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Effects of Socio-Cultural Factors on Use of Technology in Smallholder Dairy Commercialization Projects in Transnzoia County, Kenya

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Abstract:
In response to population growth, diminishing income and increased land sub-division, the demand for livestock products, such as milk is growing in Trans-Nzoia County. The growing demand offers opportunities for smallholders to realize better income hence improved livelihoods. Whereas the growing demand for milk is widely recognized, the dairy sector has not been able to produce adequate milk to satisfy this demand, mainly due to low production and productivity of milk. Most development projects are directed to the smallholder farmers with a populace of 75-80% of the Agricultural Sector in the country to re-direct their energies to help change livelihoods. Projects and/or programmes have been used based on the identified needs in different approaches fill the gap to increase milk production and productivity by use of new and tested technologies. There was likelihood of low use of technologies (Smallholder Dairy Commercialization Project (SDCP) report 2016). The overall objective of this study was to look into the effects of socio-cultural factors on use of technology in smallholder dairy commercialization projects among smallholder dairy farmers in Trans Nzoia County, Kenya. It was designed to (i) to evaluate socio-cultural factors affecting the use of technology among smallholder dairy farmers; (ii) to determine extent of effects of socio-cultural factors on use of Smallholder Dairy technology; and (iii) to establish the relationship between socio-cultural factors and Smallholder Dairy farmers' technology use. Data was collected through structured questionnaire administered to a random sample of smallholder dairy groups within Dairy Commercialization Areas (DCAs). The analytical approach used was regression and correlations based on the number of variables and form of relationship; and LSD multiple mean separation, and ANOVA p-value and general linear model to analyse for differences on socio-cultural factors in technology use, excel analysis where applicable and simple percentages thereof. Graphs indicating different levels of the factors against technology use were drawn using computer program. A scatter plot of was plotted fitted with regression line, equation and coefficient of determination (R^2) to determine unit measure for possible incremental and variability in use as a result of effects. The findings showed that socio-cultural factors affect technology use. Effects differ with each technology and there is relationship between socio-cultural factors and technology use. There were significant differences in use between technologies and interaction between intervening factors in use at p (< 0.05). Regression equation and (R^2) explained a unit of 1.4914 incremental unit offered and a 76 % variability as result of relationship between socio-cultural factors and technology use. The study therefore shall deepen the understanding on the socio-cultural factors at the levels of farm households, in the dairy industry and the institutions and policies on farmers' decision to use technologies. This will provide insights into the levels of use, technologies of preference and relative factors affecting them thereof; both technical and farmer levels.

Keywords: *Smallholder, technology use, interpretation, determinants, failures, successes, sustainability, technical change*

1. Introduction

Several projects and/or programmes have been initiated and handled to their respective logical conclusion. There is very little to show case in the aspect of changing the livelihoods from technology use. The mentioned projects and/or programmes come along in different designs and approaches with technological changes aimed at increasing production and productivity of milk in the dairy sector.

Kenya's Dairy sub-sector accounts for about 3.9% and 15.5% of the country's total and Agricultural Gross Domestic Product (GDP) respectively and has grown at an average annual rate of 4% from 1998 to 2003(Tegemeo, 2005). It is dominated by smallholder farmers, who own over 70% of the national dairy herd estimated at 3.5 million, producing over 60% of the 2.5 billion litres of cattle milk annually and over 75% of the total domestic marketed milk (Staal et al., 2003 M L&F, 2005; Ngigi, 2005). In the context of smallholder farmers, milk production is an enterprise that enables them to generate income, improve nutrition and food security and sustain soil fertility for improved crop production and subsequently reduce poverty. It should be understood that the crop production in this regard demonstrate ability to have rich source of raw materials for animal feed industry. Milk production has enormous complementary roles in smallholder farming systems and to sustain these benefits it is the most promoted development pathway out poverty for the rural poor farming households, particularly in the medium and high potential agro-Eco zones (Upton, 2000; Bebeet al., 2002).

Like many developing countries in Africa, Kenya continues to have a large Agricultural Sector that dominates economic activity in the country. This sector remains the backbone of Kenya's economy as it contributes directly and indirectly to the Gross Domestic Product (GDP). It also employs at least 30% of all workers in the formal sector and about 62% of jobs in the informal sector. The sector is also responsible for providing food security for the population and provision of raw materials for the agro-based industries. It further provides forward and backward linkages with other sectors and is a huge foreign exchange earner for the country. The sector is expected to be a key driver envisaged to deliver the 10% annual economic growth stipulated under the economic pillar of Kenya Vision 2030 and its MTP II (2013-2017).

Broad based agricultural growth in developing countries like Kenya is a strong pre-requisite to attaining the targets of sustainable development goal (SDG) number one as well as facilitating the attainment of other relevant SDGs targets. Agricultural growth contributes to the SDGs by improving people's access to more and better quality food, raising farm incomes, creating employment on and off farm, empowering poor and marginalized groups including women. It can further promote the sustainable management of the environment and natural resources. Growth in the sector is mainly realized from increased production. Either way, growth of the agricultural sector is a critical component for both rural development and poverty reduction as the sector absorbs the increasing number of job seekers and generates income and livelihoods for others. The performance of the agricultural sector bears a huge impact on the performance of the overall economy.

Challenges to eradicating extreme poverty and hunger in Kenya: The impact of climate change has led to reduced production hence a rise in both commodity and food prices; Rapid population increase coupled with decrease in food production continues to affect food security in the country; Poor infrastructure in rural areas continues to affect market access for both producers and buyers of agricultural produce; Insecurity hinders people from engaging in various economic activities that contribute to their well-being and livelihood; Loss of high potential agricultural land due to rapid urbanization and expansion of infrastructure.

Initially, it was estimated that by the year 2010, domestic milk production in Kenya then estimated before (2007) at 3.1billion liters from cattle, camels and goats (ML&F, 2005) would have to increase by over 15% to satisfy the rapidly growing demand. The growth in demand can be attributed to increase in human population, urbanization, rising incomes and changing eating habits of the human population (Omore et al., 1999; Delgado et al., 2001). The projected growth in demand for milk presents to smallholder milk producers with an expanded opportunity for milk market from which they can enhance their income generation, create wealth and reduce poverty from milk sales.

This however will be hinged on the fact that increased milk production will depend on the proposed technologies that propels the anticipated changes.

These are the strategies contained in the Smallholder Dairy Commercialization Project; the study area. They are all pointing to poverty reduction in rural and urban dwellings for the purposes of improved livelihoods. Adaptation of new technologies in milk production will enable smallholder milk producers to remain competitive in the liberalized milk market in an attempt to improve their livelihood. Commercialization in smallholder milk production systems have been promoted by the National Agriculture and Livestock Extension Programme (NALEP), Kenya Agricultural Productivity Project (KAPAP), Smallholder Dairy Commercialization Project (SDCP) in selected counties and also launched Agricultural Sector Development Support Programme (ASDSP); (SRA, 2004; NALEP, 2006; KAPAP/KAPP, 2006; SDCP, 2006 and ASDSP, 2012).

These programmes and/or projects promote commercialization of milk through the Dairy common interest groups (DCIGs) extension approach in medium to high potential agro-ecozones in Kenya where landholdings becomes smaller as intensification increases. These therefore calls for appropriate technologies to be adopted to cope with the rising scenarios as climate change and the policies attached. It is hypothesized that there could be some underlying factors which have socio-cultural biases that can compromise this noble course. However, the level of intensification of smallholder milk production systems is widely variable, depending on the risk bearing capacity of individual households to access external outputs. This is reflected in varying levels of commercialization ranging from 10 to 80% in the smallholder milk production systems (Staal, 2002; Bebe, 2004). The study was therefore geared to study the effects of socio-cultural factors on technology use among smallholder dairy farms in Trans Nzoia County, Kenya.

2. Materials and Methods Process

The study was carried out in Trans Nzoia County, the Dairy Commercialization areas I, 2 and 3 as prescribed in project design and document in smallholder dairy commercialization project. They raise various numbers of dairy animals depending on the farmer ability. These are group oriented operational venture with differing resource endowment levels

and socio-cultural characteristics. The orientation therefore depicted differences in technology use. The researcher analyzed the data using descriptive statistics, non-parametric test statistics and logistic regression modeling.

2.1. Experimental Design

The paper linked the theoretical understanding of the existing multiple sources of information that farmer use, with the empirical model to analyze the factors that affect the farmer's use of different Dairy-related Technologies. The analysis is done using a multivariate regression model: thus $Y=a + b_1X_1 + b_2X_2 + b_3X_3$..... Under LSD multiple mean separation and ANOVA p-value on the socio-cultural factors effects and in adducing the correlations strength and levels of significance in mean standard deviation to determine technology use.

2.2. Sample Selection and Sample Size

Stratified random sampling within the brackets of operating groups (selected) dealing mainly in smallholder dairy production. The group members were drawn from Kiminini, Waitaluk and Endebess sub-counties. A list of random five members from each Dairy Commercialization Area (DCA) was drawn from each group having 15 members. There were 15 groups in each Dairy Commercialization Area

These randomly sampled lists obtained by ward livestock extension agents. Each DCA had five randomly sampled characteristics for the forty five (45) groups to a total of 225 samples, which formed the sampling frame. Simple random sampling was used to select the farmers for the study.

The sample size was determined using Cochran (1977) formulae given by:

$$n = \frac{P\{1-P\}}{(S.E)^2} = 225$$

Where n is the sample size, p is the proportion of the population with the required attributes, assuming smallholder dairy farmers comprise 80% of the dairy farmers population, the value of p will be taken as 0.8, S.E the standard error of the proportion is given by 0.05/1.96 at 95% confidence level. The study sampled150 (66.7%) farms due to time and funds constraints and unfolding logistics.

2.3. Data Collection

Through a preliminary survey, the researcher identified the experts in the Livestock sector, through SDCP Coordinator and some farmer group members/leaders who helped in working out the logistics for the data collection exercise. Data was then be collected through house-to-house visits by the researcher and/or guided enumerators. The researcher personally administered the questionnaire with guidance from the Ward Livestock Extension Officers (WLEOs) and Farmer Group leaders. This ensured that errors in data collection are minimized.

A pilot test with 30 SDCP dairy producers was carried out. The sample size for the pilot study was based on the recommendation of Balian (1994). These were farmers who are Dairy producers in Trans Nzoia County, who have similar and/or corresponding characteristics with those that were sampled but have different implementation processes. Cronbach's alpha reliability coefficient was used to measure the questionnaires' internal consistency. For the instrument to be reliable the calculated alpha coefficient has to be at least 0.70 as recommended by Fraenkel and Wallen (2000).

Data was collected by personal interviews through questionnaires from January, 2019 to February 2019. A structured pre-tested questionnaires was used to collect data.

2.4. Data analysis

Data was coded and analysis expedited using Statistical Package for the Social Sciences (SPSS). Evaluations done using ANOVA and Excel to show case changes attained which are associated with level of use/uptake.

The research deployed a multiple regression and simple percentage calculations in terms of empirical model and data analysis. The researcher was interested to know whether the two variables are related and therefore focus attention on correlation coefficient, r; in this case, interested in the dependence of one variable on another.

The researcher evaluated relationship describing the strength of a linear relationship between two variables: Correlation Analysis... "$-1 \leq \rho < 1$"

Based on the strategic objectives, the analysis dwelt on attempt by the researcher to subject himself in answering the research questions through characteristic analysis.

3. Results

The following results will act as points of reference for data and/or information triangulation of effects. The total questionnaires per group for DCA 1, 2 and 3 were 50 each hence a total of 150 in number. Out of the 150 distributed, 139 were certified well filled and worth using for data entry. 11 frequencies were not well filled to completion, thus not included in the analysis. Gender responsiveness indicated 80 (57.6%) for males and 59 (42.4%) for women.

3.1. Farmer Characteristics: Age-Wise on Mostly Involved Person in Use of Technology

	No.	M	% USE	F	% USE	<18 YRS	% USE	18-35 YRS	% USE	36-50 YRS	% USE	>50 YRS	% USE
Technology													
A.I.	139	94	67.60%	45	32.40%	17	12.20%	31	22.30%	60	43.20%	31	22.30%
BIOGAS	139	87	62.60%	52	37.40%	29	20.90%	27	19.40%	53	38.10%	30	21.60%
ROCKET "JIKO"	139	23	16.50%	116	83.50%	21	15.10%	29	20.90%	69	49.60%	20	14.40%
SILAGE TUBE	139	73	52.50%	66	47.50%	18	13%	32	23.00%	58	41.70%	31	22.30%
AV. PERF.	139	69	49.80%	70	50.20%	21	15.30%	30	21.40%	60	43.20%	28	20.10%

Table 1: Farmer Characteristics Age-Wise on Mostly Involved Person in Use of Technology: Different Technologies Are Used Differently with Differing Ages M=Male F= Female

	Factor Years	% Rate		Factor Tech	(M) % Rate		Factor Tech	(F) % Rate
R			R			R		
1	36-50YRS	43.20%	1	A.I.	67.60%	1	ROCKET	83.50%
2	18-35 YRS	21.40%	2	Biogas	62.60%	2	SILAGE TU	47.50%
3	> 50YRS	20.10%	3	Silage TU	52.50%	3	BIOGAS	37.40%
4	<18 YRS	15.30%	4	Rocket	16.50%	4	A.I.	32.40%
T		100%			100%			100%

Table 2: The Table Gives Summary of Characteristics Age-Wise Reflecting Ability to Use Technology with Ranking Key: R=Rank; T=Total; M=Male; F=Female; TECH=Technology TU= Tube

3.2. Evaluation of Socio-Cultural Factors Affecting Technology Use

3.2.1. Descriptive Statistics

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Religion	556	1.00	.000	.000
Family type	556	2.02	.035	.822
Educ. level	556	2.32	.041	.963
Infrastructure	556	2.39	.034	.799
Risks/insecurity	556	2.50	.036	.844
Gender issues	556	2.55	.048	1.143
Age	556	2.74	.037	.867
Extension skills	556	2.89	.035	.814
Income leve	556	3.01	.038	.893
Valid N (listwise)	556			

Table 3: Descriptive Statistics Showing the Means and Standard Deviation of Socio-Cultural Factors on Technology Use

3.2.2. Anova Table

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Gender issues	Between Groups	179.142	3	59.714	60.310	.000
	Within Groups	546.547	552	.990		
	Total	725.689	555			
Religion	Between Groups	.000	3	.000	.	.
	Within Groups	.000	552	.000		
	Total	.000	555			
Educ. level	Between Groups	61.532	3	20.511	24.967	.000
	Within Groups	453.482	552	.822		
	Total	515.014	555			
Income leve	Between Groups	158.466	3	52.822	102.481	.000
	Within Groups	284.518	552	.515		
	Total	442.984	555			
Age	Between Groups	.209	3	.070	.092	.964
	Within Groups	417.453	552	.756		
	Total	417.662	555			
Risks/insecurity	Between Groups	55.387	3	18.462	30.008	.000
	Within Groups	339.612	552	.615		
	Total	394.998	555			
Extension skills	Between Groups	48.351	3	16.117	27.844	.000
	Within Groups	319.511	552	.579		
	Total	367.862	555			
Family type	Between Groups	38.351	3	12.784	20.980	.000
	Within Groups	336.345	552	.609		
	Total	374.696	555			
Infrastructure	Between Groups	49.142	3	16.381	29.630	.000
	Within Groups	305.165	552	.553		
	Total	354.308	555			

Table 4: The ANOVA Table Showing the SM of Squares, Degree of Freedom, Means and Significance Levels on Technology Use between and within the Groups on Socio-Cultural Factors

3.2.3. Summary Table for Mean ± SD, Anova Significance Level and LSD Multiple Mean Separations Indicated by Superscripts

Factors	Technologies up Take Scale (1 to 4)				ANOVA p-value
	Biogas	Silage tubes	Rocket "jiko"	A.I	
Gender	1.73±1.28[a]	2.46±0.87[b]	3.32±0.87[c]	2.63±0.90[b]	0.000
Religion	1.00±0.00[a]	1.00±0.00[a]	1.00±0.00[a]	1.00±0.00[a]	
Education level	1.92±1.05[a]	2.39±0.90[c]	2.15±0.83[b]	2.82±0.83[d]	0.000
Income level	3.14±0.74[b]	3.23±0.76[b]	2.12±0.70[a]	3.53±0.66[c]	0.000
Age	2.72±0.99[a]	2.73±0.83[a]	2.73±0.87[a]	2.77±0.77[a]	0.964
Risk/Insecurity	2.45±0.87[b]	2.86±0.79[c]	2.01±0.64[a]	2.68±0.93[c]	0.000
Extension skills	2.44±0.95[a]	2.94±0.71[b]	2.90±0.63[b]	3.27±0.72[c]	0.000
Family type	2.20±0.69[c]	2.33±0.81[c]	1.65±0.77[a]	1.91±0.84[b]	0.000
infrastructure	2.57±0.87[c]	2.38±0.67[b]	1.91±0.63[a]	2.70±0.77[c]	0.000

Table 5: Figures Presented Are Mean ± SD and Figures with Different Superscripts Are Significantly Different while Those with Same Superscripts Are Statistically Similar within and among the Rows and Columns (P<0.05), Age Depicted Statistical Similarity across the Row on All Technologies Fronted

3.3. Determination of Extent of Effects of Socio-Cultural Factors on Use of Technology

The researcher established to what extent these factors affect technology use among smallholder dairy farmers in Trans Nzoia County. A simple percentage calculation was employed based on the number of questionnaires correctly submitted to help determine the extent of technology use gauged against socio-cultural factors so identified. The findings are as stipulated in the subsequent table.

It was found out that all socio-cultural factors had an attachment as far as technology use is concerned. However, Religion was the only factor that did not hold any attachment figure wise in technology use. The calculated percentage weight on extent of use gave gender issue a wide birth leading with 20.9%; income level at 18%; Education level at

17.10%; Extension skills at 14%; Age at 10.10%; Risk/Insecurity at 9.40%; Infrastructure 5.90%; Family type at 4.70% and finally and has been stated, Religion at 0%.

Having identified the socio-cultural factors and now the extent of use, the results corroborate almost proportionately the consistency within which elements operate. On clinical probe, gender had an upper hand because women lay their hand in almost every technology fronted. This revealed the extent of effects of socio-cultural factors in technology use. It is not forgotten that these are inter-related determinants with almost minimal threshold to separate them in terms of analysis method used.

3.3.1. Extent to Socio-Cultural Factors Effects on Technology Use (%) Ranking

SOCIO-CULTURAL FACTORS	TECHNOLOGIES									
	BIO GAS	% USE	SILAGE TUBE	% USE	ROCKET "JIKO"	% USE	A.I.	% USE	AV.TECH.ANALYSIS %	RANK
Gender issues	29	20.90	27	19.40	31	22.30	29	20.90	20.90	1
Religion	0	0	0	0	0	0	0	0	0	9
Education Level	23	16.50	25	18	23	16.50	24	17.30	17.10	3
Income level	25	18	26	18.70	24	17.30	25	18	18	2
Age	14	10.10	13	9.40	15	10.80	14	10.10	10.10	5
Insecurity/Risks	15	10.80	14	10.10	11	7.90	12	8.60	9.40	6
Extension Skills	21	15.10	20	14.40	20	14.40	17	12.20	14	4
Family type	5	3.60	6	4.30	7	5	8	5.80	4.70	8
Infrastructure	7	5.00	8	5.80	8	5.80	10	7.20	5.90	7
	139	100%	139	100%	139	100%	139	100%	100%	

Table 6: Shows Corresponding Socio-Cultural Effects on Technology Use Ranked Percentage-Wise, Gender Issues Ranked First at 20.9% with Family Type the Least at 4.7%. Religion Scored Nil, Thus Has No Effect on Technology Use

3.3.2. Determination of Prefered Technology Use and Why: Aggregated Preference Identity

TECHNOLOGY	YOUTH		RANK	ADULT MEN		RANK	ADULT WOMEN		RANK
	No.	% age		No.	% age		No.	% age	
A.I	20	66.70	1	21	35.60	1	4	8.00	4
Biogas	5	16.70	2	17	28.80	3	13	26	2
"Kuni Mbili"	3	10.00	3	2	16.90	4	23	46	1
Silage Tubes	2	6.70	4	19	32.20	2	10	20	3
		100			100			100	
TOTAL	30			59			50		139

Table 7

Table 7 The table shows aggregated preference identity with "Kuni Mbili" (energy saving "jiko") leading with a massive 46% aligned to females gender-wise. Biogas equally scored better at 26% due to youth, adult male and female involvement. Silage tubes for conservation was 3rd at 20% while last was Artificial Insemination last at 8% but with extensive youth participating for enhancing technology but adult women least as the scenario reflected "payment" involvement by adult men.

3.3.3. Determination of Levels and Effects on Technology Use

An excel sheet was used to analyze and find graphical presentation to the effect. The following were critical revelations (Figure 1) and individual technologies measured on their own (Figures2 to 4).

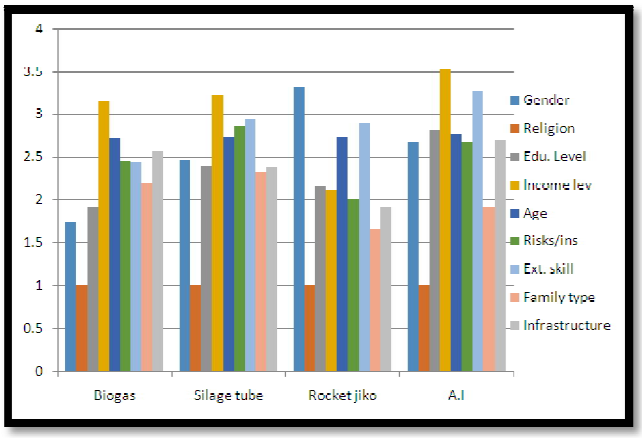

Figure 1
Key: 1= Does Not Affect, 2= Minimal Effect, 3= Moderate Effect and 4= Highly Affect

Figure 1 Determination of levels of technology use. In general, Income levels scored the highest followed by gender, extension skills, Education level, age, infrastructure, risks/insecurity and family type in that order. Religion however has no effects on technology use

3.4. Effects of Socio-Cultural Factors on Use in Individual Technologies

Individual technology: Biogas

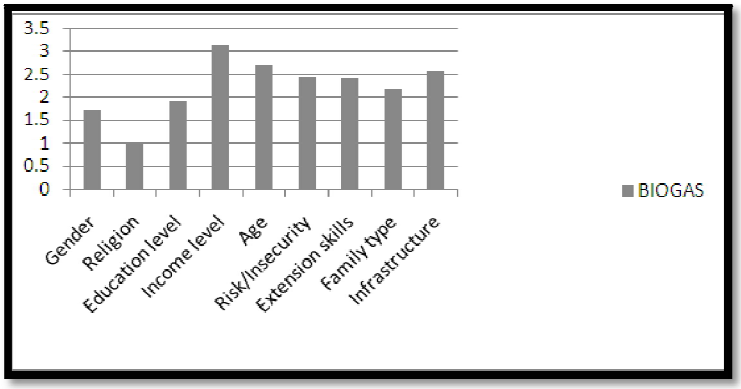

Figure 2: Responses Revealed Income Level Had Highest, Followed by Age, Infrastructure, Extension Skills and Risk/Insecurity Follow, Family Type, Education Level and Gender, Religion Has No Effect

3.5. Silage Tube Technology for Conservation

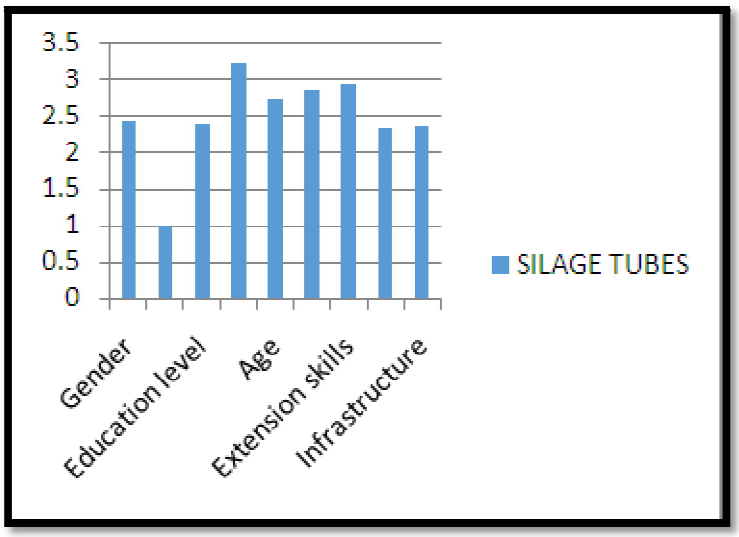

Figure 3: The Effects of Socio-Cultural Factors on Silage Tube for Conservation as a Technology

3.6. Rocket "Jiko" Technology

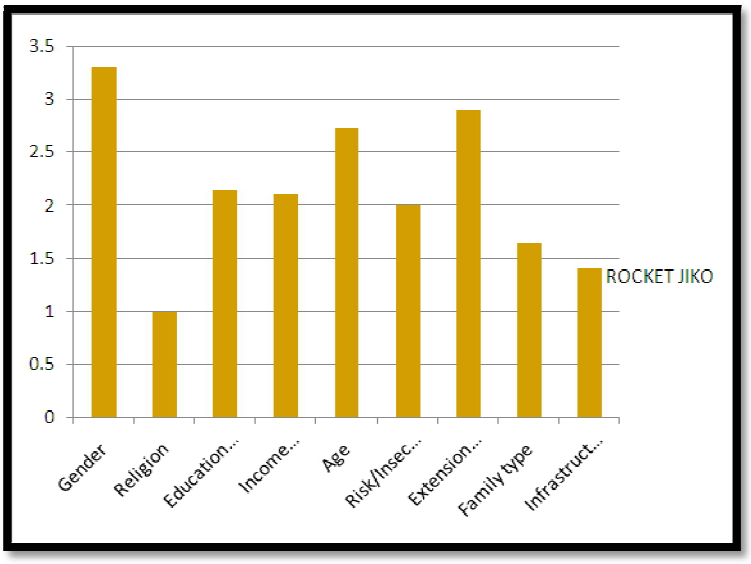

Figure 4: The Effects of Socio-Cultural Factors on Rocket "Jiko" as a Technology

3.7. Artificial Insemination (A.I.) as Technology for in Dairy Cows

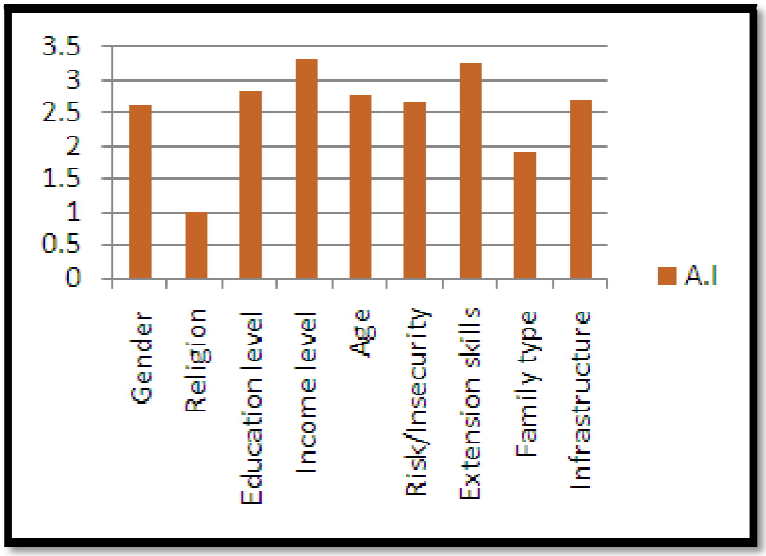

Figure 5: The Effects of Socio-Cultural Factors on Artificial Insemination (A.I) as a Technology

4. Determination/Establishing Socio-Cultural Variations/Relationship and Use of Technology (Generalized)

The strength of relationship differs with each technology and socio-cultural factor in question. Different socio-cultural factors respond differently strength-wise to technology use. There was a positive correlation between socio-cultural factors and technology use.

Determination of variations was done using regression method of analysis to help address as to how do the individual socio-cultural factors vary in relation to technology use among smallholder dairy farms in Trans Nzoia County. The results of regression are as stated below.

A scatter plot of was plotted fitted with regression line, equation and coefficient of determination (R^2) to determine unit measure for possible incremental and variability in use as a result of effects. The findings showed that socio-cultural factors affect technology use. Effects differ with each technology and there was relationship between socio-cultural factors and technology use. There were significant differences in use between technologies and interaction between intervening factors in use at p (< 0.05). Regression equation and (R^2) explained a unit of 1.4914 incremental unit offered and a 76 % variability as result of relationship between socio-cultural factors and technology use.

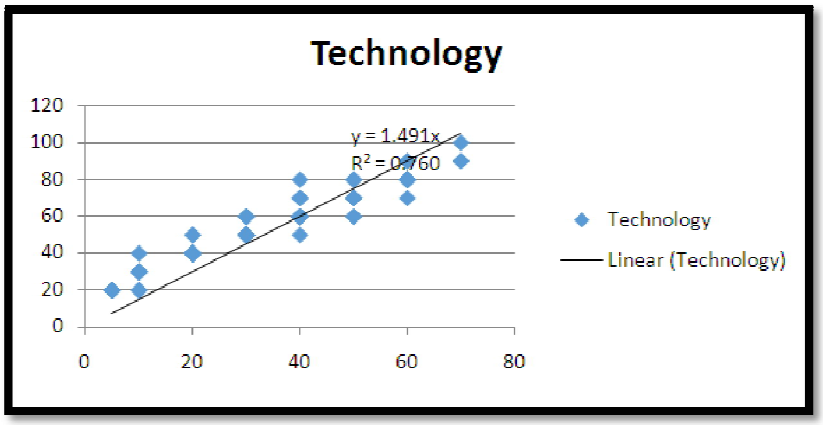

Figure 6: Relationship of socio-cultural factors and technology use
R^2 showed a variability of 76%

4.1. Other Determinants Moderating Gender Based Technology Use

	No.	Biogas		Silage Tubes		Rocket "JIKO"		A.I.		Overall Tech. Analysis On Average	
Determinants		M	F	M	F	M	F	M	F	M	F
Cost	139	78	61	81	58	29	110	88	51	49.60%	50.40%
Package	139	67	72	98	41	47	92	43	96	45.90%	44.10%
Design	139	69	70	87	52	86	53	57	81	53.80%	46.20%
Involvement	139	76	63	97	42	95	44	23	116	52.30%	47.70%
Complexity	139	71	68	85	54	31	108	54	85	43.30%	56.70%
Low Extension	139	57	82	59	80	33	106	83	56	41.70%	58.30%
Infrastructure											
Roads	139	70	69	84	55	63	76	77	62	52.90%	47.10%
Electricity	139	67	72	87	52	0	0	64	75	52.30%	47.70%
Phones	139	70	69	70	69	71	68	76	63	51.60%	48.40%

Table 8: Intervening Determinants Gender-Wise Response on Technology Use

5. Conclusions

There is relationship between socio-cultural factors and technology use. This proves the hypothesis the element of possible effect of socio-cultural factors in technology use. Socio-cultural factors affect technology use and should be effected should project implementation tend to occur. Smallholder dairy farmers prefer some technologies to others. Based on the results, technologies use score differ with every socio-cultural factor in place or factored in the process. Extent of use differs within and without each technology. There is makeable variation in technology use among dairy farmers. Religion does not affect technology use. Females have a hand in every technology fronted but are vulnerable in technology use. Smallholder dairy farmers prefer female extension agents on results, consistency and perseverance. NGOs scores less in extension as institutions mandated with extension score high albeit with reduced frequency. Community members not involved in project design and implementation. County government levies are not affecting technology use as yet. Politicians make most decisions as far as technology use is concerned through involvement in project implementation process than smallholder dairy farmers, the critical players. Youths use technology selectively: elder people lead, eldest selectively, <18 years less interested. Each technology has differing socio-cultural effect. Professional services, field days/shows females lead. Men lead in exchange trips/tours, workshops, trainings. Women are involved in other income generating activities thus feel the pinch of expenditure; a fact that might affect technology use positively or negatively e.g. Rocket “jiko”. Some technologies are complex in nature especially to women whom apparently from statistics have passion to every technology promoted. Extension services are diminishing; the increased levels in women receipts is due to women inclined technology courtesy energy saving "jiko". Orientation of the geographical area may determine the kind of technology to be promoted. Proximity, population, security, sex, experience in technology use, level of education, extension knowledge/skills and economic and/or living standards of the populace determine technology use.

6. Recommendations

Involve community members (all beneficiaries) in project design and implementation process. Train more females adequately for quality service delivery. Adequate training should be done to NGOs’ staff implementing a project. Sensitize

youth and involve them in productive work, technology use and formal land ownership to bridge the gap. Adequate facilitation of implementing agencies mandated by policy extensionists. Need to form/strengthen implementation teams to address the element of inclusivity (men, women and youth). Subsidize levies on milk and milk and products to enhance promotion of technologies. Target policy mandated institutions in extension. Increase the number of trained women in the field of expertise in context of increased technology use. Opportunities availed for women to improve on education standards in conformity/cope with increased/ changing dynamics in technologies. Simplify the technology package to help increase use of the same. Involvement of beneficiaries' key in improving technology use. Availability of design and documents help bring about ownership and increase sustainability dimension (beneficiary contribution) and role to play in conformity with socio-cultural issues from the onset. Infrastructure key to technology use depending on the technology being promoted-e.g. Road and phone...Electricity being at higher levels on the business hub as cooling and packaging (value addition).

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