both these blocks, many dairy societies in the study area are already equipped with computer facilities. Two DCS were selected from each block, one within a distance of 15-20 km from market (peri-urban) and another beyond 15-20 km from nearest market (rural) in each of the two blocks. Thus, a total of four DCS were selected for the study. A complete enumeration of all the households, having at

least one milch animal was carried out in the area covered by each DCS for the purpose of developing a sampling frame. The households which were members of DCS were then identified. In the next stage, 20 households were selected from each DCS having representation from the member and non-member categories, on proportionate basis. The total sample size thus comprised 80 households, out of which, 44 belonged to member category and the remaining 36 to the non-member category. The data for the present study were collected through personal interview of the heads of sample households. The study pertains to data collected from the survey carried out during June-December, 2012.

Descriptive Statistics: Descriptive and tabular analyses were carried out to derive meaningful inferences about socio-economic profile of members and non-members and institutional support structure from the collected data.

Identification and Ranking of Constraints Faced by Respondents: The constraints faced by the members and non-members of DCS, refer to all those conditions and restrictions concerned with infrastructural, educational and accessibility aspects that singly or in conjugation with each other hinder or constrain the use of ICT tools by farmers. A list of constraints in the form of statements was developed. These constraints faced by the milk producers were analysed according to severity of constraints based on the mean value of weights used in Likert-type scale measured on a three-point continuum (Very serious=2; Serious=1; Not serious=0). The total score for each constraint was calculated on the basis of responses received from member and non-member respondents, respectively.

Factor analysis using principal component analysis and varimax rotation was used to identify the broader category of constraints that may lie inherent in the set of 15 specific constraints that were explained to the respondents for their rankings on a three-point continuum. The factor analysis resulted in emergence of four significant factors (or broader category of constraints) with eigen values greater than 1.

Explaining the Intensity of Constraints Faced by Respondents in Using Modern ICT Tools :

Respondents in both the plains and the hills were categorised into two groups, viz. Group I (characterised by high intensity of constraints faced in using ICT tools) and Group II (characterised by low intensity of constraints faced in using ICT tools). Four factors had emerged in the principal component analysis having eigen values greater than 1. The factor scores of each respondent for each of these four factors were weighed by their respective contribution to total variance and then aggregated across all the respondents. The median aggregate score for all the respondents were then obtained for both the data sets, i.e. the plains and the hills. The entire sample was then categorised into

respective groups, viz. Group I, i.e. high intensity of constraint perception (having score above the median) and Group II, i.e. low intensity constraint perception (having score below the median).

Binary regression model, viz. Logit model was then fitted in an attempt to explain the factors that are associated with the farmers' likelihood of belonging to high and low intensity of constraints perception groups, respectively. The dependent variable took a value of 1 if the respondent belonged to high intensity constraint perception group and 0 if the respondents belonged to low intensity constraint perception group.

The Logit model used was of the form:

$$\text{Ln} \frac{P_i}{1 - P_i} = Z_i \alpha + \sum \beta_i X_i + e_i$$

Where X_i is the vector of independent variables and β_i 's are the coefficients to be estimated. The left hand side of the equation represents the log of odds of belonging to high intensity constraints perception group. The odds are expressed as single number to the ratio to 1. Table 1 gives the explanatory variables included in the model.

Table 1: Explanatory Variables Included in Logit Analyses

S.No.	Variable	Description	Nature
1	Cooperative Membership	Dummy for cooperative membership (whether ith household is a member of dairy cooperative: Yes=1; No=0)	Categorical
2	HH Head Education	Education level of household head (0-Illiterate, 1-Read & write, 2-Primary, 3-Middle, 4-High school, 5-Intermediate, 6-Graduation & above)	Categorical
3	Family Type	Family Type of ith household (joint=1, nuclear=0)	Categorical
4	Landholding	Land owned by ith household (acres)	Categorical

(Contd...)

Table 1 (Contd...)

S.No.	Variable	Description	Nature
5	Herd Size	Herd Size of ith household (measured as standard animal units)	Categorical
6	Extension Worker	Dummy for Extension Worker (whether ith household has a contact with extension worker: Y=1,N=0)	Categorical
7	Market Distance	Distance to Market (kms) Continuous	Categorical
8	Age	Age of member of ith household (years)	Categorical
9	NFI	Dummy for non-farm income (whether ith household has a non-farm income source: Yes=1; No=0)	Categorical
10	Credit Access	Dummy for access to credit (whether ith household has access to credit: Y=1,N=0)	Categorical

RESULTS AND DISCUSSION

Socio-economic Profile of Respondent Households

Table 2 (2.1-2.3) describes the socio-economic profile of member and non-member respondents of both the plains and the hills.

Age: Average age of member household heads in the plains was 49 years which was significantly higher than that (39 years) of member household heads in the hills (Table 2.1). However in case of non-member category, the average age of household head (38 years) in the plains was non-significantly

different from that (39 years) in the hills, respectively. This finding has got substantial support from Arora et al. (2006), who observed that majority of dairy farmers, belonged to middle age group (36-59 years). In the case of overall category, average age (44 years) of household head in the plains was significantly higher as compared to that (39 years) in case of the hill respondents.

Education: Significant difference was not observed in education level of household heads between member (4.45) and non-member (4.22) categories, in plains as well as member (2.95) and non-member (3.78) categories of hills. On an average, both

Table 2.1: Comparison of Respondent-specific Characteristics of Member and Non-member Respondents

S.No.	Particulars	PLAINS			HILLS		
		M (N=22)	NM (N=18)	Pooled (N=40)	M (N=22)	NM (N=18)	Pooled (N=40)
1.	Age	49.40±2.09	37.61±1.37	44.1a±1.60	39.45±1.83	39.11±1.62	39.3b±1.23
2.	Education*	4.45±0.36	4.22±0.26	4.35a±0.23	2.95±0.39	3.78±0.35	3.32b±0.27

(Contd...)

Table 2.1 (Contd...)

S. No.	Particulars	PLAINS			HILLS		
		M (N=22)	NM (N=18)	Pooled (N=40)	M (N=22)	NM (N=18)	Pooled (N=40)
3.	Caste(% of respondent)						
	General	63.63	61.11	62.5a	77.27	83.33	82.5b
	SC	18.18	33.33	25	18.18	16.66	15
	ST	4.54	5.55	5	4.5	0	5
	OBC	13.63	0	7.5	0	0	0
4.	Main Occupation/Trade (% of respondent)						
a.	Agri.	22.72	16.66	22.5	0a	16.66b	7.5
b.	Transport	9	11.11	10	4.5		2.5
c.	AH	13.63	0	7.5a	50b	11.11a	32.5b
d.	Labour	13.63	16.66	15	4.5	5.6	5
e.	Govt. Service	13.5	5.5	10	22.5	27.82	25
f.	Private job	4.5	5.5	5	0	0	7.5
g.	AH +other	4.5	0	2.5	0	0	0
h.	Agri.+AH	9	0	5	13.5a	0b	0
i.	Shopkeeper	4.5c	27.77d	15	4.5c	22.22d	12.5
j.	Tailor	0	5.5	2.5	0	5.6	2.5
k.	Pujari	0	5.5	2.5	0	0	0
l.	Army retired	0	0	0	0	5.6	2.5
m.	Pharmacist	0	0	0	0	5.6	2.5
n.	Carpenter	0	5.5	2.5	0	0	0

M=Member and NM=Non-member.

* Education: Illiterate-0; Read &Write-1; Primary School-2; Middle School-3; High School-4; Intermediate-5; Graduate and above-6

Figures having different superscripts across groups are significantly different up to 5% level of significance.

member and non-member household heads were educated between high school and intermediate school levels in case of the plains. Similar findings have been reported by Gour (2002), Bhatt (2006) and Durgga (2009). Whereas in case of hills, DCS member household heads were educated between primary school and middle school levels while non-member household heads were educated between middle and high school level. Education level of household heads was significantly higher in the plains as compared to the hills in case of member and

overall categories. Gebrekidan et al. (2012) from Ethiopia had also reported that literacy rate was higher in urban areas than the rural areas.

Caste: In case of member category in the hills, greater proportion (77.27 per cent) of member respondents belonged to general caste category, followed by scheduled caste (18 per cent) and scheduled tribe (4.5 per cent). Almost similar caste-wise distribution was observed in case of non-member category in the hills as 83 and 16 per cent of

non-member respondents belonged to general and scheduled caste categories, respectively. Not a single respondent was observed, among members and non-members in the hills, who belonged to OBC category. In case of members and non-members in the plains, highest proportions of respondents (64 and 61 per cent, respectively) belonged to general caste category, followed by scheduled caste category (18 and 33 per cent, respectively). While about 14 per cent of member respondents belonged to OBC category, no non-member respondent belonged to this caste category. A small proportion (4.5 per cent) of member and non-member respondents (5.5 per cent) belonged to scheduled tribe category. In case of overall category, significantly higher proportion (82.5 per cent) of respondents belonged to general caste category in the hills than that in the plains (62.5 per cent). It reflects that plains are more equally distributed as far as different caste composition is concerned. However, there is need to rehabilitate scheduled caste and scheduled tribes in hills.

Occupation Status: Agriculture was the main occupation for majority of member respondents (22 per cent) in the plains. The findings are in consonance with that of Raval and Chandawat (2011). Animal husbandry, government service and agricultural labourers were the other important sources of income for member category as almost equal proportions (about 13 per cent) of member households pursued these sources of livelihood as their main occupation. In case of non-member category, majority of respondents (17 per cent in each case) had agriculture and agricultural labour as their main occupation, while about 11 per cent of non-member respondents were engaged in transport business. Majority (50 per cent) of

member respondents in the hills pursued animal husbandry as their main occupation while the next important main source of income was government service, which was pursued by 22.5 per cent of respondents. In case of non-member category, majority (28 per cent) of respondents had government service as their main occupation, followed by shopkeeping business (22 per cent), agriculture (17 per cent) and transport business (11 per cent). Comparison of overall categories across plains and hills revealed that significantly higher proportion (32.5 per cent) of respondents in the hills had animal husbandry as their main occupation than that (7.5 per cent) in the plains. On the other hand, 22.5 per cent of respondents were pursuing agriculture as their main occupation which was significantly higher than that of hills (7.5 per cent). This may be because of less service class opportunities in hills and simultaneously animal husbandry provides regular income and draught power to agriculture.

Family Size and Type: Average family size per household ranged between 3.23 adult equivalents in the plains and 3.77 adult equivalents in the hills (Table 2.2). Average family size for members category was more than non-member category in both the hills and the plains, although the difference was not significant. Greater proportion of respondents of both member and non-member categories in the plains and hills belonged to nuclear families than joint families. Overall while 77 per cent of respondents in the plains belonged to nuclear families, 50 per cent of respondents in the hills were from nuclear families. It might be due to the fact that more number of males migrate from hills in search of jobs and hence members feel secure in joint family.

Table 2.2: Comparison of Household-specific Characteristics of Member and Non-member Respondents

S. No.	Particulars	PLAINS			HILLS		
		M (N=22)	NM (N=18)	Pooled (N=40)	M (N=22)	NM (N=18)	Pooled (N=40)
A.							
1.	Family size*	3.56	3.27	3.23	3.47	3.15	3.77
2.	Family type(% of respondents)						
a.	Joint	22.72	22.22	22.5	50	28	40
b.	Nuclear	77.27	77.77	77.5	50	73	60
3.	% of respondent HH's having at least one member with NFI**	77.27	88.88	82.5	81.81	77.77	80
4.	Annual income from dairying (₹)	25,524	43,888.89	33,650	23,682	33,833.33	28,250

M=Member and NM=Non-member.

* 4 children=3 adult women=2 adult men, M= member, NM=non-member, given: Average \pm S.E.; ** Non-farm Income.

Income: Overall, there was no significant difference in proportions of respondent households having at least one member with non-farm income between the plain and the hills (82.5 and 80 per cent, respectively). In case of the plains, the proportion of respondent households having at least one member with non-farm income was higher for non-member category (89 per cent) than member category (77 per cent). However, the opposite situation was observed in case of the hills, wherein the proportion of member households (82 per cent) having at least one member with non-farm income was higher than that of non-member households (78 per cent).

Landholdings: There were no significant differences in average size of landholding per household across the groups. Land owned

per household was higher in case of the hills (1.05 acres) than in the plains (0.70 acres), although the difference in landholding sizes across the regions was not significant (Table 2.3). The findings are in consonance with that of Gebrekidan et al. (2012). Member households in the plains owned higher landholding (0.85 acres) than their non-member counterparts (0.5 acres). On the other hand, in the hills, non-member households had higher landholding size (1.54 acres) as compared to member households (0.65 acres). Proportion of land used for dairying was higher in the hills (17 per cent) as compared to the plains (0.04 per cent) for overall category. However, significant differences were not observed in regard to this parameter across member and non-member households in both the plains and the hills.

Table 2.3: Comparison of Farm Characteristics of Member and Non-member Respondent Households

S.No.	Particulars	PLAINS			HILLS		
		M (N=22)	NM (N=18)	Pooled (N=40)	M (N=22)	NM (N=18)	Pooled (N=40)
1.	Operational land(acres)	0.85±0.21	0.52±0.97	0.7±0.16	0.65±0.14	1.54±0.93	1.05±0.14
2.	(% of operational land used for dairying)	11.76	17.30	0	9.23	2.59	0.04
3.	Herd size(SAU)*	4.11	3.98	4.21	4.09	4.06	4.85

M=Member and NM=Non-member.

* Standard Animal Unit (SAU): Milch CB cow = 1.4, Milch buffalo = 1.3 and indigenous cow = 1 (Kumbhare et al (1983)14.

Dairy Animal Holding: Differences between dairy animal holding in terms of SAU across groups were not significant. Average animal holding was 4.11 SAU and 3.98 SAU for member and non-member households in the plains, respectively. Member and non-member households in the hills owned herd sizes of 4.09 SAU and 4.06 SAU, respectively.

Institutional Arrangements

Table 3 depicts the institutional variables associated with respondent households in the study area. No significant difference was observed with respect to average distance to market among member and non-member categories in plains as well as hills. Cent per cent of member and non-member respondents in the plains reported that they had good road connectivity to the market. On the other hand, only 36 and 50 per cent of member and non-member respondents in the hills reported that they have good road connectivity. This is because

of emphasis of government for linking every village with peri-urban and urban areas and to provide greater access to market. Significantly higher proportion (83.33 per cent) of member households had contact with extension worker than non-member respondents (50 per cent) in the plains. The proportion of respondents who had extension worker contact was also more in case of member category (91 per cent) in the hills than that of non-member category (66.66 per cent). This finding has got sizeable support from George and Chauhan (2004), who observed that majority (80 per cent) of respondents, had extension worker contact. This might be due to the mandate of the dairy cooperative network to provide emergency veterinary services to the cooperative members due to which member farmers have relatively greater access and contact with animal health service providers and cooperative extension workers than their non-member counterparts.

Table 3: Institutional Arrangements

S. No.	Particulars	PLAINS		HILLS	
		M	NM	M	NM
1	Distance to market (km)	13.18	14	13.34	13.97
2	Percentage of respondents having good road connectivity to market	100	100	36.36	50
3	Percentage of respondents having extension worker contact	83.33a	50b	90.90	66.66
4	Percentage of respondents having access to credit	38.88	50	54.54	33.33
5	Percentage of respondents having credit from bank	27.27	38.88	27.27	11.11
6	Percentage of respondents having credit from other sources than bank	9.09	11.11	27.27	22.22

M=Members and NM=Non-members.

Figures having different superscripts across groups are significantly different up to 5% level of significance.

The proportion of respondents who had easy access to credit was more in case of member category (54.5 per cent) in the hills as compared to non-member category (33.33 per cent). However, the opposite situation was observed in case of plains wherein the proportion of member households having access to credit (38.88 per cent) was lower than that of non-member households (50 per cent). Percentage of non-members having access to credit from bank (39 per cent) and other sources (11 per cent) was greater than members in plains (27 and 9 per cent from the two sources, respectively). In contrast higher proportion of member respondents in the hills accessed to credit from bank and other sources (27 per cent) in each case than their non-member counterparts (11 and 22 per cent, respectively). This credit seeking behavior is because of technical support provided by the cooperatives to their members over the non-members.

Constraints Faced by Respondents in Using Modern ICT Tools

Factor analysis using principal component analysis and varimax rotation reduced the 15 specific constraints that were presented before the respondents for ranking on a three-point continuum into four factors with eigen values greater than one in case of both the plains and hills. Similar factor analysis was used by Ajani and Agwu (2012).

Table 4 presents the factor loadings of each constraint out of the total list of 15 constraints on the four identified factors in case of both the plains and the hills. In the plains, the constraints which had high factor loadings in case of Factor 1 were illiteracy, non-use of vernacular language and lack of knowledge about computers, e-mail and internet services. Thus, Factor 1 was named as 'respondents' capacity constraints in using modern ICT tools'. The findings are in

agreement with that of Patil et al. (2008) who found illiteracy as a major personal impediment for use of ICTs. The constraints which loaded highly on Factor 2 were long distance to business centres for e-mail and internet services, non-availability of business centres for internet services and lack of access to computer, e-mail and internet. Based upon these constraints, Factor 2 was named as 'accessibility to ICT services constraint'. The constraints, viz. high cost of mobile phones, high cost of recharge cards for mobile phones and too-tiny to-read screen displays loaded highly on Factor 3. Factor 3 was thus termed as 'mobile use related constraints'. Only one constraint, viz. poor network coverage for mobile phones, TV and internet services loaded highly on Factor 4 and as such Factor 4 was named as 'network coverage related constraints'. Thus, above analysis revealed four major categories of constraints faced by respondents in the plains, viz. 'respondents' capacity constraints in using modern ICT tools', 'accessibility to ICT services constraints', 'mobile use related constraints' and 'network coverage related constraints'.

In the hills, the constraints that loaded highly on Factor 1 were illiteracy, non-use of

vernacular language and lack of knowledge about computer, e-mail and internet services. Hence, as in case of plains, in the hills also Factor 1 was named as 'respondents' capacity related constraint in using modern ICT tools'. Poor network coverage for mobile phones, TV and internet services and too-tiny-to read screen displays were the constraints that loaded highly on Factor 2. Thus, Factor 2 was named as 'network and mobile use related constraints'. The findings were in conformity with those of Dhaka and Chahal (2010) who reported inadequate internet connectivity as a major constraint in using ICT by farmers. The constraints which had high loadings on Factor 3 were non-availability of business centres for internet services and no access to computer, e-mail and internet. Thus, Factor 3 was termed as 'accessibility to ICT services constraints'. Only one factor was loaded highly on Factor 4 in the hills, viz. lack of proper training. Thus, Factor 4 was named as 'constraint related to lack of training in using ICT tools'. Thus in hills, four broad categories of constraints were identified, viz. 'respondents' capacity related constraint in using modern ICT tools', 'network and mobile use related constraints', 'accessibility to ICT services constraints' and 'constraint related to lack of training in using ICT tools'.

Table 4: Loadings of Original Variables on Each Factor (Rotated Component Matrix)

S. No.	Particulars	PLAINS				HILLS			
		Factor1 (Respondents' capacity constraints in using modern ICT tools)	Factor2 (Accessibility to ICT services constraints)	Factor3 (Mobile use related constraints)	Factor4 (Network coverage related constraints)	Factor1 (Respondents' capacity related constraints in using modern ICT tools)	Factor2 (Network and mobile use related constraints)	Factor3 (Accessibility to ICT services constraints)	Factor4 (Lack of training in using ICT tools)
1	Illiteracy	.771	.387	.214	-.177	.828	-	.230	.287
2	Non-use of vernacular language	.712	-	-	.104	.744	.373	.262	-
3	Cost of mobile phones, computers, television	.526	-.103	.601	-.169	.633	.209	.200	-
4	Inability to pay service charge for Internet services	.576	-	.347	.455	.669	-.375	-.348	.314
5	Lack of knowledge of computer, e-mail, and Internet usage	.735	-	-.104	-	.859	-	.264	-
6	High cost of recharge cards for mobile phones	.155	-	.786	.329	.151	.652	.122	.529
7	Distance to business centres for e-mail and Internet services	.205	.806	-	-	.642	.189	.537	.250
8	Non-availability of business centres for Internet services	-.210	.721	-.136	-	.228	-	.782	.130
9	Fear to use computers	.588	.307	.292	-	.545	.350	.526	.269
10	No time to use computer, Internet, etc.	.696	-.364	-	-.105	.149	.574	.589	-.211
11	Poor network coverage for mobile phones, television, and Internet services	-.154	-	-	.850	.196	.804	-	-

(Contd..)

Table 4 (Contd...)

S. No.	Particulars	PLAINS				HILLS			
		Factor1 (Respondents' capacity constraints in using modern ICT tools)	Factor2 (Accessibility to ICT services constraints)	Factor3 (Mobile use related constraints)	Factor4 (Network coverage related constraints)	Factor1 (Respondents' capacity related constraints in using modern ICT tools)	Factor2 (Network and mobile use related constraints)	Factor3 (Accessibility to ICT services constraints)	Factor4 (Lack of training in using ICT tools)
12	Inability to pay service charge for use of electricity for computer, television, Internet, etc.	.575	.247	.452	-.239	.133	.667	-	.349
13	No access to computer, e-mail, and Internet	-	.758	-	.251	.164	.235	.807	.504
14	Lack of proper training	.227	.383	-.188	.573	.326	-	.330	.783
15	Too-tiny-to-read screen displays	-	-	.824	-.312	-	.819	.213	.140

Factors Influencing Intensity of Constraints Faced by Respondents in Using Modern ICT Tools

An attempt was made to identify the factors significantly influencing the intensity of constraints faced by respondents in using modern ICT tools. For this purpose, respondents in both the plains and the hills were categorised into two groups, viz. Group I (characterised by high intensity of constraints faced in using ICT tools) and Group II (characterised by low intensity of constraints faced in using ICT tools). Since four factors had emerged in the principal component analysis having even values greater than 1, factor scores of each of these four factors were weighted by their respective contribution to total variance and then aggregated across all the respondents.

The median aggregate score for all the respondents were then obtained for both the data sets, i.e. the plains and the hills. The entire sample was then categorised into respective groups, viz. Group I i.e. high intensity of constraint perception (having score above the median) and Group II i.e. low intensity constraint perception (having score below the median). A binary choice Logit model was then fitted wherein the dependent variable took a value of 1 if the respondent belonged to high intensity constraint perception group and 0 if the respondents belonged to low intensity constraint perception group. The set of independent variables reflected various socio-economic and institutional parameters. The results of the Logit analysis are presented in Table 5.

Table 5: Factors Influencing Intensity of Constraints Faced by Respondents in Using Modern ICT Tools

S.No.	Variables	PLAINS		HILLS	
		β	OR	β	OR
1	Intercept	4.817(3.354)		-.272 (6.578)	
2	Age (Yrs)	.052(.049)	1.054	.222 (.145)	1.249
3	Education	-1.455(.584)***	2.233	.564 (.821)	1.757
4	Family Type (joint=1,nuclear=0)	.817(1.063)	2.265	-.758 (1.973)	.469
5	NFI (Y=1,N=0)	-2.623(1.543)*	.073	-8.027 (5.008)*	.021
6	Land (acres)	.357(.532)	1.429	-2.483 (1.618)	.084
7	Market Distance (km)	.049(.079)	1.050	-.606 (.442)	.546
8	Extension worker contact (Y=1, N=0)	.731(1.116)	2.077	-5.36 (3.045)**	2.900
9	Herd Size(SAU)	2.252(1.533)	9.509	-.043(.481)	.958
10	Credit Access(Y=1, N=0)	-1.303(.997)	.272	-6.124(4.595)	.002
11	-2 Log Likelihood	36.667		15.739	
12	R ² (Cox & Snell)	.375		.629	

Significant at ***1%, **5% and *10% level of significance. Figures in parentheses indicate Standard Error.

Level of education ($P < 0.01$) and non-farm income source ($P < 0.1$) emerged as the significant variables that influenced intensity of constraints faced by respondents in using ICT tools in the plains. The signs of regression coefficients for both the variables were negative. This implies that likelihood of facing constraints in using ICT tools decreased with increase in education level of respondents. Non-farm income had negative influence on probability of facing constraints in using ICT tools, indicating that greater dependence on farm income resulted in higher intensity of constraints faced by the households in using ICT tools. Thus, additional income source, other than from farm seemed to significantly reduce the constraints pertaining to modern ICT tools accessibility and utilisation.

The odds ratio associated with the above variables indicated that the likelihood of facing high intensity constraints in using ICT tools decreased almost three times with increase in each unit level of education of respondents. On the other hand, likelihood of facing high intensity constraints in using ICT tools increased by 92 per cent when the respondent household had no alternate source of income other than from farm.

In case of hills, extension worker contact ($P < 0.05$) and non-farm income ($P < 0.1$), were the significant variables that influenced intensity of constraints faced by respondents in using ICT tools. The signs of the regression coefficients for both the variables were negative. The negative sign associated with the variable extension worker contact implies that the probability of facing constraints in operating ICT tools increased with decrease in contact with extension worker, i.e. respondents having

high frequency of contact with extension functionaries were also the ones who were more inclined towards using ICT tools for information. Mama (2010) from ADA'A district in Ethiopia also reported that farmers with frequent extension participation had more access to knowledge and information than those who do not. The odd's ratios indicated that the likelihood of facing high intensity constraints in using ICT tools decreased by almost three times with each unit increase in contact with extension worker, while it increased by 97 per cent when there was no NFI source.

Conclusion

The study assessed the major constraints faced by dairy farmers in plains and hills of Uttarakhand in respect to accessibility and utilisation of modern ICT tools. 'Respondents' capacity related constraint in using modern ICT tools,'lack of accessibility to ICT services' and 'Network and mobile use related constraints' emerged as the major constraints which were common in both the plains and the hills. In the hills, 'lack of training in using ICT tools' was identified as an additional constraint.

The study also identified the variables which significantly influence the intensity of constraints faced by the farmers in use of modern ICT tools. Non-farm income significantly and negatively influenced the likelihood of facing constraints in using ICT tools in both the plains and hills. This implies that additional income source, other than from farm significantly reduces the constraints pertaining to modern ICT tools accessibility and utilisation.

In the plains, likelihood of facing constraints in using ICT tools decreased with

increase in education level of respondents. Thus, education emerged as an important variable in determining utilisation of modern ICT tools. In the hills, probability of facing constraints in operating ICT tools increased with decrease in contact with extension worker. The study thus identified the variables specific to regions, viz. plains and hills, which affect utilisation of modern tools.

Policy Suggestions

The capacity of the farmers in using modern ICT tools needs to be increased. For this, adequate training of farmers in the use of computer, e-mail and Internet needs to be imparted. Awareness creation through newspapers and television, in various sources of information among farmers would be helpful. This is more required in the hills than in the plains. There is need for re-orientation of the public extension system in timely delivery of information in the hills. Overall, there is greater need on the part of government to focus on improving information delivery system.

Irrespective of region, the infrastructural bottlenecks related to network coverage and accessibility to ICT tools need to be removed. Adequate connectivity of Internet services in rural communities; and delivery of information through appropriate communication channels will go a long way in helping farmers to make effective use of ICTs for greater productivity.

The potential offered by the ICT infrastructure of the dairy cooperative network in the country needs to be adequately exploited. The capacities of the existing cooperatives to serve farmers could be increased with the use of modern ICT tools. The investments in the form of public-private partnerships in ICT initiatives should be increased in the cooperative sector because of its significant role in information dissemination. It is also essential to install a regulatory and supervisory mechanism to ensure proper working of module and fulfilling the information needs of farmers.

References

1. Ajani, E. N. and Agwu, A. E. (2012), Information Communication Technology Needs of Small-Scale Farmers in Anambra State, Nigeria, *Journal of Agricultural and Food Information*, 13(2): 144-156.
2. Arora, A.S., Kumar, A., Bardhan, D. and Dabas, Y.P.S. (2006), Socioeconomic and Communication Variables Associated with Level of Knowledge and Degree of Adoption of Improved Dairy Husbandry Practices in U.S. Nagar District of Uttaranchal, *Indian Journal of Dairy Science*, 59(5): 337-343.
3. Bardhan, D., Sharma, M. L. and Saxena R (2010), Livestock in Uttarakhand: Growth Patterns and Determinants of Composition and Intensity, *Indian Journal of Animal Sciences*, 80: 584-589
4. Bhatt, P.M. (2006), Effect of Mass Media Exposure on Dairy Farmers Regarding Animal Husbandry Practices, Thesis, Ph.D. (Agric) AAU, Anand, India.

5. Dhaka, B.L., and Chayal, K. (2010), Farmers' Experience with ICTs on Transfer of Technology in Changing Agrirural Environment, *Indian Research Journal of Extension Education*, 10(3): 114-118.
6. Durgga, R.V. (2009), Crisis Management Practices Adopted in Dairy Farming by the Farmers of Anand District of Gujarat, Ph.D. Thesis, Anand Agricultural University, Anand, India.
7. Gebrekidan, T., Zeleke, M., Gangwar, S.K. and Aklilu, H. (2012), Socio-economic Characteristics and Purpose of Keeping Dairy Cattle in Central Zone of Tigray, Northern Ethiopia, *International Journal of Advanced Biological Research*, 2(2) 2012: 256-265.
8. George, S. and Chauhan, J.P.S. (2004), Profile Characteristics of Dairy Farmers of Ernakulam District, Karnal, *Agricultural Science Digest*, 24(4): 274 – 276.
9. Girard, Bruce. (2003), The One to Watch, Radio, New ICTs and Interactivity, Rome, Italy, Food and Agriculture Organisation of the United Nations. [On-line]. Available: <http://www.fao.org/DOCREP/006/Y4721E /y4721e00 .htm> [Accessed on May 21, 2012].
10. Gour, A.K. (2002), Factors Influencing Adoption of Some Improved Animal Husbandry Practices of Dairying in Anand and Vadodara Districts of Gujarat State, Ph.D. Thesis, Gujarat Agricultural University, Sardar Krushinagar, India.
11. Kumbhare, S.L.; Sharma, K.N.S. and Patel, R.K. (1983), Standardization of Bovine Units, *Indian Journal of Animal Science*, 53: 547.
12. Mama, Jemal. Kuru. (2010), Access and Utilisation of Agricultural Knowledge and Information by Women Dairy Farmers: The Case of Ada'a District, Oromia Regional State, Ethiopia. M.Sc. Thesis, Haramaya University.
13. Mishra, N. (2010), Livestock Information Dissemination Among Farmers Through ICT: An Exploratory Study in Tarai Area of Uttarakhand, Thesis, MVSc. G.B. Pant University of Agriculture and Technology, Pantnagar.
14. Patil, V.C., Gelb, Ehud, Maru, Ajit, Yadaraju, N.T., Moni, M. and Misra, Harekrishna (2008), "Adoption of Information and Communication Technology (ICT) for Agriculture: An Indian Case Study" in Proc. IAALD AFITA WCCA 2008, at Tokyo University of Agriculture from August 24-27. [On line]. Available www.cabdirect.org/abstracts/20083298229.html? [Accessed on April 14, 2013].
15. Ramaraju, G. V.; Anurag, T.S.; Singh, H. Kumar and Kumar, Shambhu, (2011), ICT in Agriculture: Gaps and Way Forward, Information Technology in Developing Countries, A Newsletter of the IFIP Working Group 9.4 and Centre for Electronic Governance, Indian Institute of Management, Ahmedabad, Volume 21, No. 2.

16. Raval, Rupeshkumar. J. and Chandawat, M.S. (2011), Extent of Knowledge of Improved Animal Husbandry Practices and Socio-economical Characteristics of Dairy Farmers of District Kheda, Gujarat, *International Journal of Farm Sciences*, 1(2):129-137.
17. [www. Uttarakhandstat.com](http://www.Uttarakhandstat.com) (Accessed on May 29, 2012).