Technology Utilization and Its Socio-economic Determinants among Cashew Farmers of Karnataka

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ABSTRACT

A focused orientation on technology utilization can transform passive populations into active adopters through a balanced approach, influencing the ability of farmers and organizations to cooperate in taking advantage of emerging technology innovations, opportunities and synergies. The present investigation analyses the existing technology utilization status in the Dakshina Kannada district of Karnataka state in India, as a prerequisite for developing and initiating innovative cashew production technology interventions for combating low productivity and profitability from cashew cultivation. An 'ex-post-facto cause to effect' design was used, and a rural appraisal ascertained that the levels of technology utilization were significantly low among cashew farmers in this region. The majority of farmers surveyed exhibited a medium level of technology utilization status. Seven variables viz., the age of cashew farmer, years of experience in farming, participation in extension programmes, number of crops grown, farm size, number of yielding cashew trees and expenditure incurred in cashew farming have a significant positive contribution, while two variables i.e. type of land used for cashew cultivation and distance of cashew plot from home had a significant negative contribution towards adoption of cashew production technologies. Stepwise regression yielded a model with eight predictors viz; number of cashew trees, other crops grown, cultivable land available, experience in farming, age of the farmer, participation in extension programmes, distance of cashew plot from the farmer's home and years of experience in cashew farming; collectively explaining up to 69.7 per cent of the variation in technology utilization among cashew farmers. Understanding the above dynamics in farmers' technology utilization process can help researchers and extension agencies working in cashew sector to design better innovations and effective outreach strategies.

Keywords: *Technology utilization; Cashew production technologies; Determinants; Cashew farmers;*

The cashew (*Anacardium occidentale* L.), often referred to as 'wonder nut', is one of the most valuable processed nuts traded on the global commodity markets. In India, as an important cash crop, it provides livelihood to the cashew growers, empowers rural women in the processing sector, creates employment opportunities and generates foreign exchange through exports. Presently, cashew has gained the status of a commercial crop through technological advancements with respect to propagation, production, management and mechanized processing. This change was fuelled as a result of increasing demand for raw cashew nuts and enhanced interest for its commercialization (*Venkattakumar, 2009*).

The cashew cultivation in India mainly confines to peninsular region covering the states of Kerala, Karnataka, Maharashtra and Goa along the West Coast, whereas in Tamil Nadu, Andhra Pradesh, Orissa, West Bengal along the East Coast region. It is also grown in plains like Chhattisgarh, Jharkhand, Gujarat, Bihar and North East Hill Regions like Meghalaya, Manipur and Tripura and also in Andaman and Nicobar Islands (*DCR, 2011*). In India, it is cultivated in an area of 9.82 lakh ha with a production of 7.28 lakh tonnes and productivity of 772 kg/ha (*DCCD, 2012-13*). India has the maximum area (21.6%) under cashew nut and is the third largest producer (17.3%) of raw nuts in the world. After Vietnam, the country is the second largest exporter, accounting for 34 per cent of the world's export of cashew kernels. India has a comparative advantage in the production and processing of cashew nuts on account of its cheap and skilled labour force. There are

3650 cashew processing industries in the country (both organized and unorganized sector together), with an installed capacity for processing of 15 lakh tonnes, for which the contribution from the indigenous production is only 38 per cent (*Shalini, 2010*). India earned Rs. 4450 crores through export of processed cashew kernels and cashew nut shell liquid during 2011-12 (*CEPCI, 2013*).

To explore the applicability of technology adoption premise in the context of cashew cultivation in India, a study was undertaken. This study measures the technology utilization status in terms of adoption levels of recommended technologies, identifies the socio-economic determinants of farm level adoption and provides a model for predicting adoption of cashew production technologies.

METHODOLOGY

The study was conducted by Directorate of Cashew Research, Puttur as part of the project 'Impact of Cashew Production Technologies on Area, Production and Productivity of Cashew'. Purposive sampling technique was used to select Dakshina Kannada district of West Coast. An 'ex-post-facto cause to effect' design was applied. The data were collected during the 2012-13 through questionnaire and personal interviews.

Overall adoption index for the farmer was calculated as mean of sum of adoption scores obtained for all the seven major technology components measured. Appropriate statistical measures such as Phi, Spearman's rank correlation and linear regression and stepwise regression analysis were employed to arrive at conclusions. Data was analyzed using Microsoft Excel 2007 and IBM SPSS Statistics Ver. 20.

RESULTS AND DISCUSSION

The results on socio-economic determinants of farm level adoption of cashew production technologies and the technology utilization status in terms of adoption levels of recommended cashew production technologies are furnished here and discussed to arrive at conclusions. For ease of comprehension, the 12 personal variables and 10 economic variables measured for the study are discussed separately here.

Socio-personal profile of cashew farmers: The twelve personal variables studied are furnished in Table 1. It can be noted that cashew farmers were equally distributed as far as their age was concerned with mean age of 47 years.

Table 1. Socio-personal profile of cashew farmers (N=75)

Independent variables	Category	No.	%
Age (Years)	Young (<40)	24	32
Mean=46.5	Middle (40-53)	25	33
SD=12.93	Old (>53)	26	35
Educational status	Illiterate	3	4
Mean=3.77	Primary	11	15
SD=1.19	Secondary	7	9
	High School	34	45
	PUC	4	5
	Degree	11	15
	PG	5	7
Primary Occupation	Agriculture	70	93
	Others	5	7
Experience in farming (yrs)	Low (<17)	21	28
Mean=23.5	Medium (17-30)	36	48
SD=13.54	High (>30)	18	24
Exp.in cashew farming (yrs)	Low (<7)	31	41
Mean=10.5	Medium (7-14)	23	31
SD=7.24	High (>14)	21	28
Extension contact	Low	51	68
Mean=3.03	Medium	17	23
SD=6.29	High	7	9
Extension participation	Low	15	20
Mean=6.69	Medium	48	64
SD=7.36	High	12	16
ICT usage	Low	17	23
Mean=10.03	Medium	42	56
SD=5.90	High	16	21
Cosmopoliteness	Low	27	36
Mean=7.81	Medium	27	36
SD=5.13	High	21	28
Land used for cashew	Fully irrigated	2	3
	Partially irrigated	5	7
	Rain-fed	68	90
Land used for other crops	Fully irrigated	57	76
	Partially irrigated	8	11
	Rain-fed	10	13
Distance of cashew plot	Less	2	3
from home (Meters.)	Moderate	60	80
Mean=427	Large	13	17
SD=850			

Majority had up to high school education (45%) while 93 per cent had agriculture itself as their primary occupation. Most farmers (48%) had medium level of

experience in farming with an average experience of 23.5 years in agriculture. These findings are in line with that of *Lakshmisha (2000), Shivaramu et. al. (2004), Veerkar et. al. (2006) and Venkattakumar (2006, 2008, 2009)*. Majority (41%) had low experience in cashew farming with an average experience of 10.5 years only. These findings are in line with that of *Venkattakumar (2006)* but in contrast with studies conducted in same region by *Veerkar et. al. (2006)*. Contact with extension agencies was found to be low among majority of the cashew farmers (68%) while participation in extension programmes was found to be medium for almost two-third of the farmers (64%). These findings are in line with that of *Lakshmisha (2000)* and *Shivaramu et. al. (2004)*. More than half of the cashew farmers (56%) exhibited medium levels of ICT usage while in case of cosmopoliteness, majority were equally divided into low and medium categories (36%). These findings are contrary to earlier ones by *Lakshmisha (2000), Shivaramu et. al. (2004)* and *Venkattakumar (2006)*. While three-fourth majority (76%) of cashew farmers was giving irrigation for other crops grown by them, 90 per cent of them cultivated cashew under rainfed system only. The average distance of cashew plots from farmers' homes were found to be around half a kilometer (427 meters) with vast majority (80%) having to cover this distance to reach their plots.

Economic profile of cashew farmers: The economic profile of cashew farmers is presented in Table 2. Around half of the farmers (48%) grew 3-4 crops on an average in their farms while almost three-fourth of them (72%) gave least priority to cashew farming. These findings are in line with that of *Venkattakumar (2008)*. The average farm size was found to be 1.9 acres while average area of un-used land available for cultivation was found to be 86 cents. Majority (55%) had nil or negligible amount of unused land available for cultivation. The study showed that households had an average number of 173 cashew trees with a mean yield of 2.45 kg/tree. More than half of the cashew farmers (55%) realized only moderate yields with an average net income of Rs. 29,664/year against an average expenditure of Rs. 9293/year. Majority (46%) made low levels of yearly investment in agriculture of Rs. 90,981 with a net income to the tune of Rs. 2,40,540/year.

Table 2. Economic profile of cashew farmers (n=75)

Independent variables	Category	No.	%
No: of crops grown	Less (<2)	20	27
Mean=3.28	Moderate (2-4)	36	48
SD=1.62	High (>4)	19	25
Importance given to cashew	Least	54	72
Mean=1.56	Moderate	8	11
SD=1.0	High	11	14
	Very High	2	3
Farm size (acres)	Low (<2.5 ha)	31	41
Mean=1.9	Medium (2.5-5 ha)	23	31
SD=0.82	High (>5 ha)	21	28
Cultivable land (cents)	Low (<0.21)	41	55
Mean=0.86	Medium (0.21-1.51)	20	27
SD=1.29	High (>1.51)	14	18
Yielding cashew trees (Nos.)	Low (<63)	26	35
Mean=173	Medium (63-283)	38	51
SD=220	High (>283)	11	14
Yield of cashew/tree (kg)	Low (>3.96)	23	31
Mean=2.92	Moderate (3.96-1.87)	27	36
SD=2.09	High (<1.87)	25	33
Expenditure in agri. (Rs.)	Low (<52523)	35	46
Mean=90981	Medium	20	27
SD=64037	(52523-129258)		
	High (>129258)	20	27
Net income from agri. (Rs.)	Low (<124032)	37	49
Mean=240540	Medium	20	27
SD=149649	(124032-357048)		
	High (>357048)	18	24
Expenditure in cashew	Low (<3780)	28	37
farming (Rs.)	Medium	31	41
Mean=9293	(3780-14806)		
SD=11028	High (>14806)	16	21
Net income from cashew	Low (<5994)	29	39
farming (Rs.)	Medium	40	53
Mean=29664	(5994-64602)		
SD=70426	High (>64602)	6	8

Technology utilization status of recommended cashew production technologies: The adoption of recommended cashew production technologies categorized to seven groups such as Planting and initial care, Soil and water conservation, Manures and fertilizers, Pruning and training, Plant protection, Intercropping and Harvesting and post harvest technologies were studied separately. The adoption of specific recommended practices under each production technology mentioned above was studied and the results are presented in Table 3.

Table 3. Adoption levels of recommended cashew production technologies (n=75)

Cashew Production Technologies	Adoption Index	Rank	S.D.	% farmers under various levels of adoption			
				High	Medium	Low	Non
Planting and initial care	73	1	24.1	25	52	23	-
Soil and water conservation	48	2	25.0	32	35	25	08
Manures and fertilizers	30	5	18.3	53	14	13	20
Pruning and training	43	3	34.8	33	35	01	31
Plant protection	20	7	19.2	29	26	28	17
Intercropping	22	6	35.7	05	20	04	71
Harvesting and post harvest	43	3	12.9	37	39	24	-
Overall adoption of CPTs	40	-	16.1	24	44	32	-

The overall adoption of cashew production technologies received an index score of 40 only with majority farmers (44%) showing medium level of adoption only. Similar findings were made by *Zagade et. al. (2000, 2003), Lakshmisha (2000), Bhairamkar et. al. (2004), Shivaramu et. al. (2004) and Venkattakumar (2005, 2006, 2009)*. Cashew farmers were found to adopt maximum practices under planting and initial care (Rank 1) including recommended varieties and planting material (grafts). This reasons the high demand for cashew grafts in government run as well as private nurseries in the locality. The findings can be read along with that of *Lakshmisha (2000)* and *Venkattakumar et. al. (2004)*. Also, these practices were easy to adopt and initial interest plays a major role in the high adoption rate of this technology. More than half of the farmers (52%) exhibited medium levels of adoption for this technology. This finding is in line with earlier reports of *Bhairamkar et. al. (2004)* and *Shivaramu et. al. (2004)*. Soil and water conservation techniques were also followed by almost half of the farmers (Rank 2). This is in contrast to findings by *Shivaramu et. al. (2004)* and *Venkattakumar (2009)* in which adoption of soil and water conservation techniques were found to be low. However, earlier studies had shown a positive perception of cashew demonstration farmers towards soil and water conservation techniques *(Venkattakumar, 2005)*. The increased availability of heavy machineries at affordable per hour rates for land leveling, pit digging, terrace making etc. is a major reason behind this. Also, the practices under this technology are mostly adopted along with or in continuance with planting and after care thereby increasing its chance of adoption due to initial interest. Almost one-third of the farmers (35%) exhibited medium levels of adoption for soil and water conservation technology. Adoption of pruning and training along with harvesting and post harvest technologies stood together at third place with adoption index of 43 while majority farmers belonged to medium level adopter category for both the technologies. This finding is in line with earlier reports of *Shivaramu et. al. (2004)*. In case of pruning and training, 31 per cent of farmers have never adopted this technique in their orchard. Adoption of manures and fertilizers was found to be poor among farmers with an adoption index of 30 while one-fifth (20%) of the farmers didn't apply any sort of manures or fertilizers to their cashew crop. Similar observations were made by *Nirban and Sawant (2000)* with respect to adoption of manures and fertilizers in cashew plantations. Intercropping was another technology which was poorly adopted (Rank 6) with the highest rate of non adoption (71%) among all the technologies. Similar observation was made by *Shivaramu et. al. (2004)*. Low to medium adoption with respect to most cashew production technologies could be attributed to the fact that farmers are yet to realize the importance of these technologies on the yield level and potential economic benefits that accrues from it.

Plant protection, which is one of the most important components, scored the lowest adoption rate among cashew farmers in the present study. Farmers were equally distributed among high, medium and low adopter categories for this technology while 17 per cent reported complete non adoption of any crop protection technologies in their cashew crop. This finding is in line with earlier reports of *Nirban and Sawant (2000)* and *Zagade et. al. (2000, 2003)* but in contrast with the findings by *Venkattakumar (2009)*. However, 90 per cent of demonstration farmers who availed subsidies

were found to have adopted plant protection measures (*Venkattakumar, 2005*). Non-adoption was particularly high for plant protection technologies against Cashew Stem and Root Borer (CSRB) due to the complexity of the technology while majority had adopted measures against Tea Mosquito Bug (TMB) due to less complexity, higher trialability and observability of results in comparison to measures recommended against CSRB. *Venkattakumar (2005)* also reported farmer responses indicating that recommended control measures could not check the attack of CSRB explaining poor adoption rates of plant protection technology as a whole. It is obvious from these findings that there is tremendous scope in the region for increasing adoption of recommended cashew production technologies.

Socio-economic determinants of farm level adoption of cashew production technologies: Correlation and regression analysis was employed to ascertain the relationship between adoption and socio-economic variables and their contribution in explaining the variability in adoption respectively. The results are presented separately for socio-personal variables and economic variables in Tables 4 and 5.

Relationship between adoption and socio-personal variables and their contribution towards adoption of cashew production technologies: The correlation analysis identified that five socio personal variables viz. level of education, years of experience in farming, years of experience in cashew farming and extension participation of cashew farmers had a significant relationship with farmers' adoption of cashew production technologies. The regression analysis revealed that three variables viz. the age of cashew farmer, years of experience in farming and extension participation have a significant positive contribution towards adoption while two factors, type of land used for cashew cultivation and distance of cashew plot from home had a significant negative contribution towards adoption of cashew production technologies (Table 4). The correlation of age with adoption is in line with the findings of *Venkattakumar (2006)*.

Relationship between adoption and economic variables and their contribution adoption: The study identified six economic variables viz. number of crops grown, importance given to cashew, cultivable land available, number of yielding cashew trees, expenditure in agriculture and net income from cashew farming as having significant relationship with adoption of cashew production technologies.

The regression analysis reveals that four variables viz. the number of crops grown, farm size, no: of yielding cashew trees and expenditure incurred in cashew farming were the economic factors which had a significant positive contribution towards explaining the variability in adoption of cashew production technologies (Table 5). The socio-personal and economic variables

Table 4. Relationship between adoption and socio-personal variables and their contribution in explaining the variability in adoption (N=75)

Socio-personal variables	'r' value	'b' value
Age	0.134^{NS}	-0.0628***
Level of education	0.354**	0.073^{NS}
Primary occupation	-0.107^{NS}	-0.068^{NS}
Experience in farming	0.380**	0.660***
Experience in cashew farming	0.334**	0.143^{NS}
Extension contact	0.205^{NS}	-0.159^{NS}
Extension participation	0.292*	0.339*
ICT usage	0.175^{NS}	0.112^{NS}
Cosmopoliteness	0.103^{NS}	-0.037^{NS}
Land used for cashew	-0.030^{NS}	-0.172**
Land used for other crops	0.116^{NS}	0.066^{NS}
Distance of cashew plot from home	-0.202^{NS}	-0.266***

$R^2 = 0.786$

NS – Non-Significant, *** - Significant at 1 % level, ** - Significant at 5 % level, * - Significant at 10 % level

Table 5. Relationship between adoption and economic variables and their contribution in explaining the variability in adoption (N=75)

Economic variables	'r' value	'b' value
No. of crops grown	0.450***	0.262***
Importance given to cashew	0.393***	-0.075^{NS}
Farm size	0.074^{NS}	0.174**
Cultivable land available	0.371***	0.161^{NS}
No: of yielding cashew trees	0.536***	0.297*
Yield of cashew/tree	0.155^{NS}	-0.082^{NS}
Expenditure in agriculture	0.282**	-0.197^{NS}
Net income from agriculture	0.176^{NS}	-0.120^{NS}
Expenditure in cashew farming	0.141^{NS}	0.219*
Net income from cashew farming	0.416***	0.280^{NS}

$R^2 = 0.786$

NS – Non-Significant, *** - Significant at 1 % level, ** - Significant at 5 % level, * - Significant at 10 % level

Table 6. Models predicting adoption of cashew production technologies: Step-wise regression analysis

Model 8			Coefficients[a] Un-standardized Coefficients B	Std. Error	Standardized Coefficients (Beta)	t	Sig.
	Constant		30.543	5.073		6.021	.000
	CSHWTRS	X_1	.029 .	005	.400	5.383	.000
	CRPSGRWN	X_2	2.472	.755	.247	3.274	.002
	NONCLTV	X_3	3.207	.869	.261	3.691	.000
	FRMNGEXP	X_4	.531	.126	.443	4.222	.000
	AGE	X_5	-.531	.133	-.426	-4.007	.000
	EXTNPRTPN	X_6	.508	.174	.234	2.917	.005
	PLOTDIST	X_7	-.004	.001	-.202	-2.615	.011
	CSHWEXP	X_8	.384	.166	.173	2.310	.024

a. Dependent Variable: CPT AI

b. CPT AI = 30.543 + 0.400 X_1 + 0.247 X_2 + 0.261 X_3 + 0.443 X_4 – 0.426 X_5 + 0.234 X_6 – 0.202 X_7 + 0.173 X_8

Model Summary

Model	R	R^2	Adjusted R^2	SE of the Estimate
8	.835h	.697	.660	9.3513131

Predictors: (Constant), CSHWTRS, CRPSGRWN, NONCLTV, FRMNGEXP, AGE, EXTNPRTPN, PLOTDIST, CSHWEXP

used in the study could together explain upto 78 per cent variability in adoption of cashew production technologies (R^2 = 0.786).

Predicting adoption of cashew production technologies: Step-wise regression models: Stepwise regression was used to check the extent to which the selected models explained the variation in adoption of cashew production technologies. In this analysis, eight models were tested to examine the variation in adoption among the respondents.

Model 8 explained up to 69.7 per cent of the variation in adoption using the predictors; no. of cashew trees (X_1), other crops grown (X_2), cultivable land available (X_3), years of experience in farming (X_4), age of the farmer (X_5), extension participation (X_6), distance of cashew plot from the farmers home (X_7) and expenditure in cashew farming (X_8) (Table 6).

The model 8 also had the lowest standard error of the estimate (9.3513) thus making it the best model suited to predict adoption of cashew production technologies by farmers. The model is fitted as: *CPT AI = 30.543 + 0.400 X_1 + 0.247 X_2 + 0.261 X_3 + 0.443 X_4 – 0.426 X_5 + 0.234 X_6 – 0.202 X_7 + 0.173 X_8* .

The model can be used to predict adoption of cashew production technologies by farmers under similar agro-ecological situations.

CONCLUSION

The purpose of this study was to analyse the existing status of technology utilization among cashew farmers in Dakshina Kannada district of Karnataka, India. The findings are intended to help research and development agencies in targeting their efforts in increasing technology application among cashew farmers in order to form a foundation for sustainable adoption of cashew production technologies. The results reveal that a majority of cashew farmers had medium level of technology utilisation status. Based on the premise that a solid technology utilisation status is a pre-requisite for accelerated productivity in horticultural sector, there is a reason for concern about the chances of promoting cashew cultivation in this region without higher field level adoption of recommended cashew production technologies. There are important implications of this study in terms of the importance of technology utilization by farmers and how this relates to their ability to adopt recommended technology and ultimately to participate in the cashew value chain. The set of intrinsic motivations resulting from these factors may expand farmer aspirations towards better situations and cause farmers to set more compelling targets by adopting the latest technologies. Understanding some of the dynamics in technology utilization process can

help researchers working in cashew sector to design innovations. The variables that were identified as key indicators towards explaining adoption of cashew production technologies can be utilized in this context.

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