CHAPTER 8

DECISION MAKING AND ICT ACROSS THE AGRICULTURAL SUPPLY CHAIN

Agriculture sector has been transformed from subsistence agriculture to largely information dependent requiring a vast range of scientific knowledge and technical information for effective decision making among farming community (Cash, 2001). Decision making involved the whole agriculture supply chain covering different aspects of farming needs. But there exists a large scale of asymmetric information at all the stages of agriculture decision making in India as well as in the developing world (Gollakota, 2008). Only the delivered information could not help in making an efficient decision but is to be delivered in a knowledgeable content and to be disseminated in right volume and right kind of format. It varies a great deal across various stages of supply chain that is to be manageable in an efficient way involving all parties through cooperation and information sharing (Gunasekaran & Ngai, 2004).

Most governments all over the world realized the importance of real-time information and thus innovative mechanisms to deliver information to farmers are being developed. The agriculture extension systems effectiveness have significantly reduced and weekend (APAARI, 2004). Although low investment in agriculture sector based initiatives, a number of public, private and NGOs based development models has been emerged to provide advanced and real time information in an innovative information delivery mechanism for agrarian community ranging from ICT embedded models and Non ICT models. ICT models include technologies such as radio, mobile/phone, internet kiosk etc. to provide innovative information to agrarian communities. The use of ICT in disseminating knowledge and technology to farmers have been demonstrated by number of studies but there are limited concerns about understanding of the impact of this intervention on the behavior of farmers and its capacity to act as an enabler of technology adoption (Ali & Kumar, 2010; Aker, 2010).

This chapter presents a comparative study of four information delivery models. Three are ICT based models namely 'Lifeline'; 'E-Choupal' and (CSC) Common Service Center (provide information through innovative and integrative use of ICT) and a non-ICT model is (TKS) Tata Kisan Sansar, which operates through franchise and demonstration facility at farm level. This analysis gives the comparative results of the above four models based on their service provision. 'Lifeline' is an informational type of model; 'e-choupal' a transactional based model; 'CSC' an e-governance based model and finally 'TKS' a non-ICT based model. Quality of their information provision has been compared on various supply chain decisions i.e. 'Planning decision'; 'Input decisions'; 'Cultivation decisions'; 'Post harvest decisions' and 'Marketing and Distribution decisions' using chi-square test statistics.

Mean scores of overall user and non-user group farmers and individual comparisons of four models on various dimensions of decision-making are given in Table 8.1. Responses on quality of the information regarding various activities on the whole supply chain decisions (Agricultural practices) were collected on five point 'Likert' scale where 1=very poor, 2=poor, 3=satisfactory, 4=good, 5=very good.

As perceived from Table 8.1 quality of decision making of user group and non user group farmers showed that farmers get improved on all aspects of supply chain decisions related to planning, input, cultivation, post harvest and marketing & distribution decisions except some of the activities such as how to grow, seed sources, credit support, irrigation sources, government subsidies, land preparation, number and type of irrigation, time of harvesting, transportation/logistics, inventory decisions and nature of transactions.

For planning decisions, user farmers responded good quality of decision making at 1 % level of significance. This indicates that the user farmers were more planned to their farming practices in comparison to non- user farmers and they structure farming from the initial level. Farmers who are the users of any model were more capable of good 'input decisions' i.e. 7 out of 11 activities were significant at 1 % level of significance. Farmers using traditional sources of information were getting poor quality of information for the activities such as seed sources, government subsidies, irrigation sources and credit support in comparison to farmers who use innovative information delivery models. Only two activities (quantity of seeds and quantity & frequency of fertilizers) showed highly significant differences for cultivation decisions. This may indicates that farmers are less cautious about cultivation decisions.

Table 8.1: Mean Scores of Relationship between Quality of Decision and Usage and Non Usage of Models

Supply Chain Decisions (Agricultural practices)	Lifeline		E-Choupal		TKS		CSC		Overall	
	User	Non user	User	Non user	User	Non user	User	Non user	User	Non user
What crop to grow	3.00	3.11	3.49	3.2	3.15	3.0	2.92	3.1	3.17	3.1
Crop diversification	1.97	1.95	2.60	1.3	1.23	1.5	1.73	1.3	1.92	1.5
How to grow	2.84	3.00	3.28	3.1	2.90	3.0	3.08	3.2	3.03	3.1
Land allocation	2.84	3.00	3.28	3.1	2.90	3.0	3.08	3.2	3.03	3.1
How much to grow			1.58	1.0	1.21	1.3	1.54	1.5	1.44	1.3
Lease-in/Non-lease	2.24	2.78	3.49	2.5	2.33	2.6	1.65	1.9	2.53	2.4
Soil testing			1.42	1.0	1.08	1.2	1.00	1.0	1.19	1.1
Cropping pattern	1.65	1.65	2.07	1.3	1.21	1.5	2.62	2.0	1.83	1.7
Seed selection	3.03	3.11	3.63	3.5	3.15	3.1	3.27	3.5	3.28	3.3
Input prices and availability	3.00	3.03	3.47	3.0	3.15	3.1	3.54	3.6	3.28	3.2
Use of fertilizers/pesticides	3.32	3.38	3.56	3.0	2.90	2.9	3.23	2.8	3.26	3.0
Seed sources	3.08	3.08	3.60	3.5	3.44	3.3	3.19	3.2	3.35	3.2
Technical support	2.24	2.65	2.84	2.1	1.90	2.0	3.38	2.5	2.53	2.4
Use of Farm machinery	2.59	2.86	2.88	2.6	2.38	2.5	2.88	2.6	2.68	2.7
IPM			2.56	1.0					2.56	1.0
Insecticides/ Weed management	2.89	2.95	2.72	1.8	1.69	1.8	2.19	2.2	2.39	2.2
Credit support			1.70	1.5	1.33	1.6	1.54	1.5	1.53	1.5
Irrigation sources	2.86	2.95	3.05	3.0	2.49	2.7	2.88	2.9	2.82	2.9
Training	1.68	1.59	1.81	1.6	1.26	1.5	2.23	1.6	1.70	1.6
Government subsidies	1.59	1.70	2.00	1.7	1.51	1.5	2.35	1.9	1.83	1.7
Land preparation	3.27	3.43	3.35	3.0	2.87	2.8	3.23	3.3	3.18	3.2
Quantity of seed	3.24	3.32	3.70	3.2	3.18	3.0	3.42	3.1	3.39	3.2
Number of irrigations	2.92	3.16	2.86	2.9	2.77	2.6	2.88	2.9	2.86	2.9
Type of irrigation	2.73	2.84	2.84	2.7	2.49	2.6	2.73	2.8	2.70	2.8
Quantity & frequency of fert./pest.	3.38	3.22	3.44	3.2	3.03	2.9	3.19	2.8	3.27	3.0
Harvesting technique	2.78	2.95	3.28	2.7	2.74	2.9	3.35	3.1	3.02	2.9
Time of harvest	3.43	3.62	3.65	3.4	3.26	3.3	3.42	3.2	3.45	3.4
Cleaning	2.14	2.27	2.72	1.1	1.46	1.5	2.42	1.5	2.18	1.6
Sorting and grading	2.14	2.22	2.67	2.0	1.72	2.0	2.50	1.8	2.25	2.0
Weighing	3.05	3.00	3.02	2.5	2.26	2.4	2.96	2.5	2.81	2.6
Packaging	2.03	2.05	2.35	1.9	1.44	1.5	1.81	1.3	1.92	1.7
Storage	1.97	2.14	2.53	2.3	1.64	1.7	1.62	1.4	1.99	1.8
Transportation/logistics	2.86	3.08	2.95	2.7	2.36	2.6	2.46	2.6	2.68	2.7
Inventory decisions			1.60	1.6	1.46	1.7	1.04	1.2	1.42	1.4
Market prices	2.43	2.65	3.53	2.8	2.41	2.3	3.00	2.6	2.86	2.6
Minimum support price (MSP)			2.42	2.2	1.62	2.0	2.62	2.3	2.18	2.2
Sell at farm gate	1.68	1.62	2.84	1.0					2.30	1.3
Selection of marketing channels	2.65	2.92	3.40	3.1	2.46	2.6	2.77	2.7	2.84	2.8
Selling at distant market/local mkt	2.41	2.95	2.86	1.6	2.00	2.1	2.88	2.2	2.52	2.2
Nature of transaction (cash/credit)	3.30	3.30	3.44	3.4	3.00	3.1	3.04	2.9	3.21	3.1
Public/private transportation	2.68	2.81	3.12	2.8	2.31	2.3	3.12	3.0	2.79	2.8

Source: Field survey

Note: Higher mean score on a particular activity indicates better quality of decision

For post harvest decisions, user farmers were more inclined to save their post harvest losses as 5 out of 8 activities were found to be highly significant as compared to non user farmers. For marketing decisions, 6 out of 7 activities were found to be significant at 1% and 5 % level of significance. This indicates that the user famers were well informed about market prices of the produce, more concerned about marketing & channelizing their produce in local or distant markets. This indicates that the usage of information delivery models could improve the quality of decision making of farmers in quite a significant way. In other words, information and services delivered by models for decision making at different level of agricultural supply chains were far better than those farmers who use traditional sources of information. This strongly recommends the need of information to be delivered in appropriate manner and to be prioritized according to agricultural supply chain stages which ultimately will lead to increase production and income of the farmers.

Now we compare different information delivery models to check their individual effectiveness in quality of decision making on the basis of information delivery mechanism. As perceived from Table 8.2, column second shows chi-square statistic values for difference in quality of decision making between 'Lifeline' and 'e-Choupal' user group farmers. Out of 41 agricultural supply chain activities, 14 activities showed significant results at 1%, 5% and 10% level of significance. The above findings interpreted that e-choupal model has greater influence in improving the decision making ability of farmers than lifeline.

At the planning level, e-choupal initiative provide better quality of information for the activities such as "what crop to grow, crop diversification, leasing landholding, cropping pattern and seed selection" (users mean value of e-choupal is greater than lifeline initiatives). It may be due to the fact that e-choupal users consider more planned strategy at the initial level of farming than the lifeline users. At the input level, users of e-choupal are more likely to be facilitated by better price of inputs like seeds, fertilizers, machinery, collection of seeds, technical support, insecticides & weed management and training. Both the users of e-choupal and lifeline did not showed significant difference for cultivation decisions, only harvesting technique was found to be significant at 5 % level. Post harvest and marketing & distribution decisions showed significant differences for cleaning, market prices, selling at farm gate and in selecting channels of marketing at 1%, 5% and 10% level of significance.

Summarizing all the above results, e-choupal has improved the information dissemination quality of farmers as compared to lifeline users. This may be due to their working nature, as e-choupal worked as transactional model whereas lifeline worked as informational model. E-choupal not only disseminates information to farmers but also provides services and transactions of inputs, post harvest and marketing facilities.

Third column in Table 8.2 shows chi-square statistic values for differences in quality of decision making between 'Lifeline' and Tata Kisan Sansar 'TKS' user group farmers. 23 out of 41 supply chain variables showed results at 1 %, 5 %, 10 % level of significance. Mean value and statically significant differences showed that 'Lifeline' initiative better information (on 18 activities) than TKS user farmers (on 5 activities). TKS users got better information on crop selection, ratio of land allocation, selection of seeds, input prices and the sources of buying seeds.

TKS was implemented by Tata Chemicals Private Limited which was established for development of inputs like seeds, fertilizers etc. according to local conditions and to provide these developed inputs through their franchise based model (TKS). The low impact of TKS on farmer's development may be due to the reason that TKS only concentrate on the selling of these inputs, however its effectiveness could be achieved by covering the whole supply chain.

Lifeline being a non profitable organization developed by One World South Asia, Tarahaat and Development Alternatives performed well in facilitating agricultural information to farmers, covering whole supply chain decisions except planning decision (3 out of 5 significant results favors TKS). Users of lifeline got better information than TKS about post harvest management. The lifeline users lagged in getting real time market price for their produce (significant at 1 %) although they adopted different markets to sale their produce (distant & local markets) and also availed information about transportation facilities. It may be the reason that farmers use another sources like community radio, mandi, fellow farmers, newspapers etc. in information accessing. The TKS users responded that demonstration facilities were of bad quality and provided occasionally, regarding weed management, technical support/machinery and use of fertilizers. This may be due to inefficiency of extension workers (doctor).

Table 8.2: Chi-Square Test of Relationship between Quality of Decisions and Usage of Models and Overall Users and Non-Users of Models

Supply chain decisions / Planning Decisions	Lifeline and e-choupal users	Lifeline and TKS users	Lifeline and CSC users	e-choupal and TKS users	e-choupal and CSC users	TKS and CSC users	Overall users and Non-users
What crop to grow	7.785**	7.957**	6.276**	15.062***	23.136***	8.290**	6.357*
Crop diversification	9.612**	19.051***	15.731***	39.046***	37.290***	4.333	36.249***
How to grow	4.66	4.528	7.708*	11.232**	4.624*	10.443**	7.715
Land allocation	1.146	14.998***	1.598	16.843***	2.515	11.873***	22.280***
How much to grow				27.668***	15.269***	11.739***	30.811***
Lease-in/Non-lease	12.717**	4.72	9.125*	17.468***	31.223***	9.327*	31.155***
Soil testing				20.101***	24.991***	5.373**	16.589***
Cropping pattern	6.594*	10.761***	9.066**	11.983***	1.569	27.885***	11.270***
Seed selection	9.231**	10.543**	6.548**	13.303***	3.62	13.179***	16.935***
Input Decisions							
Input prices and availability	12.043***	9.373**	14.706***	14.119***	7.299*	18.933***	17.674***
Use of fertilizers	3.167	10.703***	5.566*	13.731***	8.578**	1.124	29.082***
Seed sources	13.290***	9.079**	2.739	5.263**	13.352***	9.016**	5.910
Technical support	7.803*	27.135***	11.061**	22.017***	3.878	27.456***	23.313***
Use of machinery	3.433	6.377*	2.142	11.003**	2.423	6.518*	22.929***
IPM							57.600***
Insecticides/Weed mgmt.	10.837**	43.078***	31.153***	30.146***	19.195***	7.067*	32.702***
Credit support				7.718**	1.667	2.766	1.569
Irrigation sources	3.763	4.844	3.75	10.360***	0.007	10.518***	2.884
Training	7.060*	9.398**	14.530***	10.835***	5.800*	10.858***	15.642***
Government subsidies	4.592	1.199	6.429*	5.141*	2.262	7.667*	6.087
Cultivation Decisions							

Land preparation	2.357	13.021***	10.440**	12.222***	5.031	5.94	2.699
Quantity of seed	7.119	1.941	1.52	11.980**	11.225**	0.061	25.967***
Number of irrigations	4.26	6.768**	5.152*	0.375	0.097	0.277	3.453
Type of irrigation	3.707	8.256**	1.395	2.657	2.411	3.574	1.356
Quantity & freq. of fert.	5.758	6.119	3.384	6.569*	10.817***	5.673	18.660***
Harvesting technique	8.403**	1.224	5.587	11.984***	13.620***	4.45	27.907***
Post Harvest Decisions							
Time of harvest	3.038	4.949	7.889**	5.265	14.132***	8.707**	
Cleaning	8.598**	28.046***	7.926**	49.056***	26.742***	8.848**	47.150***
Sorting and grading	4.738	11.553**	3.456	21.234***	12.076***	4.133	31.713***
Weighing	2.727	25.381***	8.655**	27.277***	13.715***	12.120***	20.934***
Packaging	2.298	23.039***	16.639***	27.882***	20.222***	6.486**	21.148***
Storage	2.49	18.499***	32.920***	20.076***	29.009***	11.910***	23.022***
Transportation/logistics	2.472	12.722***	6.904	11.631***	9.528**	11.559**	7.536
Inventory decisions				3.692	12.678***	5.495*	2.669
Marketing & Distribution							
Market prices	31.987***	5.100*	6.956**	33.350***	14.860***	8.182**	25.107***
Minimum support price				16.920***	8.531**	17.255***	7.989**
Sell at farm gate	32.065***						38.793***
Selection of marketing	9.813**	6.121	3.761	23.760***	16.482***	2.981	9.555**
Selling at distant market	1.744	17.302***	6.175	20.408***	6.586	11.727***	58.395***
Nature of transaction	4.743	3.899	6.571*	7.416*	3.675	2.605	7.701
Public/private transportation	4.586	14.485***	8.203*	22.294***	2.927	26.773***	10.130**

Source: Field Survey

Note: ***significant at 1 % level, **significant at 5 % level, *significant at 10 % level

In Table 8.2 column four shows the comparison of quality of decision making across supply chain between 'Lifeline' and 'Common Service Center (CSC)'. Lifeline users made better agricultural decisions than CSC users i.e. 23 out of 41 activities were found to be significant. At planning decisions, lifeline made good quality of decisions for what crop to grow and crop diversification at 5 % level of significance. CSC users responded good quality of information for cropping pattern and seed selection at 5 % level of significance. CSC users made better quality of input decisions than lifeline users in technical support to farmers, insecticides/ weed management, training and government subsidies. It may be due to the fact that farmers adopted information from IFFCO procurement established in the study area (Gorakhpur) for some of the above input activities.

On comparing cultivation decisions for users of both the models, we did not found any significant differences. For the post harvest decisions, lifeline users made better quality of decisions regarding weighing, packaging and storage as compared to CSC users (significant at 5%). On the other hand, CSC users got improved information on marketing & distribution decisions as compared to 'Lifeline' users. It may be the reason that CSC model is equipped with internet facilities, so the users got real time information on market prices and other activities.

Column sixth in Table 8.2 represents the quality of decision making of e-choupal and CSC users. The analysis showed that e-choupal users have significantly greater impact on 28 activities (mostly significant at 1% and 5% level). Six agricultural activities at planning level, five at input and cultivation level, eight at post harvest and five at marketing & distribution level were found to be significant. Both the models are transaction based but their service provision is different, as e-choupal covers the whole agricultural supply chain whereas, CSC model transact governance needs. These findings give further results that by embedding agricultural information services with CSC model, farmers could get more enhanced and useful information and knowledge on most of their agricultural activities. CSC being a government initiated model could fill the void space as the farmers are living in information deprived state by enabling them with latest agricultural technologies and services.

Column seventh in Table 8.2 shows the comparison of quality of decision making between TKS and CSC model. As perceived from the data twenty seven activities were found to be significant mostly at 1 % and 5 % for CSC Model. TKS users extremely

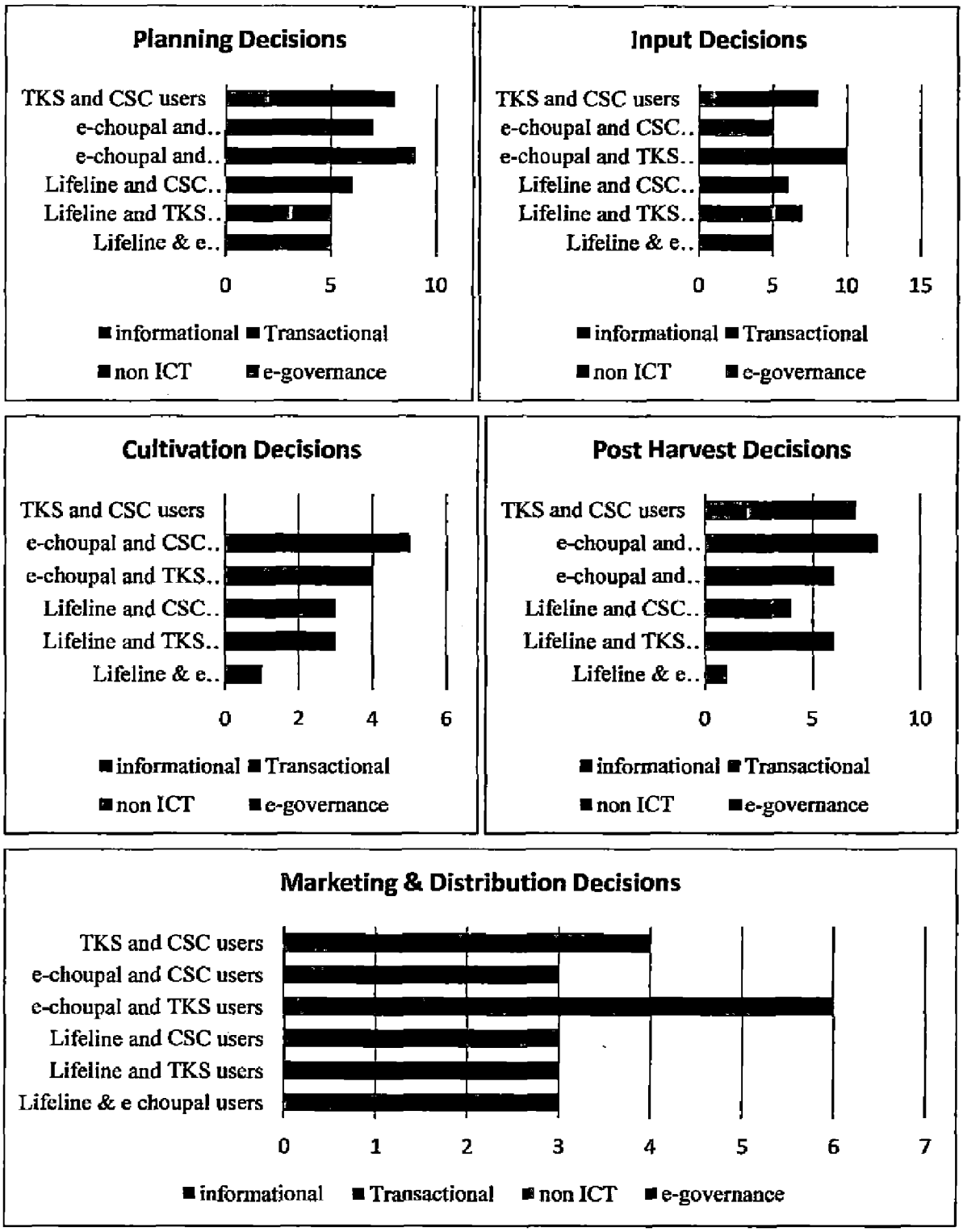
lagged in making decision for post harvest activities, marketing & distribution, inputs and planning activities. Some of the activities (to find sources of seeds, soil testing and crop selection) are the front end activities provided by TKS model via franchise ownership located at block level. Rest of the interpretation is similar to the ones discussed earlier in case of e-choupal and CSC comparison.

From the above discussed results we conclude that ICT user group performs better than the non ICT user group. Further the performance of the models could be extended within ICT user group according to their service provision such as informational, transactional and e-governance based models.

Figure 8.1 represents the distribution of models according to their services provision by number of activities compared in the group of two at various stages of agricultural supply chain using Chi-square statistics and later on, it was represented in bar chart for easy understanding of the analysis. Transactional model (e-choupal) has been emerged as the most successful model for all the stages of agricultural supply chain on comparing other three types of models. It clearly indicates that e-choupal users are making better agricultural decisions than all other three models, right from planning to marketing & distribution. The data gives interesting results on comparing informational and e-governance model that users of e-governance model made better decisions for planning, input and marketing whereas users of informational model perform better for cultivation and post harvest decisions.

Informational model (Lifeline) of service provision appeared to be as the second most effective for cultivation, post harvest and marketing stages, but partially abortive for planning and input decisions (very few of the activities were found to be significant) in comparison to non ICT model (TKS). Crop selection, cropping pattern, balanced fertilizer application, weed management, technical support and training were better availed by users of informational model (Lifeline) that would reduce farmer's extra expenses incurred on inputs and facilitate better training to proper utilization of inputs that will enhance farmers financial status and establish them more firmly in the competitive market. Users of e-governance model made better decisions for planning, input and marketing while users of informational model performed better in cultivation and post harvest decisions.

Figure 8.1: Distribution of Models According to Service Provision by Number of Activities for Various Stages of Agricultural Supply Chain (Within Group of Two)



Source: Field Survey

E-governance model (CSC) has been recognized as the third most effective model in making delivery of information to farmers. Generally CSC users were getting better information than TKS users for planning, input, post harvest, marketing and distribution but for cultivation decisions both the users were similar in decision making.

The present analysis (Table 8.3) explored the quality of decision making between user and non users group of farmers with respect to particular models by doing a comparative analysis. Chi-square statistics of decision making process on various agricultural practices are shown between users and non users of particular models on five stages of agricultural supply chain starting from planning, inputs, cultivation, post harvest, marketing and distribution.

As it is evident from the socio-demographic profile of farmers (chapter 6, Table 6.1), a significant difference was found between profile of users and non users of models. Education, social category and landholding size (showed significant differences between user and non user group) are further included in the analysis to assess the impact of these factors on the agricultural supply chain decisions by comparing users and non users of same profiles using Chi-square statistics and ANNOVA analysis.

Column second in Table 8.3 shows the comparison in quality of decisions between user group and non user group of 'Lifeline' model. Most of the activities were significant at 1% and 5%, except some of the activities i.e. "crop selection, how to grow, training, quantity of seed and time of harvest" were significant at 10%. In Table 8.1 we found that there was not a much mean difference related to particular agricultural activities. Results indicate that 21 out of 41 decisions showed significant difference. Users of lifeline model made good quality of decision for crop diversification, training etc. The poor performance may indicate toward inefficiency of field workers and farmers unwillingness to pay for the particular information. Lifeline mainly facilitates information to farmers on various agricultural decisions through question and answer services by agricultural experts via field worker's mobile. As perceived from the analysis we found that farmers consider interpersonal sources of information more reliable than other sources.

Due to lack of education and unfamiliarity to the technologies, farmers prefer interpersonal information sources as more reliable. Inefficiency of field workers and farmers' unwillingness to pay for the particular information may be the reason for poor performance of lifeline model. This implies that lifeline did not improve quality of decision making of users as such in comparison to non users of lifeline for the location surveyed.

Table 8.3: Chi Square Test of Relationship between Quality of Decisions Making between Usage and Non Usage of Models

Supply chain variables	Lifeline users and non-users	E-choupal users and non-users	TKS users and non-users	CSC users and non-users
Planning decisions				
What crop to grow	4.753*	11.641***	3.818	4.944*
Crop diversification	11.725***	47.651***	0.657	1.692
How to grow	7.675*	7.556**	3.014	3.304
Land allocation	15.692***	6.297*	6.261*	4.406
How much to grow		45.818***	5.342*	3.033
Lease-in/Non-lease	7.356	17.011***	10.252**	2.400
Soil testing/soil sampling		25.811***		
Cropping pattern	2.948	21.257***		2.025
Seed selection	12.694***	7.140*	3.908	3.869
Input Decisions				
Input prices and available	0.384	25.088***	4.567	5.646
Use of fertilizers/pesticides	6.792**	18.653***	2.360	7.993**
Seed sources	3.749	3.377	2.335	0.533
Technical support	17.071***	13.286***	5.212	7.763
Use of Farm machinery	9.091**	7.533**	4.243	6.869**
IPM		57.600***		
Insecticides/Weed mgmt.	16.835***	34.323***	3.206	1.661
Credit support			1.406	
Irrigation sources	3.010	1.010	0.475	5.049*
Training	7.357*	4.852*	1.641	5.932*
Government subsidies	2.600	1.725	3.118	2.957
Cultivation Decisions				

Land preparation	1.681	9.656**	1.006	0.630
Quantity of seed	7.639*	13.819***	8.565**	4.351
Number of irrigations	8.836**	2.565	4.594	2.177
Type of irrigation	4.393	0.763	0.340	0.421
Quantity & freq. of fert/pest.	2.725	9.524**	11.016**	3.800
Harvesting technique	5.729	21.234***	5.118	5.001
Post Harvest Decisions				
Time of harvest	4.673*	2.766	1.734	0.637
Cleaning	14.379***	66.000***	0.165	3.224
Sorting and grading	17.290***	19.918***	8.695**	3.141
Weighing	6.564**	18.015***		5.501*
Packaging	12.208***	14.676***	1.640	2.633
Storage	29.075***	7.888**	2.392	1.556
Transportation/logistics	4.093	4.714	0.058	3.378
Inventory decisions		3.755	0.660	5.385*
Marketing & Distributions				
Market prices	9.618***	17.945***	2.783	4.000
Minimum support price		8.811**	2.320	6.583*
Sell at farm gate/marketing	1.118	68.108***		
Selection of marketing	9.157**	5.809	1.133	1.390
Selling at distant market	16.565***	48.258***	1.231	12.061***
Nature of transaction	0.244	4.644	0.111	4.516
Public/private transport	4.058	10.862**	1.020	2.048

Source: Field Survey

Note: ***significant at 1 % level, **significant at 5 % level, *significant at 10 % level

Annexure Table A1 shows the quality of decision making for the five stages of agricultural supply chain across equally educated 'lifeline' user and non user group. The results indicated that the quality of decision making was not much differing on most of the activities across users and non users whether they are illiterate or less educated. Illiterate or less educated non users made better quality of decisions for technical support, number of irrigations and transportation.

The user group farmers made better quality of decision for storage activity only. When the education level becomes higher (secondary & senior secondary and graduate & above) for the user and non user group farmers, the quality of decision making was significantly different only in nine activities out of forty one included in the study. The nine activities on which these two groups of farmers significantly differ include planning related decisions (leasing and selection of seeds), input decisions (farm machinery and irrigation sources), cultivation decisions (quantity of seeds and harvesting techniques), post harvest decisions (weighing) and marketing and distribution decisions (sell at distant market and types of transactions). The above results implied that the lifeline model is not providing sufficient and reliable information to the users on most of the important activities. The mode of delivery of information was found to be the major barrier. It may be the reason that farmers face difficulty in understanding the delivered information.

In Annexure Table A2 & A3 user and non user group farmers of lifeline model made very less significant decisions according to land holding size. User and non user group farmers of lifeline model did not showed any significant differences across social status. These results reflected that there was a lack of segmentation of covered population. These results are in the line with previous studies (Dossani et al., 2005).

Reported in third column of Table 8.3 decision making quality of e choupal users and non users have been compared. A total of 30 out of 41 activities were found to be significant. The value of chi square statistics is significant at 1% and 5% level of significance for most of the activities. Farmers responded that the activities such as land allocation and training were found to be significant at 10%. This implies that the farmers who use an e-choupal system of information delivery and services (a kiosk type of operator) were able to make better decisions than those using traditional sources of information. Users of e-choupal made planned decisions at all level of agricultural supply chain. E-choupal delivered improved informational as well as transactional services to the end users.

In Annexure Table B1 results of analysis with controls of education level of user and non user group of e-choupal were discussed. The results indicated that the quality of decision making was not much different when the farmers were educated up to literate and secondary level. User group farmers of higher education level (graduate and above) showed much better quality of decision for planning level activities (seven out of nine activities were significantly better). User farmers educated up to secondary and senior secondary level showed significantly different results for input decisions (six out of eleven activities were significant). While the user group having education up to moderate level significantly impacted on the quality of decision at cultivation processes. The results also indicated the importance of post harvest decisions, when the education level was moderate and higher. It implied that users were seriously concerned about the activities like cleaning, sorting, grading and weighing in particular. The same justification is for moderate educated user group at marketing level. These above results are in line with Ali & Kumar (2010) and Taragola & Van Lierde (2010). These showed that better quality of decisions on several agricultural practices was acquired by more educated farmers.

In Annexure B2, results of analysis with control of landholding size of user and non user group of e-choupal have been discussed. Analysis found significant differences between user and non user groups of e-choupal. According to land holding size, medium landholding farmers were more concerned about planning activities than large farmers (seven out of nine activities were significant). However as we move up the hierarchy of social category from OBC to General the impact on quality of decision making between user and non user group improved significantly (Annexure B3). The results of our study indicate that the use of e-Choupal does not seem to have a significant impact on socially lower classes. Farmers belong to higher social class were early adaptors of innovative ICT technologies and are considered as opinion leaders in the local society. Our results are in line with (Ali & Kumar, 2010), who reported several reasons such as socially deprived people faced resource constraints and differential impacts of availability of information and knowledge on actual behavior across different groups.

Column fourth in Table 8.3 showed chi square statistic for difference in quality of decision making between user and non user group of Common Service Center (CSC) which is initiated by government for providing e-governance services particularly. Only nine activities were found to be significant out of forty one activities at 1%, 5% and 10% of significance level. The most number of significant activities such as 'use of fertilizers

&pesticides, use of farm machinery, training and irrigation sources' correspond to input level. It may be due to availability of some other information sources to the survey location such as input dealers, IFFCO procurement etc.

Now we move to in depth analysis according to education, land holding size and social groups of the users and non users of CSC model. Firstly, we consider education level of respondents from literate to higher education of user and non user group. A different preference pattern has been observed. Some of the previous studies (Agwu et al., 2008; Ali & Kumar, 2010) found that educated farmers made more informed decisions on agricultural activities. But in our study moderate and highly educated users made better quality of decisions as compared to non users of CSC model. As the education level of users increases, their decision making preference shifts to input, post harvest and marketing & distribution activities. The results strongly pronounced the reason that less educated farmers were not familiar with the technologies like internet and computer and also they lacked in understanding the health of the delivered information.

The same results were obtained for user farmers according to landholding sizes, as the large land holdings showed higher significant decisions i.e. eleven out of forty one activities were significant (Annexure D2). Again the same justification for CSC users was observed in the case of e-choupal model related to analysis of land holding size. Annexure D3 presents the analysis according to social category of user and non user group. It shows that OBC users made better quality of decisions and were frequent users of CSC kiosks to transact e-governance related activities like caste certificate, ration card, BPL cards etc.

Finally we consider TKS model, which provides informational as well as transactional services to farmers via franchise and by field demonstration. Farmers up to junior level of education showed significant decisions. According to land holding size, medium farmers made more significant decision at different levels of agricultural supply chain (8 out of 41 significant decisions were made). Socially higher class farmers often made more informational and transactional exchanges in comparison to other social groups, the justification is same as in the case of e-choupal model.