Does TV edutainment lead to farmers changing their agricultural practices aiming at increasing productivity?

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1 **Does TV edutainment lead to farmers changing their agricultural practices aiming at**

2 **increasing productivity?**

3 **Abstract**

4 We investigate the influence of an agricultural TV edutainment programme on farmers'

5 decisions to implement changes of agricultural practices. We use data obtained from a survey

6 conducted to 1,572 households in Kenya across the target areas of a TV edutainment

7 programme, Shamba-Shape-Up (SSU). A conceptual framework is developed to account for

8 the interaction between farmers watching SSU internal factors including farmer's and

9 household's characteristics, farmer's views on farming and farmer's trust on sources of

10 influence and farmer's decision to change their agricultural practices. Structural equations

11 and probit models are used to understand how watching edutainment TV programme Shamba

12 Shape-Up (SSU) along with farmers and household's characteristics, famer's views on

13 farming and farmer's trust on sources of information affect maize and dairy farmer's

14 probability to make changes to agricultural practices shown in SSU. We find that SSU has an

15 influence on maize and dairy farmers' decisions to implement changes of agricultural

16 practices. Farmers who watch SSU have a higher probability to implement a greater number

17 of agricultural practices. However, SSU influence varies depending on the agricultural

18 practice recommended as well as on the reasons that farmers have for watching the

19 programme. The probability of implementing agricultural practices shown on SSU was

20 dependent the associated difficulty of making such changes. Edutainment TV can be a viable

21 channel to nudge farmers to implement practices that contribute to face local and global

22 challenges such as adapting and mitigating climate change, poverty reduction, increasing

23 productivity and income of smallholders in developing countries.

24

25   **Key words:** Edutainment, agricultural practices, Shamba Shape-Up

26   **1. Introduction**

27   Increasing the number of changes farmers make in their agricultural practices that aim at

28   increasing productivity and producing sustainable outputs by farmers is key to achieving

29   Sustainable Development Goals such as no poverty and zero hunger (Pretty et al., 2003).

30   Importantly, food insecurity and poverty are interconnected with other important issues such

31   as undernourishment, which affect significant parts of the population in developing countries.

32   For instance, in Sub-Saharan Africa undernourishment affected 22.7% of the population in

33   2016 (FAO and OCDE, 2018). Increasing smallholder farmers' income and adapting to

34   climate change to mitigate its effects on food security through the use of more productive and

35   sustainable agricultural practices is crucial to solve not only food security but also contributes

36   to tackle poverty and undernourishment. In order to increase farmers' use of such beneficial

37   practices, understanding the reasons behind farmer's decision (whether or not to make a

38   change) is key. Typically, studies investigating the determinants of the innovation in

39   smallholder agriculture put emphasis on how socio-economic characteristics of the

40   household/farmer, sources of information and risk aspects influence farmer's decisions

41   regarding the use of new farming practices (i.e. innovation) (Boucher et al., 2008; DEFRA,

42   2019). Attention has been paid to how membership of agricultural organisations (e.g. unions,

43   cooperatives, etc.) and access to financial services (e.g. institutional credit provisions) may

44   influence farmers' adoption of agricultural practices in Sub Saharan Africa (Abate et al.,

45   2016; Abebaw and Haile, 2013a; Teklewold et al., 2013) but other aspects, such as policy

46   measures (Areal et al., 2012) and their impact on innovation have received relatively less

47   attention.

48   One channel, which has received little attention so far but may contribute to increasing

49   innovation and agricultural productivity is the broadcast of TV edutainment programmes

50   aimed at showing farmers solutions to agricultural problems. Therefore, TV edutainment

51   programmes can potentially influence farmer's decision to implement more productive and

52   sustainable agricultural practices (Clarkson et al., 2018).

53   Edutainment, a term that refers to TV programmes, computer games, internet sites, videos

54   and films, workshops, theme parks that mix entertainment and education material, has a

55   number of qualities such as helping learners, focusing the attention and facilitating

56   individuals internalising difficult subjects with the simulation and visual methods

57   representing real life conditions (de Fossard, 2008; Okan, 2003). Although edutainment is

58   usually referred to children educational programmes it can target all ages through

59   edutainment TV shows, DIY, theme park style educational centres (Creighton, 2007) and

60   events such as educational workshops (Feenstra et al., 2015). TV edutainment or educational

61   TV, which refers to TV programmes that mix entertainment to educational material (Colace

62   et al., 2006), has risen worldwide seeking to increase programmes' audience by capturing

63   viewers with entertainment motives rather than educational motives to watch the programme

64   (Caraher et al., 2009). The effects of edutainment TV shows has been examined from

65   different perspectives with relationships between watching edutainment TV shows and

66   changes in habits being found (De Backer and Hudders, 2016; Dway et al., 2015; Flora et al.,

67   2014; Forster et al., 2016; Jana et al., 2015; Jenkins et al., 2012). There are a number of TV

68   edutainment programmes in Sub-Sahara African countries such as Kuapa in Ghana and

69   Kilimo Biashara, Shamba Shape Up (SSU) and Mazingira 24 in Kenya which aim to help

70   farmers increase their productivity by showing them how to implement agricultural practices.

71   Little research has been done so far on the effects of TV edutainment on agriculture

72   productivity (Clarkson et al., 2018). One exception is the work by Clarkson et al. (2018) who

73 estimated that the interaction of Kenyan farmers with one edutainment TV program, SSU in

74 Kenya, benefitted 430,000 farmers through increased income and / or a range of related social

75 benefits.

76 Here, we analyse how the implementation of agricultural practices, recommended in SSU, a

77 TV edutainment program, by maize and dairy farmers in Kenya may be associated with

78 watching the SSU TV edutainment programme and reasons for watching the programme

79 amongst other factors including farmer's and household's characteristics, farmer's views on

80 farming and farmer's trust on sources of influence. SSU goes beyond the broadcasting of

81 information, from a pre-scripted lecture or documentary. It brings experts to a farm

82 household so that the audience is able to watch the interactions between farmers and experts,

83 understanding and empathising with the farmer and hoping to see a positive way forward for

84 the farm. If the farm has been chosen well then the audience will identify with the situation

85 and the challenges, doubts and aspirations of the host household.

86 Kenya is a useful location to explore the role of edutainment in agricultural development

87 since the SSU programme is broadcasted to important agricultural areas of the country. To

88 our knowledge this is the second paper that investigates edutainment within the agricultural

89 context and it is the first to examine ways in which farmers engage to the SSU TV

90 programme and how these may be associated with favouring or discouraging the

91 implementation of agricultural technologies. Although SSU covers a wide range of topics

92 across the agricultural spectrum we focus our analysis on recommendations made to maize

93 and dairy farmers using information obtained through a questionnaire disseminated to maize

94 and dairy farmers who are watchers and non-watchers of SSU. We measure the changes of

95 farmer's agricultural practices to those shown in the edutainment programme in two ways: 1)

96 change as a whole: farmers implementing a relatively large number of practices during the

97 last 12 months/season and 2) a specific change: farmers implementing a specific agricultural

4

98 practice. Using these we investigate the association between watching SSU and farmers'

99 reasons for watching SSU as well as other as at the household level as well as the community

100 level (e.g. other sources of information) with such changes in agricultural practices.

101 1.1 Shamba Shape up (SSU)

102 SSU is a makeover educational TV programme broadcast on Citizen Television, in Kenya in

103 39 weekly, 30 minute instalments throughout the main cropping season. Each episode is

104 broadcast twice a week, once in Swahili (on Sunday afternoon) and once in English (on

105 Saturday afternoon). Each weekly instalment consists of a visit to a selected farm (Shamba)

106 where current issues and problems facing a host farmer and household are discussed.

107 Solutions and opportunities are identified with the help of experts. Potential changes to the

108 farm enterprises are explored through demonstration and explanation. In some cases, a

109 contribution to the costs of making changes to effect solutions is paid by SSU. Each SSU

110 instalment covers up to five topics broadly relevant to the stage of the cropping season when

111 the broadcast takes place. SSU covers a wide range of topics across the agricultural

112 spectrum. The programme also broadcasts widely in Tanzania and less widely in Uganda.

113 The following sections are dedicated to the description of the methodology and empirical

114 approaches used, the data, presentation of the results and a final section that concludes.

115

116 **2. Materials and methods**

117 Factors influencing farming decisions taken by farm households can be classified into

118 external factors such as world/regional economic situation, market conditions and physical

119 infrastructures, international and national political situation as well as seasonal and weather

120 factors, and internal factors: farm household's characteristics, composition, access to

121 resources, attitudes to risk and its goals. In addition, farm household decisions can be

122 influenced by household members interacting with sources of information and influence.

123 Examples of these are their own network of family and friends, mass media, general public,

124 NGOs and commercial providers of information. SSU is both a source of information and

125 influence on farmer's decisions to use more productive and sustainable agricultural practices

126 and a potential source of influence on other innovation system actors (input dealers, extension

127 workers, traders, etc…). We focus here on the interaction between the internal factors and

128 farmer's decision to change the agricultural practices used. We acknowledge that this study

129 could be framed into existing theories such as the theory of reasoned action (Fishbein, 1967),

130 theory of planned behaviour (Ajzen, 1991, 1987, 1985) and the technology acceptance model

131 (Davis, 1989; Davis et al., 1989), however, although elements included in these theories such

132 as attitudes, subjective norms and perceived behavioural control, perceived usefulness and

133 perceived ease of use can be identified under our approach we decided to use a different

134 structure that puts emphasis on the association between edutainment TV, reasons to watch the

135 edutainment programme and farmer's behaviour (implementing agricultural practices).

136

137 *2.1 Conceptual framework*

138 We developed a framework for making changes in agricultural practices by farm households

139 including potential drivers on farmer's decisions to change their current agricultural practices

140 for those shown in the SSU TV programme (Figure 1). Figure 1 shows which elements may

141 influence change along with the methodological steps followed.

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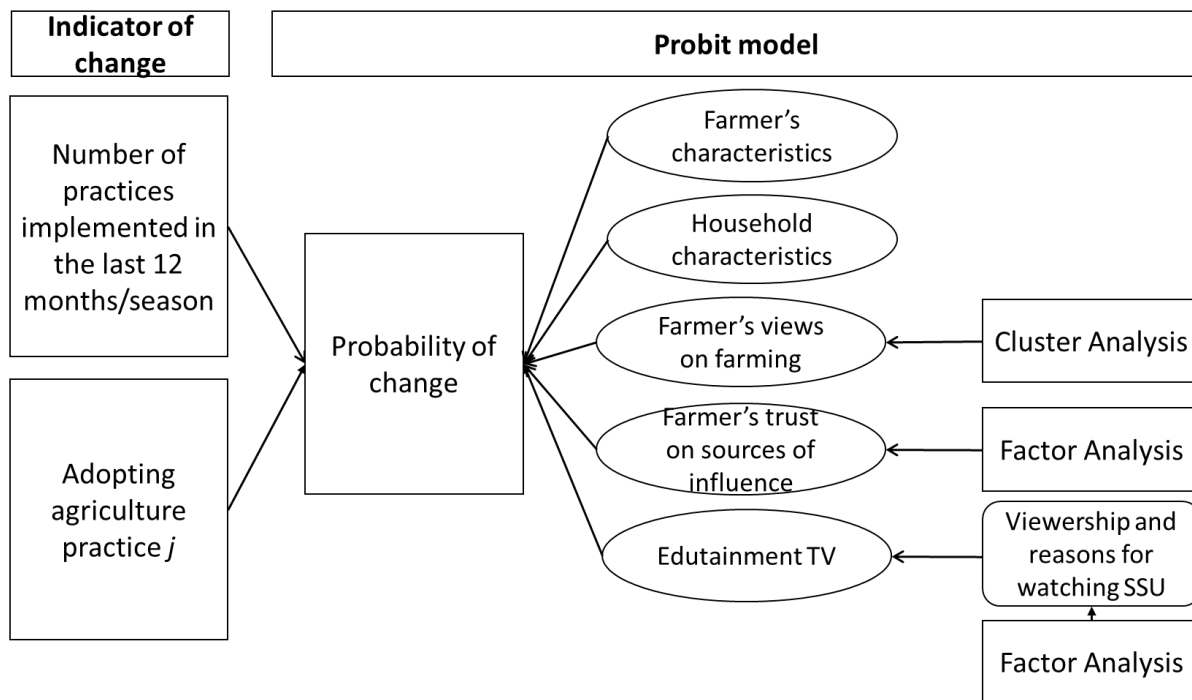
Figure 1. Framework for making changes in agricultural practices

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152   We use the total number of agricultural practices implemented/applied/changed during the

153   last season (maize) and during the last 12 months (dairy) as an indicator of farmers changing

154   agricultural practices. This indicator gives us a "broad" picture on the farmer's decision to

155   make changes to their agricultural practices. We use a second indicator, which accounts for a

156   farmer's decision to implement individual agricultural practices. This gives us a "specific"

157   picture on which agricultural practices farmers are more likely to change and the reasons for

158   these changes.

159

160   Agricultural practices shown on the SSU TV programme are shown in table 1 for maize and

161   dairy enterprises.

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165   Table 1: Specific agricultural practices promoted by SSU in maize and dairy enterprises

166

Maize Practices	Dairy Practices
Apply fertilizer at planting	Increase the size of your dairy herd
Apply fertilizer mixed with manure at planting	Plant Napier Grass for the first time
Apply manure at planting	Increase the area of Napier Grass
Purchase maize seed from a agro-dealer/shop	Feed cows using chopped Napier Grass
Plant a crop in your maize plot as an intercrop	Spray dairy cows for ticks or lice
Purchased packed seeds for intercropping from a shop/agro dealer	Deworm your dairy cows
Planted your maize at this distance 2.5 feet/75cm between rows and 1 foot/30cm between plants	Treat for mastitis
Apply top dressing fertilizer	Make and feed hay
Weed your maize two times (or more)	Make and feed silage
Planted Desmodium in the maize field	Purchase supplement feeds or salt licks
Use Actellic in your stored maize	Ensure cows have enough water all day
Test the soil in your farm	Since March 2012 Construct a new dairy shed with a floor, easy to clean, has dry space for the cow and is protected against wind
	Since March 2012 Make improvements to your dairy cow shed so that it is easy to clean, has dry space for the cow and is protected against wind

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170   Hence we interpret change in agricultural practices in two ways: the first is change as farmer

171   implementing a relatively large number of practices during the last 12 months/season. Under

172   this view, we classify farmers into two groups: those who uptake a substantial number of

173   practices during the last 12 months/season[1] (i.e. the number of practices implemented is

174   above the median) and those who do not (i.e. the number of practices implemented is below

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[1] The median values for number of practices implemented for maize and dairy farmers are 3 and 4 respectively. Therefore two variables were created: changes maize taking a value of 1 if the number of changes is greater than 3 and takes a value of 0 otherwise and changes dairy which takes a value of 1 if the number of practices implemented is greater than 4 and takes a value of 0 otherwise.

175   the median). The second way we interpret change is as a change at the specific agricultural

176   practice level (i.e. a farmer would change if she or he implements a particular agricultural

177   practice). In this case, we analyse change at a practice level rather than at change as a whole

178   (i.e. large number of practices). Whereas the first approach allows us to investigate whether a

179   farmer has made a significant number of changes and what factors, including TV edutainment

180   measured as SSU viewership, are associated to these changes the second approach allows us

181   to investigate in which of all agricultural practices analysed changes have occurred, and what

182   factors are associated to them, again focusing on whether TV edutainment is associated with

183   change in agricultural practices. More specifically, the probability of changing current

184   agricultural practices (i.e. the probability of implementing a relatively large number of

185   practices; the probability of implementing a particular agricultural practice) is explained

186   through a number of explanatory variables that account for farmer characteristics (farmer's

187   age, gender, education level and income), household characteristics (household female ratio,

188   household children ratio), farmer's general views on farming, their level of trust in sources of

189   influence of change and SSU viewership. We use SSU viewership as an indicator of

190   edutainment that enables us to test whether edutainment (i.e. watching SSU) is associated

191   with changes in agricultural practices. Farmer´s level of education is taken into account using

192   dummy variables (no formal education, primary education, secondary education, college after

193   secondary and university). Farmer income, measured through the Progress out of Poverty

194   Index (PPI[2]), is included in the model using three dummy variables: *low* PPI that takes a

195   value of 1 if their PPI score is lower than 40 and 0 otherwise; *normal* PPI takes a value of 1 if

196   their PPI score is between 40 and 69 and takes a value of 0 otherwise; *high* PPI takes a value

197   of 1 if their PPI is greater than 70 and 0 otherwise[3]. Household characteristics include the

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[2] In October 2017 the PPI was rebranded to Poverty Probability Index http://www.progressoutofpoverty.org

[3] The figures determining the PPI groups are the quartiles of the distribution of the PPI in the sample.

198   household female ratio (number of adult women divided by total number of adults in the

199   household), household children ratio (number of children in the household divided by the

200   total number of members in the household), household income is captured by the PPI

201   indicator. Farmer's general views and attitudes towards farming are incorporated after

202   conducting a cluster analysis. A cluster analysis (CA), a statistical method for identifying

203   homogenous groups of objects called clusters, was performed on the statements related to

204   farmers' perceptions and views on farming in general. The aim of conducting this analysis

205   was to group farmers into two distinct groups according to their general perceptions and

206   views on farming. For this we used a partitioning method (more precisely, k-means)[4].

207   A factor analysis (principal component analysis) was used to group sources of information

208   into relatively small common themes. We also collected information on farmer's reasons for

209   watching SSU. Farmers had to explain their reasons for watching SSU through scoring 13 1-5

210   Likert scale statements[5]. A factor analysis (principal component analysis) was used to group

211   reasons for watching SSU into relatively small common reasons. These themes and reasons

212   obtained from a factor analysis conducted on sources of information and reasons for watching

213   SSU were then incorporated in the model as explanatory variables[6].

214

215   *2.2 Survey and questionnaire*

216   A survey was conducted with 1,572 households across the target areas of SSU viewership

217   with 893 SSU-viewers and 679 non-viewers. Prior to the survey a listing survey was

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[4] See Table A.1 in Appendix for correlations between statements. Variables used in the cluster analysis are not highly correlated (<0.9) which would be problematic. See Table A.2 in Appendix for average scores regarding farmer's views and attitudes towards farming by cluster

[5] We initially developed 20 statements during the conceptualisation of the problem stage. We piloted the questionnaire with the initial 20 statements after which the research team re-evaluated the statements, refined them and reduced their number to the final 13 statements.

[6] Factors were extracted for eigenvalues greater than one and varimax rotation was adopted, which guarantees that the obtained factors are orthogonal reducing the risk of multicollinearity in the probit models.

218   conducted with 9,885 households in 119 Enumeration Areas (EAs) randomly selected. This

219   was necessary to accurately establish the level of TV ownership and SSU viewership in the

220   designated study area, as there were previously no definitive figures on TV ownership or the

221   number of people watching SSU in the area. The classification between SSU-viewers and

222   SSU non-viewers was based on respondents' statements as to whether they were SSU

223   viewers or not. The survey specifically targeted selected regions of Kenya based on SSU

224   broadcasting areas as outlined by Mediae[7] (figure 2).

225

226   Figure 2. Map of Kenya highlighting study area

227

[7] Mediae (www.mediae.org) are the producers of Shamba Shape Up. Mediae provided with information on the regions where SSU was broadcasted in Kenya.

228   Data collection began on 17th April 2014 and ran through to 30th May 2014 using a

229   questionnaire. On average a personal interview with a farmer took 80 minutes. The

230   questionnaire consisted of a number of sections including socio-economic characteristics of

231   the household; SSU processes and influences; farmer influencing sources; perceptions and

232   views about SSU including (i.e. reasons to watch SSU); general perceptions and views about

233   farming; level of trust on sources of information. One to five Likert scales were used in

234   questions related to perceptions and views about SSU and general perceptions and views

235   about farming. The questionnaire was inputted into Survey to go - PC Surveyor, which is an

236   application for conducting surveys.

237   The practices recommended and demonstrated by SSU differ by enterprise and only the most

238   commonly promoted practices were analysed. Overall 12 practices were analysed for maize

239   and 13 for dairy (table 1)[8].

240   Table 2 shows the descriptive statistics of the data used in the analysis.

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[8] These agricultural practices are not new, they have been promoted in the locations covered by a range of organisations.

Table 2. Descriptive statistics

Maize			Dairy		
Variable	**Mean**	**SD**	**Variable**	**Mean**	**SD**
# Changes	0.52	0.50	# Changes	0.40	0.49
Apply fertiliser at planting	0.53	0.50	Increase the size of your dairy herd	0.18	0.38
Apply fertukuser mixed with manure at planting	0.08	0.27	Increase the area of Napier Grass	0.15	0.35
Apply manure at planting	0.21	0.40	Feed cows using chopped Napier Grass	0.46	0.50
Purchase maize seed from agr-dealer/shop	0.61	0.49	Spray dairy cows for ticks or lice	0.74	0.44
Plant a crop in your maize plot as an intercrop	0.48	0.50	Deworm your dairy cows	0.83	0.38
Purchased packed seeds for intercropping from a shop/agro dealer	0.11	0.31	Treat for mastitis	0.15	0.36
Planted your maize at this distance 2.5 feet/75 cm between rows and 1 foot/30cm between plants	0.28	0.45	Purchase supplement feeds or salt licks	0.65	0.48
Apply top dressing fertiliser	0.35	0.48	Ensure cows have enough water all day	0.56	0.50
Weed your maize two times (or more)	0.57	0.50	SSUviewers	0.59	0.50
Use Actellic in your stored maize	0.18	0.39	F1 - Education/Usefulness/Empathy	2.93	0.71
SSUviewers	0.57	0.50	F2 - Entertainment/fun	2.55	0.68
F1 - Education/Usefulness (empathy - dairy)	2.99	0.68	F3 - Entertainment/frinends	2.38	0.67
F2 - Empathy	2.88	0.64	Media_trust (TV news, magazine)	-7.E-03	1.00
F3 - Entertainment/fun	2.79	0.72	External1_trust (Agro-dealers/shopkeeper/agrivet)	0.08	0.98
F4 - Entertainment/friends	2.15	0.70	External2_trust (NGO/Agriculture extension officer)	0.03	0.96
Media_trust (TV news, magazine)	-9.E-03	1.01	Traditional_trust (friends/family)	0.06	1.02

External1_trust (Agro-dealers/shopkeeper/agrivet)	-2.E-03	1.00	Farmer´s Age	45.90	14.72
External2_trust (NGO/Agriculture extension officer)	-0.01	1.00	Gender	0.46	0.50
Traditional_trust (friends/family)	9.E-04	0.99	Primary education	0.45	0.50
Farmer´s Age	43.35	14.41	Secondary education	0.34	0.47
Gender	0.49	0.59	College after secondary/University	0.15	0.36
Primary education	0.46	0.49	Cluster F1 (farming as a business, enjoying farming)	0.43	0.50
Secondary education	0.33	0.47	HH female ratio	0.51	0.20
College after secondary/University	0.15	0.36	HH children ratio	0.40	0.23
Cluster F1 (farming as a business, enjoying farming)	0.44	0.50	Cropland area/number of cows	2.11	2.61
HH female ratio	0.51	0.21	Normal PPI	0.60	0.49
HH children ratio	0.41	0.23	High PPI	0.28	0.45
Cropland area/number of cows	1.76	2.28			
Normal PPI	0.58	0.49			
High PPI	0.28	0.45			

242

2.3 Statistical analysis

The information collected through the survey regarding a) farmers' perceptions and views on farming; b) farmers' level of trust in sources of information; and c) farmers' reasons for watching the edutainment TV programme SSU was organised and simplified by using cluster analyses and factor component analysis and incorporated into models to explain the farmer's probability of changing current agricultural practices. This enabled us to find factors behind reasons for watching SSU such as education/usefulness; empathy with farmers appearing in the programme; entertainment/fun and entertainment associated to watching the programme in company of friends. Hence, we are able to investigate how the different ways that SSU has to engage with audiences (e.g. through education, entertainment, empathy) may influence farmer's decision to implement agricultural practices shown in the TV programme.

We conduct two separate analyses, one for each indicator (total number of agricultural practices changes and changes of specific agricultural practices). Firstly, two simultaneous equations models (SEMs), one for maize and one for dairy, based on the number of agricultural practices implemented in the last 12 months/season were estimated. Secondly, a set of SEMs analysing relevant individual agricultural practice (for maize and for dairy) were estimated. By using SEM for a dichotomous endogenous variable we deal with a particular problem of endogeneity, simultaneity. This approach allows us to test whether the probability of implementing agricultural practices and being a SSU viewer are jointly determined (i.e. the errors of both equations (1) and (2) below are correlated). In the case that implementing agricultural practices and being a SSU viewer are jointly determined we provide results from the SEM; otherwise we provide the results for the probit regressions (1) and (2) below[9].

These SEMs can be described as follows:

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[9] z_i is exogenous if the error term in equation (1), ε_i is uncorrelated with the error term in equation (2), ξ_i . We tested whether this correlation is 0 or not. If they are correlated we analyse a SEMs, otherwise we analyse two probit models.

266

$$y_i = x_i\beta + z_i\gamma + \varepsilon_i \quad (1)$$

267

$$z_i = x_i\delta + v_i\theta + \xi_i \quad (2)$$

268

269   where y_i, depending on the type of model, can be the probability of farmer i implementing a

270   number of agricultural practices (i.e. a number of practices greater than the sample median of

271   number of practices implemented in the last 12 months/season) or the probability of farmer i

272   implementing a particular agricultural practice in the last 12 months/season; x_i is a

273    $1 \times k$ vector of exogenous explanatory variables for farmer i; z_i is a $1 \times k$ vector of

274   endogenous variable(s) for individual i; v_i is a $1 \times m$ vector of variable(s) that explain z_i

275   (apart from x_i) for individual i; $\beta, \gamma, \delta,$ and θ are vectors of parameters to be estimated; and

276   ε_i and ξ_i are error terms. A test for exogeneity of z is equivalent to test whether ε_i and ξ_i are

277   independent ($H_0: \rho = 0$; ρ being the correlation between ε_i and ξ_i) (Cameron and Trivedi,

278   2010). As pointed out above if ε_i and ξ_i are found to be correlated SEMs estimates are

279   reported, otherwise (i.e. if evidence of simultaneity is not found) probit estimates are

280   reported.

281   All explanatory variables (x_i and v_i) in the model are treated as exogenous variables except

282   for SSU viewership (z_i) which is treated as endogenous for the following reason[10]. Since our

283   aim is to study whether watching SSU leads to change (i.e. increasing likelihood of

284   implementing new agricultural practices) we are concerned that the explanatory variable SSU

285   viewership may be correlated with other factors that can affect change. In order to control for

286   this form of endogeneity we use information about whether the farmer has a TV and it is in a

287   working condition as an instrumental variable for explaining SSU viewership (i.e. the

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[10] An exogenous variable is defined as any variable that is uncorrelated with the error term in the model. In other words, an exogenous variable is any variable that is assumed to be determined outside the model. On the other hand, an endogenous variable is any variable that is presumed to be correlated with the error term in the model.

288 likelihood of implementing a greater number of practices/ a particular practice is

289 simultaneously explained with SSU viewership)[11]. Consequently, we generated a dummy

290 variable, TV works, that takes a value of 1 if the household has a TV set that is in working

291 condition and takes a value of 0 otherwise.

292

293 **3. Results and discussion**

294 We first present the results for the elements that are integrated as explanatory variables in

295 the models described above (equations (1) and (2)) through the use of cluster and factor

296 analysis[12]. These are farmers' perceptions and views on farming; farmers' level of trust on

297 sources of information and farmers' reasons for watching the edutainment TV programme

298 SSU. Then we present and discuss the results of the 2 models for a) explaining the number

299 of agricultural practices implemented in the last 12 months/season, and b) explaining the

300 specific agricultural practices implemented in the last 12 months/season.

301

302

303 *3.1 Farmers' perceptions and views on farming*

304 We identified two distinct groups, F1 and F2 using cluster analysis (Figure 3 and Appendix 1

305 and 2). Group F1 includes farmers who are relatively more positive about trying new things,

306 enjoying farming, seeing farming as a business and as a way to feed the HH whereas group

307 F2 is formed by farmers who tend to think more that their farm is too small to care about

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[11] We selected the variable having a TV in working condition since is unlikely to be correlated with any unobservable factors influencing the dependent variable (i.e. the probability of implementing a number of agricultural practices or the probability of a particular agricultural practice in the last 12 months/season).
[12] Previous work on adoption of multiple agricultural practices has put emphasis on accounting for the possibility that adoption of different agricultural practices may be correlated (Teklewold et al., 2013). We have estimated a multivariate probit model (Cappellari and Jenkins, 2003) for dairy agricultural practices, which does not show signs of endogeneity. Results are similar to the ones presented here with no significant changes in the estimated coefficients, with the exception that SSU viewers are more likely of deworm their dairy cows at 10% significance level.

308 making changes; find relatively more difficulties in knowing who to contact about inputs and

309 materials; and farmers who are relatively more sceptical that new technologies will work. We

310 use a dummy variable that takes a value of 1 if the farmer is classified as belonging to cluster

311 F1 and takes a value of 0 otherwise.

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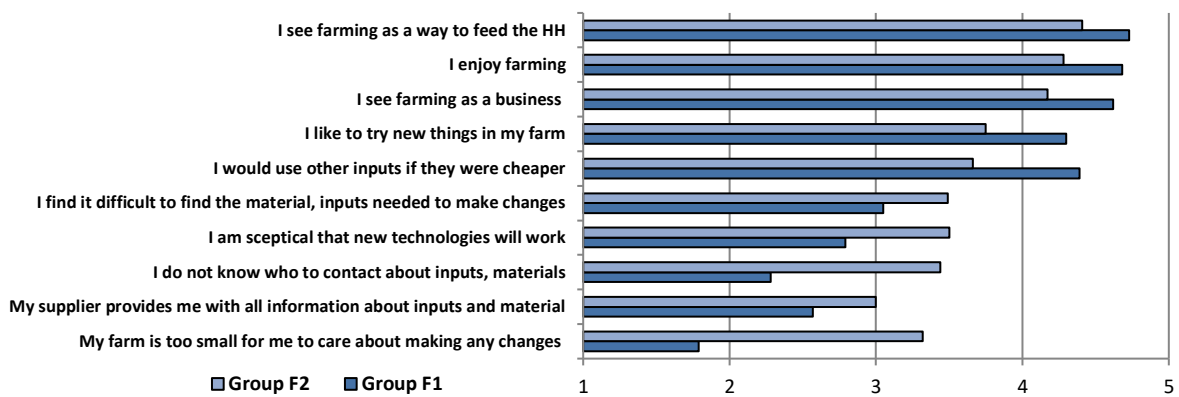
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315 Figure 3: Average score to statements related to farming by cluster

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317 *3.2 Farmers' level of trust in sources of information*

318

319 The analysis of the sources of influence on change is focused on level of trust in sources of

320 information including farmer's social network and additional media of information. We asked

321 farmers to evaluate their level of trust in sources of information such as: family and friends,

322 agricultural extension officers, agro-dealers/shopkeepers, agro-vets and religious institutions,

323 non-governmental organisations, radio, TV news programmes, SSU TV programme, other

324 farming programmes, newspapers-magazines.

325 Principal component analysis produced a four factor solution which explains 67.8% of the

326 total variance on the level of trust on sources of information[13]. Table 3 shows the factor

327 loadings obtained for the rotated component matrices. The first factor (Media_trust) is

328 associated with trust in sources related to general media (i.e. TV news programme, other TV

329 programme on agricultural issues, newspapers/magazines); the second factor

330 (External1_trust) is associated with trust in sources of information that involve the farmer

331 usually contacting these sources (agro-dealers/shopkeepers, agri-vets); the third component

332 (External2_trust) is associated with trust on sources of information that usually come to the

333 farm to provide advice (agricultural extension officers and NGOs) whereas the fourth

334 component (Traditional_trust) is associated with trust on traditional sources of information

335 such as radio and friends and family.

336 **Table 3: Factor loadings for level of trust on information sources**

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	Factor 1	Factor 2	Factor 3	Factor 4
TV news programme	0.82			
Other TV programme	0.83			
Newspaper/magazine	0.70			
Agro-dealers/shopkeeper		0.87		
Agrivet		0.84		
Agricultural extension officer			0.76	
NGO			0.64	
Religious Institution			-0.47	
Friends or family				0.90
Radio				0.46

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344 *Farmers' reasons for watching the edutainment TV programme SSU*

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[13] The Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser, 1970) was 0.80 indicating the convenience of conducting factor analysis.

345 Farmers who were viewers the edutainment TV programme were further asked about the

346 reasons behind watching SSU. Farmers were asked to evaluate a total of 13 statements by

347 scoring using a 1 to 5 Likert scale, being 1 completely disagree and 5 completely agree. We

348 conducted another principal component analysis to group the different reasons for farmers

349 watching SSU into relatively small common themes that represent the relationship of farmers

350 and the TV programme[14]. Tables 4 and 5 show the factor loadings for maize and dairy

351 farmer´s watching SSU, respectively. A total of four and three factors were found that explain

352 56% and 48% of the variance on the reasons for maize and dairy farmers to watch SSU TV

353 edutainment programme, respectively.

354 The first factor for maize farmers is related to the farmer finding the programme useful in

355 terms of new learning and decision making. Statements such as "I like SSU because it gives

356 me ideas which I try", "I watch SSU because it helps me to make decisions" and "I believe I

357 learn new things about farming when I watch SSU" are the top reasons within this factor.

358 Hence the first factor covers one aspect of TV edutainment, which is the educational part.

359 The second factor for maize farmers is associated with the empathy felt by farmers when

360 watching the programme with the farmers and their families. This second aspect identified

361 has nothing to do with education nor entertainment but the farmer feeling engaged through

362 sensitive aspects related to care and empathy with farmers appearing on the show. The third

363 aspect relates to the fun/entertainment part of the programme, whereas the last factor

364 highlights other part of the entertainment feature of the programme. This fourth factor

365 touches on being entertained because the farmer finds the presenters likeable and because the

366 programme is watched in a public place (i.e. with others).

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[14] The Kaiser-Meyer-Olkin measure for maize and dairy were 0.82 indicating the convenience of conducting factor analysis.

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Table 4: Factor loadings for reasons to watch SSU TV edutainment -maize farmers

Statements	Factor1	Factor2	Factor3	Factor4
I like Shamba Shape-Up because it gives me ideas which I try	0.82			
I watch Shamba Shape-Up because it helps me to make decisions	0.71			
I believe I learn new things about farming when I watch Shamba shape up	0.71			
I watch SSU because I know I am going to get useful information	0.47			-0.41
Shamba Shape-up makes me feel happy	0.43		0.51	
I care about families shown in the Shamba Shape-Up TV programme		0.79		
I get emotional/involved when I see the problems farmers face in the SSU TV programme		0.70		
I identify with the problems farmers face in Shamba Shape-up TV programme		0.66		
I always think of other farmers I know when I watch the Shamba Shape-Up programme		0.44		
I like Shamba Shape-Up because it is fun to watch			0.77	
I find useful that I can text or call Shamba Shape-UP to ask questions			0.59	
I enjoy watching Shamba Shape-Up TV programme with others in a public place				0.79
I watch Shamba Shape-Up mainly because I like the presenters				0.70

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372   Regarding dairy farmers, three factors were identified to be behind watching SSU (Table 4).

373   In this case, farmer's decision to watch SSU is mainly due to the perceived usefulness of the

374   programme, the two aspects related to entertainment identified for the maize farms: "…it is

375   fun to watch" and the entertainment related to watching the programme with others in a

376   public place and finding the presenters likeable.

377   As for farmer's level of trust in sources of information, the farmer's reasons for watching

378   SSU were incorporated into the in the model as explanatory variables.

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Table 5: Factor loadings for reasons to watch SSU TV edutainment -dairy farmers

Statements	Factor1	Factor2	Factor3
I like Shamba Shape-Up because it gives me ideas which I try	0.73		
I watch Shamba Shape-Up because it helps me to make decisions	0.68		
I believe I learn new things about farming when I watch Shamba shape up	0.65		
I watch SSU because I know I am going to get useful information	0.59		
I identify with the problems farmers face in Shamba Shape-up TV programme	0.58		
I care about families shown in the Shamba Shape-Up TV programme	0.53		
I get emotional/involved when I see the problems farmers face in the SSU TV programme	0.53		
I always think of other farmers I know when I watch the Shamba Shape-Up programme	0.50		
I like Shamba Shape-Up because it is fun to watch		0.75	
I find useful that I can text or call Shamba Shape-UP to ask questions		0.58	
Shamba Shape-up makes me feel happy		0.58	
I enjoy watching Shamba Shape-Up TV programme with others in a public place			0.75
I watch Shamba Shape-Up mainly because I like the presenters			0.75

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385   *Explaining the number of agricultural practices implemented in the last 12 months/season*

386   Results show that SSU viewers are more likely to make more changes in their agricultural

387   practices than non SSU viewers (Table 6). Although the results apply to both maize and dairy

388   farmers, it was found that SSU has a higher impact for dairy farmers. There are two reasons

389   that may explain why dairy farmers are more likely to make changes used than maize farmers

390   in their agricultural practices. The first reason is that dairy production may be seen as more of

391   a business than maize farming. Whereas dairy production may be a product primarily

392   oriented for sale, this may not be the case for maize. A growing demand for milk offers scope

393   for wealth creation among small-scale farmers and poor remote households in Kenya. Indeed,

394   effective participation in the production of milk for emerging lucrative markets is considered

395   a supply-response to the potential for increments in household wealth among farmers in

396   developing countries over time (Burke et al., 2007; Martínez-García et al., 2013; Omiti et al.,

397   2009). Martínez-García et al. (2013) found that small-scale dairy systems play an important

398   role in providing income, employment and nutrition in the highlands of central Mexico. Also,

399   evidence drawn from household surveys suggest that small holder farmers in Kenya do not

400   often participate in staple food markets and when they do, their market share is low. Mather

401   et al. (2013) found that only 43% of rural households were net sellers of maize and that sales

402   were highly concentrated among a few sellers. The second reason has to do with dairy being

403   a more recent enterprise than maize, so farmers may be still learning and expanding dairy

404   production.

405   Results also show that farmer's reasons for watching SSU may affect farmer's probability of

406   implementing agricultural practices shown in the SSU TV programme. More specifically, for

407   maize farmers we find that when a farmer's reason for watching SSU is purely for

408   entertainment and watching SSU with friends the probability of implementing agricultural

409   practices shown in SSU is less than when this is not the reason for watching SSU.

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410 Regarding the effect of farmer´s characteristics on their decision to implement a relatively

411 large number of practices, farmer's level of education was found to be an important factor

412 determining change in the agricultural practices implemented, with more educated farmers

413 being more likely to implement a relatively larger number of practices. This is in line with

414 earlier literature on education which finds education as a factor in 'innovation' and

415 technology adoption (Baltenweck et al., 2003; Nicholson et al., 1999; Staal et al., 2002). A

416 Farmer's age was also found to be a significant factor, with older farmers applying relatively

417 higher number of agricultural practices shown in SSU than younger farmers. The literature

418 offers a mixed picture regarding the relationship of age and innovation. Whereas some

419 literature notes that younger farmers are more dynamic, energetic, keen to change (Espinoza-

420 Ortega et al. 2007); on the other hand, some other literature finds no relationship between age

421 and innovation (Abebaw and Haile, 2013b) and some finds a positive relationship that older,

422 more experienced farmers are more likely to have secure access to land, access to money to

423 invest in new inputs . Thus, Staal et al. (2002) found that farming experience was positively

424 related to uptake of dairy cattle. We found no statistically significant differences in the

425 number of agricultural practices applied in terms of gender. Regarding household

426 characteristics studied, results suggest that relatively medium/high income level households

427 are more likely to implement changes to their current agricultural practices (i.e. a relatively

428 high number of agricultural practices) than poor income households. Wealthier households

429 have more opportunity of making changes than poorer households or households with

430 liquidity or capital constraints (Lapar and Ehui, 2004). Other household characteristic

431 considered, household female ratio and household children ratio, had no significant impact on

432 the probability of applying relatively high numbers of practices. Number of cows was found

433 to be negatively associated with implementing a relatively large number of agricultural

434 practices shown on SSU TV programme (i.e. the bigger the number of cows the less likely it

25

is that dairy farmers will apply a large number of practices). Farmers with many cows may

be relatively limited to make the changes proposed (e.g. increase the number of cows, make

and feed hay). However, this association was found not to be statistically significant.

Farmers´ general views on farming were found to be an important factor leading to change,

particularly for dairy farmers. Those farmers who are relatively more positive about trying

new things, enjoying farming, seeing farming as a business and a way to feed their family

(group F1) were found to be more likely to implement more practices than those who tend to

think more that their farm is too small to care about making changes; find relatively more

difficulties in knowing who to contact about inputs and materials; farmers who are relatively

more sceptical that new technologies will work (group F2). Finally, the level of trust on

sources of income was found to have some influence on change. For maize farmers it was

found that the higher the level of trust is in traditional sources (mainly farmer's close social

network of friends and family) the less likely it is that farmers will implement a relatively

large number of changes. On the other hand, for dairy farmers the more trust they have in

sources of information that come to the farm to provide advice, such as agricultural extension

officers and NGOs, the more likely it is that they will apply a large number of changes.

Table 6: Determinants of farmer´s applying a relatively large number of practices on maize and dairy production

	Maize		Dairy	
	Coeff.	**z-statistic**	**Coeff.**	**z-statistic**
Constant	-0.631	-1.59	-1.844***	-3.45
SSU viewers	0.160**	1.98	0.438***	3.87
F1 - Education/Usefulness (empathy - dairy)	0.020	0.38	-0.031	-0.47
F2 - Empathy	0.025	0.46	-	-
F3 - Entertainment/fun	0.033	0.68	-0.011	-0.15
F4 - Entertainment/friends	-0.184***	-3.61	-0.047	-0.66
Media_trust (TV news, Magazine)	0.008	0.21	0.119**	2.14
External1_trust (Agro-dealers/shopkeeper/agrivet)	0.012	0.37	0.043	0.87

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External2_trust (NGO/Agriculture extension officer)	-0.022	-0.65	0.093*	1.78
Traditional_trust (friends/family)	-0.078**	-2.25	0.031	0.65
Farmer´s Age	0.005*	1.76	0.010***	2.55
Gender	-0.060	0.82	0.028	0.27
Primary education	0.308*	1.89	0.509**	2.21
Secondary education	0.410**	2.38	0.569**	2.37
College after secondary/University	0.638***	3.29	0.640**	2.42
Cluster F1 (farming as a business, enjoying farming)	0.083	1.14	0.198*	1.95
HH female ratio	-0.253	-1.43	0.054	0.21
HH children ratio	0.208	1.21	0.026	0.11
Cropland area/number of cows	0.008	0.49	-0.028	-1.03
Normal PPI	0.284**	2.56	0.466**	2.49
High PPI	0.150	1.07	0.687***	3.16
ρ	*0.067*	*0.65*	*-0.202*	*-1.38*
Log-likelihood (Probit model)	*-1648.452*		*-489.940*	
Log likelihood (SEM)	*-1648.239*		*-874.595*	
N	*1436*		*806*	

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Marginal effects on the probability of implementing a number of agricultural practices in

the last 12 months/season for maize and dairy farmers

Table 7 presents the marginal effects for both models, maize and dairy. The marginal effects

for dummy variables (SSU viewers, Gender, Primary education, Secondary education,

College after secondary/University, Cluster F1, Normal PPI and High PPI) measures the

effect of a change in the dummy variable, from 0 to 1, on the probability of implementing

agricultural practices in the last 12 months/season.

The estimated probability of implementing a relative large number of agricultural practices

for the average maize and dairy farmer in the sample (i.e. taking the average values in the

sample of the explanatory variables) is 52% and 38%, respectively. However, there are

differences in these probabilities between SSU watchers and non-watchers holding

everything else constant. The models estimate a 6 and 16 points increase in the probability of

implementing a relative high number of agricultural in the case that maize and dairy farmers

are SSU viewers, respectively. It is worth noting that if the main reason for farmers watching

470   SSU is that maize farmers like the presenters or want to watch the programme in a public

471   place then there would be no difference in the probability of implementing agricultural

472   changes between SSU viewers and non-viewers.

473   The difference between educated and non-educated farmers in the increase in the probability

474   of implementing a relatively large agricultural changes varies between 12% (19%) and 24%

475   (25%) for maize (dairy) farmers depending on their level of education.

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477   **Table 7. Marginal effects of variables on the probability of implementing a number of**

478   **agricultural practices in the last 12 months/season for maize and dairy farmers**

	Maize		Dairy	
	dy/dx	z-statistic	dy/dx	z-statistic
SSU viewers	0.064**	1.98	0.164***	3.98
F1 - Education/Usefulness (empathy - dairy)	0.008	0.38	-0.012	-0.47
F2 - Empathy	0.010	0.46	-	-
F3 - Entertainment/fun	0.013	0.68	-0.004	-0.15
F4 - Entertainment/friends	-0.073***	-3.61	-0.018	-0.66
Media_trust (TV news, magazine)	0.003	0.21	0.045**	2.14
External1_trust (Agro-dealers/shopkeeper/agrivet)	0.005	0.37	0.017	0.87
External2_trust (NGO/Agriculture extension officer)	-0.009	-0.65	0.036*	1.78
Traditional_trust (friends/family)	-0.031**	-2.25	0.010	0.55
Farmer´s Age	0.002*	1.76	0.004***	2.55
Gender	-0.024	0.82	0.011	0.27
Primary education	0.122*	1.90	0.194**	2.24
Secondary education	0.161**	2.43	0.219**	2.39
College after secondary/University	0.241***	3.61	0.250***	2.47
Cluster F1 (farming as a business, enjoying farming)	0.033	1.14	0.076*	1.95
HH female ratio	-0.101	-1.43	0.020	0.21
HH children ratio	0.083	1.21	0.010	0.11
Cropland area/number of cows	-0.003	-0.49	-0.011**	-1.03
Normal PPI	0.113***	2.58	0.174**	2.58
High PPI	0.059	1.08	0.266***	3.22

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483   *Explaining the individual agricultural practices implemented in the last 12 months/season*

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485   The results shown above show that edutainment programme SSU is correlated with the

486   probability of implementing a relatively large number of agricultural practices. However, we

487   also investigated whether particular practices differ in terms of being more (or less) popular

488   than others and what may be influencing such differences in the number of farmers

489   implementing these practices. For this, we analysed the relationships between SSU

490   viewership and the implementation of individual practices. We only analyse those practices

491   for which at least 80 farmers (i.e. 6% of the sample for maize and 10% for dairy) answered

492   that they implemented the particular agricultural practice. Tables 8 and 9 show the coefficient

493   estimates for models explaining the probability of implementing individual agricultural

494   practices by maize and dairy farmers, respectively (Marginal effect tables can be found in the

495   appendices A.3 and A.4).

496   Results for maize show that SSU viewership is positively associated with implementing

497   agricultural practices such as applying fertilizer at planting, applying fertilizer mixed with

498   manure at planting, purchasing maize seed from agro-dealer shop, purchasing packed seeds

499   for intercropping from a shop/agro dealer, applying top dressing fertiliser and using actellic in

500   the stored maize. Interestingly it was also found that planting maize at 2.5 feet/75 cm

501   between rows and 1 foot/30cm between plants was negatively associated with being a SSU

502   viewer. This could be due to some particular difficulties found by the farmer in the TV

503   programme. We found that the farmers' stated reasons for watching SSU explain some of the

504   heterogeneity within the probability of SSU viewers of making specific changes to their

505   agricultural practices. Being empathetic with farmers appearing on the TV programme is

506   associated with farmer's decision to implement the agricultural practices shown on SSU. It

507   was positively associated with farmer's decisions to apply fertiliser at planting and planting a

508 crop as an intercrop. We found that those being empathetic had lower overall probability of

509 applying fertiliser mixed with manure at planting. A possible explanation may be that farmers

510 in the programme had particular difficulties that made those empathising with them being

511 less keen to implement this practice. We also found that for most practices those viewers that

512 enjoyed watching SSU mainly because of having entertaining time with friends tended to be

513 less keen to apply the practices shown in the programme than those who watch the program

514 for other reasons. Watching SSU for educational purposes was positively related to the

515 probability of purchasing packed seeds for intercropping from a shop/agro dealer (if the

516 reason for watching SSU is educational) and to the probability of planting maize at 2.5

517 feet/75 cm between rows and 1 foot/30 cm between plants. Watching SSU for fun or with

518 friends was negatively associated to the probability of implementing most of the agricultural

519 practices considered. It is worth noting that we also found differences in the associations

520 between farmer and household's characteristics, farmer's views on farming and farmer's trust

521 on sources of influence.

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525   Table 8. Determinants of maize farmers' probability of implementing agricultural practices

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	Apply fertilizer at planting		Apply fertilizer mixed with manure at planting		Apply manure at planting		Purchase maize seed from an agro-dealer/shop		Plant a crop in your maize plot as an intercrop	
	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.
Constant	-0.418	-1.05	-1.277**	-2.04	-1.091**	-2.44	-0.024	-0.06	-0.648*	-1.65
SSU viewers	0.274***	3.36	-0.510**	1.97	-0.083	-0.91	0.255***	3.12	0.069	0.86
F1M - Education/Usefulness	-0.011	-0.22	-0.012	-0.16	0.029	0.50	0.010	0.20	0.062	1.21
F2M - Empathy	0.119**	2.20	-0.200***	-2.69	0.018	-0.30	-0.064	-1.14	0.108**	2.01
F3M - Entertainment/fun	0.049	1.00	-0.081	-1.13	0.116**	2.10	0.102**	2.02	0.068	1.42
F4M - Entertainment/friends	0.008	0.16	0.010	0.14	-0.224***	-3.90	-0.149***	-2.85	-0.110**	-2.18
Media_trust (TV news, magazine)	-0.124***	-2.90	0.107*	1.73	0.099**	2.16	0.011	0.27	0.004	0.09
External1_trust (Agro-dealers/shopkeeper/agrivet)	0.062*	1.82	0.053	0.97	0.041	1.05	0.008	0.23	-0.033	-0.99
External2_trust (NGO/Agriculture extension officer)	0.061*	1.77	0.099*	1.80	-0.123***	-3.12	0.053	1.52	-0.037	-1.08
Traditional_trust (friends/family)	-0.110***	-3.16	-0.015	-0.28	-0.006	-0.15	-0.078**	-2.24	-0.107***	-3.12
Farmer´s Age	-0.004	-1.61	0.006	1.47	0.007**	2.34	0.001	0.23	0.003	1.11
Gender	-0.078	-1.05	-0.002	-0.02	0.115	1.36	-0.140*	-1.87	-0.057	-0.78
Primary education	0.142	0.87	-0.092	-0.35	0.001	0.01	0.270*	1.68	-0.107	-0.68
Secondary education	0.168	0.98	-0.149	-0.54	-0.103	-0.55	0.343**	2.00	-0.044	0.26
Higher education	0.325*	1.69	-0.162	-0.53	-0.159	-0.75	0.496**	2.55	0.098	0.52
Cluster F1	-0.041	-0.56	-0.497***	-4.20	0.084	1.01	0.007	0.10	0.105	1.45
HH female ratio	-0.365**	-2.06	-0.198	-0.75	-0.163	-0.82	-0.389**	-2.17	-0.191	-1.09
HH children ratio	0.642***	3.73	-0.560**	-2.23	-0.138	-0.72	0.231	1.33	0.145	0.85
Cropland area	-0.015	-0.94	-0.021	-1.11	-0.029	-1.50	0.025	1.42	-0.018	-1.21
Normal PPI	-0.131	-1.17	0.688**	2.21	0.248*	1.86	0.149	1.35	0.012	1.06
High PPI	-0.258*	-1.84	0.795**	2.31	0.354**	2.17	0.006	0.04	0.045	0.32
ρ	-0.056	-0.53	-0.365*	-1.89	-0.021	-0.18	-0.003	-0.03	0.154	1.42
Log-likelihood (two-part model)	-1639.792		-1044.922		-1385.320		-1613.619		-1665.065	

	Log likelihood (SEM)	-1639.651	-1042.928	-1385.304	-1613.618	-1663.955
	N	1436	1436	1436	1436	1436

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531   Table 8 (continued). Determinants of maize farmers' probability of implementing agricultural practices

	Purchased packed seeds for intercropping from a shop/agro dealer		Planted your maize at this distance 2.5 feet/75cm between rows and 1 foot/30cm between plants		Apply top dressing fertilizer		Weed your maize two times (or more)		Use Actellic in your stored maize	
	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.
Constant	-2.134***	-3.81	-0.971**	-2.30	-0.602	-1.41	-0.177	-0.45	-1.409***	-2.94
SSU viewers	0.023	0.21	-0.382**	-2.29	0.208**	2.46	0.114	1.40	0.202**	2.08
F1M - Education/usefulness	0.168**	2.36	0.156**	2.84	-0.029	-0.55	0.046	0.90	0.061	1.04
F2M - Empathy	0.068	0.92	0.052	0.91	-0.084	-1.53	0.066	1.23	-0.005	-0.08
F3M - Entertainment/fun	0.047	0.74	-0.008	-0.16	-0.083*	-1.67	0.049	1.00	0.037	0.67
F4M - Entertainment/friends	-0.125*	-1.83	0.013	0.24	-0.156***	-2.99	-0.152***	-2.97	-0.187***	-3.21
Media_trust (TV news, magazine)	-0.128**	-2.39	0.169***	3.99	-0.095**	-2.30	-0.026	-0.67	-0.043	-0.91
External1_trust (Agro-dealers/shopkeeper/agrivet)	0.015	0.33	0.032	0.89	0.019	0.54	-0.032	-0.94	0.014	0.36
External2_trust (NGO/Agriculture extension officer)	-0.019	-0.41	-0.218***	-6.02	0.096***	2.68	-0.053	-1.54	0.014	0.33
Traditional_trust (friends/family)	-0.070	-1.52	-0.093***	-2.53	-0.026	-0.72	-0.080**	-2.33	0.012	0.30
Farmer´s Age	-0.003	-0.87	0.001	0.44	0.002	0.61	-0.002	-0.75	-0.001	-0.44
Gender	0.144	1.44	-0.000	-0.00	0.004	0.06	-0.060	-0.81	-0.004	-0.48
Primary education	0.195	0.80	-0.061	-0.36	0.566***	2.87	0.029	0.18	-0.075	-0.36
Secondary education	0.216	0.85	-0.020	-0.11	0.786***	3.84	0.094	0.56	0.195	0.90
Higher education	0.229	0.82	0.240	1.16	0.925***	4.16	0.173	0.91	0.389*	1.65
Cluster F1	0.247**	2.56	0.109	1.41	0.102	1.35	-0.168**	-2.30	0.089	1.03

HH female ratio	-0.274	-1.17	-0.305	-1.61	-0.202	-1.08	-0.211	-1.20	-0.268	-1.24
HH children ratio	-0.109	-0.47	0.192	1.04	0.329	1.83	0.003	0.02	0.333	1.62
Cropland area	-0.020	-1.08	-0.022	-1.33	0.047***	2.76	0.016	0.98	0.091***	4.65
Normal PPI	0.230	1.41	0.004	0.03	0.072	0.61	0.075	0.68	0.327**	2.19
High PPI	0.183	0.91	-0.076	-0.45	0.097	0.66	-0.197	-1.42	0.213	1.19
ρ	-0.246	-1.61	-0.219**	1.97	0.045	0.41	0.150	1.45	-0.091	-0.69
Log-likelihood (two-part model)	*-1160.041*		*-1504.814*		*-1566.300*		*-1652.620*		*-1318.004*	
Log likelihood (SEM)	*-1158.688*		*-1502.853*		*-1566.214*		*-1651.567*		*-1317.178*	
N	*1436*		*1436*		*1436*		*1436*		*1436*	

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Regarding results for dairy farmers results show that SSU viewers are keener to implement certain practices shown in the edutainment programme than non-SSU viewers (see table 9; marginal effects can be found in the appendix). These practices are increasing the area of Napier grass, feeding cows using chopped Napier grass and purchasing supplemented feeds or salt licks. As in maize production, SSU viewers who watch the programme for entertainment tend to be less keen on increasing the area of Napier grass and feeding cows using chopped Napier grass. If the reason for watching the TV programme is for educational/usefulness purposes or empathy with the farmers, the probability of treating for mastitis increases. Again, as in the case for maize farmers we also found heterogeneity regarding the effect of other drivers and the probability of implementing agricultural changes between agricultural practices.

To summarise, although we find that overall SSU positively affects the probability of implementing a greater number of agricultural practices related to maize and dairy production, this effect is not homogeneously found across the practices shown in the edutainment program. Thus, holding everything constant maize farmers who are SSU viewers are more likely to apply fertiliser at planting (+11%), apply fertilizer mixed with manure at planting (+8%), purchase maize seed from a agro-dealer/shop (+7%); apply top dressing fertiliser (+8%) and use actellic in their stored maize (+5%) than farmers who do not watch SSU. However, these increases are moderated by SSU viewers' reasons for watching SSU. For example, the probability of applying fertiliser at planting increases by 5% if farmers show empathy with farmers appearing in the programme. Regarding agricultural practices relevant for dairy farmers watching SSU holding everything constant dairy farmers who are SSU viewers are more likely to increase the area of Napier grass (+6%), feed cows using chopped Napier grass (9%) and purchase supplement feeds or salt licks (+9%).

558 Table 9. Determinants of dairy farmers' probability of implementing agricultural practices
559

	Increase the size of your dairy herd		Increase the area of Napier Grass		Feed cows using chopped Napier Grass		Spray dairy cows for ticks or lice	
	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.
Constant	-2.158***	-3.63	-2.522***	-3.84	-1.233***	-2.34	0.517	0.95
SSU viewers	0.188	1.42	0.274**	1.99	0.229**	2.04	0.047	0.39
F1D - Education/Usefulness/empathy	0.044	0.56	0.153*	1.95	-0.024	-0.35	-0.052	-0.69
F2D - Entertainment/fun	0.068	0.87	0.010	0.13	-0.091	-1.29	-0.012	-0.15
F3D - Entertainment/friends	-0.035	-0.42	-0.224**	-2.58	-0.156**	-2.17	-0.087	-1.08
Media_trust (TV news, magazines)	-0.021	-0.32	-0.063	-0.93	0.140**	2.53	0.187***	3.15
External1_trust (Agrodealers, agrivet)	-0.072	-1.30	0.032	0.53	0.092*	1.86	0.064	1.25
External2_trust (Ag. Extension officer, NGO)	-0.094*	-1.65	-0.080	-1.30	-0.009	-0.18	0.259***	4.78
Traditional_trust (friends, family)	0.047	0.86	0.056	0.96	0.041	0.86	-0.023	-0.45
Farmer´s Age	0.004	0.90	0.006	1.38	0.013***	3.35	-0.001	-0.16
Gender	-0.083	-0.70	0.053	0.42	0.110	1.06	-0.083	-0.76
Primary education	0.256	0.94	0.460	1.47	0.558**	2.50	0.380*	1.80
Secondary education	0.339	1.20	0.669**	2.07	0.614***	2.63	0.180	0.80
Higher education	0.606**	1.97	0.753**	2.17	0.547**	2.11	0.167	0.65
Cluster F1	0.025	0.21	-0.106	-0.86	0.183*	1.80	-0.027	-0.25
HH female ratio	-0.077	-0.27	-0.052	-0.17	-0.115	-0.45	-0.031	-0.12
HH children ratio	0.592**	2.18	0.079	0.28	-0.019	-0.08	0.126	0.51
Number of cows	0.068***	4.20	-0.011	-0.43	-0.152***	-4.29	0.009	0.49
Normal PPI	0.071	0.37	0.600**	2.30	0.756***	4.02	0.289*	1.76
High PPI	0.017	0.07	0.472	1.61	0.943***	4.29	0.440**	2.12
P	*-0.033*	*-0.85*	*-0.240*	*-0.17*	*-0.229*	*-1.64*	*0.032*	*0.84*

Log-likelihood (two-part model)	*-739.831*		*-698.654*		*-877.733*		*-813.426*	
Log likelihood (SEM)	*-739.813*		*-699.996*		*-876.311*		*-813.637*	
N	*805*		*805*		*805*		*805*	

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564 Table 9 (continued). Determinants of dairy farmers' probability of implementing agricultural practices

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	Deworm your dairy cows		Treat for mastitis		Purchase supplement feeds or salt licks		Ensure cows have enough water all day	
	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.	Coeff.	z-stat.
Constant	1.283**	2.04	-2.726***	-4.13	0.814	1.54	-1.398***	-2.68
SSU viewers	0.195	1.42	0.122	0.89	0.238**	2.08	0.166	1.47
F1D - Education/Usefulness/empathy	-0.131	-1.49	0.160**	2.01	-0.140*	-1.93	-0.094	-1.37
F2D - Entertainment/fun	-0.059	-0.65	-0.001	-0.01	-0.143*	-1.94	-0.055	-0.79
F3D - Entertainment/friends	0.061	0.67	-0.114	-1.37	0.03	0.40	0.118	1.62
Media_trust (TV news, magazines)	0.217***	3.26	0.088	1.32	0.184***	3.27	0.163***	2.96
External1_trust (Agrodealers, agrivet)	0.112*	1.95	0.090	1.52	-0.039	-0.81	0.125**	2.57
External2_trust (Ag. Extension officer, NGO)	0.306***	5.15	0.049	0.81	0.098*	1.90	0.161***	3.18
Traditional_trust (friends, family)	0.094*	1.71	-0.033	-0.60	0.065	1.35	0.125***	2.64
Farmer´s Age	0.003	0.62	0.005	1.13	-0.001	-0.34	0.009**	2.3
Gender	-0.146	-1.19	0.086	0.69	0.087	0.83	-0.023	-0.22
Primary education	0.056	0.22	0.453	1.42	0.086	0.42	0.663***	3.08
Secondary education	-0.188	-0.70	0.604*	1.84	0.019	0.09	0.542**	2.4
Higher education	-0.122	-0.40	0.675*	1.92	0.194	0.77	0.435*	1.73

Cluster F1	0.437**	3.57	0.110	0.91	0.370***	3.57	0.172*	1.69
HH female ratio	-0.124	-0.41	0.005	0.02	-0.304	-1.17	0.169	0.65
HH children ratio	-0.273	-0.97	0.139	0.49	-0.188	-0.78	0.024	0.10
Number of cows	-0.015	-0.69	0.022	1.13	-0.035	-1.49	-0.046	-1.66
Normal PPI	-0.020	-0.11	0.504**	1.97	0.191	1.21	0.512***	3.08
High PPI	0.143	0.62	0.414	1.43	0.518***	2.60	0.921***	4.51
P	*0.218*	*0.20*	*-0.274*	*-0.13*	*-0.093*	*-0.53*	*0.061*	*0.44*
Log-likelihood (two-part model)	*-715.285*		*-708.319*		*-858.176*		*-878.401*	
Log likelihood (SEM)	*-714.480*		*-707.106*		*-857.973*		*-878.302*	
N	*805*		*805*		*805*		*805*	

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4. Conclusions and policy implications

Edutainment TV programs aiming at farmers in developing countries can be a way of succeeding in having a more productive and sustainable agriculture in developing countries that contributes to achieving Sustainable Development Goals of no poverty and zero hunger. The use of edutainment programmes has been shown that can be a powerful tool in encouraging farmers to make changes in their agricultural practices. We found that the SSU TV edutainment programme contributes to helping farmers making changes in their agricultural practices by showing real life examples. However, changing the agricultural practices shown on edutainment depends on the type of agricultural output produced and the associated difficulty of making the changes. Thus, we found that relatively simple changes in maize production practices are more likely to be implemented as a consequence of watching TV edutainment programmes than those practices that are relatively more complex. Individual characteristics of the farmers such as their reasons behind watching the TV edutainment programme, their level of education and the level of trust on sources of information such as family and friends also shape the likelihood of changing their agricultural practices. Since not all agricultural practices shown in edutainment programmes may have the same level of acceptance care should be taken by the edutainment TV programme in selecting agricultural practices that are realistic for targeted farmers to implement.

Policy implications of our findings are that edutainment TV should be considered and supported as a way to introduce changes in specific agricultural practices. Organisations and governments could contribute by supporting edutainment TV as a viable channel to educate farmers in agricultural practices that are sustainable, protect the environment, contribute to climate change adaptation and mitigation and contribute to reducing poverty, hunger and malnutrition by increasing productivity, income and food security. Thus, support by governments could be through collaboration with private enterprises in these initiatives (e.g.

593 providing information on the key agricultural practices supported by the government and/or

594 providing funding) or providing edutainment TV through national channels.

595

596 It is worth pointing out that parallel information to the one presented by SSU could have been

597 presented through radio and other TV programmes which could have reinforced SSU

598 messages. Also, in this analysis we have used a binary viewership indicator. Using

599 information on the level of viewership (e.g. always, sometimes, a few episodes, never) could

600 have provided a more disaggregated analysis in terms of by level of viewership

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References

611 Abate, G.T., Rashid, S., Borzaga, C., Getnet, K., 2016. Rural Finance and Agricultural Technology

613   Adoption in Ethiopia: Does the Institutional Design of Lending Organizations Matter? World

614   Dev. 84, 235–253. https://doi.org/10.1016/J.WORLDDEV.2016.03.003

615 Abebaw, D., Haile, M.G., 2013a. The impact of cooperatives on agricultural technology adoption:

616   Empirical evidence from Ethiopia. Food Policy 38, 82–91.

617   https://doi.org/10.1016/J.FOODPOL.2012.10.003

618 Abebaw, D., Haile, M.G., 2013b. The impact of cooperatives on agricultural technology adoption:

619   Empirical evidence from Ethiopia. Food Policy 38, 82–91.

620   https://doi.org/10.1016/J.FOODPOL.2012.10.003

621 Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50, 179–211.

622   https://doi.org/10.1016/0749-5978(91)90020-T

623 Ajzen, I., 1987. Attitudes, Traits, and Actions: Dispositional Prediction of Behavior in Personality and

624   Social Psychology. Adv. Exp. Soc. Psychol. 20, 1–63. https://doi.org/10.1016/S0065-

625   2601(08)60411-6

626 Ajzen, I., 1985. From Intentions to Actions: A Theory of Planned Behavior, in: Kuhl, J., Beckmann, J.

627   (Eds.), Action Control. Springer, Berlin, Heidelberg, pp. 11–39.

628 Baltenweck, I., Staal, S., Ibrahim, M.N.M., Herrero, M., Holfman, F., Manyong, V., Jabbar, M., Patil,

629   B.R., Thornton, P.K., Williams, T., Waithaka, M.M., De Wolf, T., 2003. Crop-livestock

630   intensification and interaction across three continents. Final Project Report. Addis Ababa,

631   Ethiopia.

632 Boucher, S.R., Carter, M.R., Guirkinger, C., 2008. Risk Rationing and Wealth Effects in Credit Markets:

633   Theory and Implications for Agricultural Development. Am. J. Agric. Econ. 90, 409–423.

634   https://doi.org/10.1111/j.1467-8276.2007.01116.x

635   Burke, W.J., Jayne, T.S., Freeman, H.A., Kristjanson, P., 2007. Factors associated with farm

636   households' movement into and out of poverty in Kenya: The rising importance of livestock,

637   Discussion paper.

638   Cappellari, L., Jenkins, S.P., 2003. Multivariate Probit Regression using Simulated Maximum

639   Likelihood. Stata J. Promot. Commun. Stat. Stata 3, 278–294.

640   https://doi.org/10.1177/1536867x0300300305

641   Caraher, M., Lange, T., Dixon, P., 2009. The Influence of TV and Celebrity Chefs on Public Attitudes

642   and Behavior Among the English Public. J. Study Food Soc.

643   https://doi.org/10.2752/152897900786690805

644   Clarkson, G., Garforth, C., Dorward, P., Mose, G., Barahona, C., Areal, F., Dove, M., 2018. Can the TV

645   makeover format of edutainment lead to widespread changes in farmer behaviour and

646   influence innovation systems? Shamba Shape Up in Kenya. Land use policy 76.

647   https://doi.org/10.1016/j.landusepol.2018.05.011

648   Colace, F., De Santo, M., Pietrosanto, A., Troiano, A., 2006. Work in progress: Bayesian networks for

649   edutainment, in: Proceedings - Frontiers in Education Conference, FIE.

650   https://doi.org/10.1109/FIE.2006.322573

651   Creighton, M.R., 2007. "Edutaining" Children: Consumer and Gender Socialization in Japanese

652   Marketing. Ethnology. https://doi.org/10.2307/3773973

653   Davis, F.D., 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information

654   Technology. MIS Q. 13, 319–340. https://doi.org/10.2307/249008

655   Davis, F.D., Bagozzi, R.P., Warshaw, P.R., 1989. User Acceptance of Computer Technology: A

656   Comparison of Two Theoretical Models. Manage. Sci. 35, 982–1003.

657 De Backer, C.J.S., Hudders, L., 2016. Look who's cooking. Investigating the relationship between

658   watching educational and edutainment TV cooking shows, eating habits and everyday cooking

659   practices among men and women in Belgium. Appetite.

660   https://doi.org/10.1016/j.appet.2015.10.016

661 de Fossard, E., 2008. Using Edu-Tainment for distance education in community work. Sage

662   Publishing.

663 DEFRA, 2019. Agriculture in the United Kingdom 2018. DEFRA.

664 Dway, N.S., Soonthornworasiri, N., Jandee, K., Lawpoolsri, S., Pan-Ngum, W., Sinthuvanich, D.,

665   Kaewkungwal, J., 2015. Effects of edutainment on knowledge and perceptions of Lisu mothers

666   about the immunisation of their children. Health Educ. J. 75, 131–143.

667   https://doi.org/10.1177/0017896915569086

668 Espinoza-Ortega, A., Espinoza-Ayala, E., Bastida-López, J., Castañeda-Martínez, T., Arriaga-Jordán,

669   C.M., 2007. SMALL-SCALE DAIRY FARMING IN THE HIGHLANDS OF CENTRAL MEXICO:

670   TECHNICAL, ECONOMIC AND SOCIAL ASPECTS AND THEIR IMPACT ON POVERTY. Exp. Agric. 43,

671   241–256. https://doi.org/10.1017/S0014479706004613

672 FAO, OCDE, 2018. Food security and nutrition: challenges for agriculture and the hidden potential of

673   soil.

674 Feenstra, F., Muzellec, L., de Faultrier, B., Boulay, J., 2015. Edutainment experiences for children in

675   retail stores, from a child's perspective. J. Retail. Consum. Serv. 26, 47–56.

676   https://doi.org/10.1016/J.JRETCONSER.2015.05.004

677 Fishbein, M.E., 1967. Readings in attitude theory and measurement.

678 Flora, J.A., Saphir, M., Lappé, M., Roser-Renouf, C., Maibach, E.W., Leiserowitz, A.A., 2014.

679   Evaluation of a national high school entertainment education program: The Alliance for Climate

680   Education. Clim. Change 127, 419–434. https://doi.org/10.1007/s10584-014-1274-1

681   Forster, M., Allem, J.-P., Mendez, N., Qazi, Y., Unger, J.B., 2016. Evaluation of a telenovela designed

682   to improve knowledge and behavioral intentions among Hispanic patients with end-stage renal

683   disease in Southern California. Ethn. Health 21, 58–70.

684   https://doi.org/10.1080/13557858.2015.1007119

685   Jana, M., Letsela, L., Scheepers, E., Weiner, R., 2015. Understanding the Role of the OneLove

686   Campaign in Facilitating Drivers of Social and Behavioral Change in Southern Africa: A

687   Qualitative Evaluation. J. Health Commun. 20, 252–258.

688   https://doi.org/10.1080/10810730.2014.925014

689   Jenkins, A.L., Tavengwa, N. V, Chasekwa, B., Chatora, K., Taruberekera, N., Mushayi, W., Madzima,

690   R.C., Mbuya, M.N.N., 2012. Addressing social barriers and closing the gender knowledge gap:

691   exposure to road shows is associated with more knowledge and more positive beliefs, attitudes

692   and social norms regarding exclusive breastfeeding in rural Zimbabwe. Matern. Child Nutr. 8,

693   459–470. https://doi.org/10.1111/j.1740-8709.2011.00325.x

694   Lapar, M.L.A., Ehui, S.K., 2004. Factors affecting adoption of dual-purpose forages in the Philippine

695   uplands. Agric. Syst. 81, 95–114. https://doi.org/10.1016/J.AGSY.2003.09.003

696   Martínez-García, C.G., Dorward, P., Rehman, T., 2013. Factors influencing adoption of improved

697   grassland management by small-scale dairy farmers in central Mexico and the implications for

698   future research on smallholder adoption in developing countries. Livest. Sci. 152, 228–238.

699   https://doi.org/10.1016/J.LIVSCI.2012.10.007

700   Mather, D., Boughton, D., Jayne, T.S., 2013. Explaining smallholder maize marketing in southern and

701   eastern Africa: The roles of market access, technology and household resource endowments.

702   Food Policy 43, 248–266. https://doi.org/10.1016/J.FOODPOL.2013.09.008

703 Nicholson, C.F., Thornton, P.K., Mohammed, L., Muninga, R.W., Mwamachi, D.M., Elbasha, E.H., S.J.,

704   S., Thorpe, W., 1999. Smallholder Dairy Technology in Coastal Kenya. An adoption and impact

705   study, ILRI Impact Assessment Series 5.

706 Okan, Z., 2003. Edutainment: is learning at risk? Br. J. Educ. Technol. 34, 255–264.

707   https://doi.org/10.1111/1467-8535.00325

708 Omiti, J., Otieno, D., Nyanamba, T., McCullough, E., 2009. Factors influencing the intensity of market

709   participation by smallholder farmers: A case study of rural and peri-urban areas of Kenya.

710   Ajfare 3, 57–82.

711 Pretty, J.., Morison, J.I.., Hine, R.., 2003. Reducing food poverty by increasing agricultural

712   sustainability in developing countries. Agric. Ecosyst. Environ. 95, 217–234.

713   https://doi.org/10.1016/S0167-8809(02)00087-7

714 Staal, S.., Baltenweck, I., Waithaka, M.., deWolff, T., Njoroge, L., 2002. Location and uptake:

715   integrated household and GIS analysis of technology adoption and land use, with application to

716   smallholder dairy farms in Kenya. Agric. Econ. 27, 295–315. https://doi.org/10.1016/S0169-

717   5150(02)00075-0

718 Teklewold, H., Kassie, M., Shiferaw, B., 2013. Adoption of Multiple Sustainable Agricultural Practices

719   in Rural Ethiopia. J. Agric. Econ. 64, 597–623. https://doi.org/10.1111/1477-9552.12011

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Appendix

Table A.1: Correlation between responses to statements related farmers' perceptions and views on farming

	I would use other inputs if they were cheaper	I find it difficult to find the material, inputs needed to make changes	My supplier provides me with all information about inputs and material	I do not know who to contact about inputs, materials	My farm is too small for me to care about making any changes	I like to try new things in my farm	I am sceptical that new technologies will work	I enjoy farming	I see farming as a business	I see farming as a way to feed the HH
I would use other inputs if they were cheaper	1.00									
I find it difficult to find the material, inputs needed to make changes	0.13	1.00								
My supplier provides me with all information about inputs and material	-0.18	-0.08	1.00							
I do not know who to contact about inputs, materials	-0.78	0.31	0.01	1.00						
My farm is too small for me to care about making any changes	-0.15	0.13	0.14	0.32	1.00					
I like to try new things in my farm	0.24	-0.03	0.01	-0.07	-0.13	1.00				
I am sceptical that new technologies will work	-0.20	0.06	0.18	0.20	0.19	0.00	1.00			
I enjoy farming	0.33	-0.03	-0.05	-0.06	-0.14	0.31	-0.02	1.00		
I see farming as a business	0.25	-0.07	0.01	-0.05	-0.12	0.36	-0.03	0.52	1.00	
I see farming as a way to feed the HH	0.25	0.02	0.00	-0.03	-0.09	0.28	0.04	0.45	0.46	1.00

Table A.2: Cluster analysis

	Group F1	Group F2
I would use other inputs if they were cheaper	4.40[a]	3.66[b]
I find it difficult to find the material, inputs needed to make changes	3.05[a]	3.50[b]
My supplier provides me with all information about inputs and material	2.57[a]	3.00[b]
I do not know who to contact about inputs, materials	2.27[a]	3.44[b]
My farm is too small for me to care about making any changes	1.79[a]	3.32[b]
I like to try new things in my farm	4.30[a]	3.75[b]
I am sceptical that new technologies will work	2.79[a]	3.50[b]
I enjoy farming	4.68[a]	4.28[b]
I see farming as a business	4.63[a]	4.17[b]
I see farming as a way to feed the HH	4.74[a]	4.40[b]

Average scores between groups were statistically tested for significant difference. Scores followed by the same letters are not statistically different at 0.05 level.

Table A.3a: Marginal effects on the probability of implementing individual agricultural practices in the last 12 months/season for maize farmers

	Apply fertilizer at planting	Apply fertilizer mixed with manure at planting	Apply manure at planting	Purchase maize seed from an agro-dealer/shop	Plant a crop in your maize plot as an intercrop
SSU viewers	0.109***	0.072*	-0.023	0.098***	0.028
F1M - Education/Usefulness	-0.004	-0.002	0.008	0.004	0.025
F2M - Empathy	0.047**	-0.028***	-0.005	-0.024	0.043**
F3M - Entertainment/fun	0.019	-0.011	0.032**	0.039**	0.027
F4M - Entertainment/friends	0.003	0.001	-0.062***	-0.056***	-0.044**
Media_trust (TV news, magazines)	-0.054***	0.015*	0.027**	0.004	0.001*
External1_trust (Agrodealers, agrivet)	0.025*	0.007	0.011	0.003	-0.013
External2_trust (Ag. Extension officer, NGO)	0.0254*	0.014*	-0.034***	0.020	-0.015
Traditional_trust (friends, family)	-0.044***	-0.002	-0.002	-0.030**	-0.043***
Farmer´s Age	-0.002	0.001*	0.002**	0.001	0.001
Gender	-0.031	-0.001	0.032	-0.054*	-0.022
Primary education	0.056	-0.013	-0.001	0.103*	-0.042
Secondary education	0.066	-0.021	-0.028	0.129**	-0.017
Higher education	0.127*	-0.023	-0.042	0.177***	0.039
Cluster F1	-0.016	-0.070***	0.023	0.003	0.042
HH female ratio	-0.145**	-0.028	-0.045	-0.149**	-0.076
HH children ratio	0.255***	-0.079**	-0.038	0.089	0.057
Cropland area	-0.006	-0.003	0.008	0.010	-0.007
Normal PPI	-0.052	0.097**	0.067*	0.057	0.046
High PPI	-0.103*	0.112**	0.104**	0.002	0.018
Conditional probability (model)	*0.53*	*0.09*	*0.19*	*0.61*	*0.48*
Probability (sample)	*0.53*	*0.08*	*0.21*	*0.61*	*0.48*

Table A.3b: Marginal effects on the probability of implementing individual agricultural practices in the last 12 months/season for maize farmers

	Purchased packed seeds for intercropping from a shop/agro dealer	Planted your maize at this distance 2.5 feet/75cm between rows and 1 foot/30cm between plants	Apply top dressing fertilizer	Weed your maize two times (or more)	Use Actellic in your stored maize
SSU viewers	0.004	-0.123**	0.076**	0.045	0.050**
F1M - Education/Usefulness	0.029**	0.050***	-0.011	0.018	0.015
F2M - Empathy	0.012	0.017	-0.031	0.026	0.001
F3M - Entertainment/fun	0.008	-0.003	-0.030*	0.019	0.009
F4M - Entertainment/friends	-0.022*	0.004	-0.057***	-0.060*	-0.047***
Media_trust (TV news, magazines)	-0.022**	0.054***	-0.035**	-0.010	-0.01
External1_trust (Agrodealers, agrivet)	0.003	0.010	0.007	-0.013	0.004
External2_trust (Ag. Extension officer, NGO)	-0.003	-0.070***	0.035***	-0.021	0.003
Traditional_trust (friends, family)	-0.012	-0.030**	-0.009	-0.032**	0.003
Farmer´s Age	-0.001	4.E-04	0.001	-0.001	-4.E-04
Gender	0.025	5.E-05	0.002	-0.024	-0.010
Primary education	0.034	-0.020	0.207***	0.014	-0.019
Secondary education	0.039	-0.006	0.294***	0.037	0.050
Higher education	0.044	0.077	0.355***	0.067	0.109
Cluster F1	0.044**	0.035	0.037	-0.066**	0.022
HH female ratio	-0.047	-0.098	-0.074	-0.083	-0.066
HH children ratio	-0.019	0.062	0.120*	0.001	0.082
Cropland area	0.003	-0.007	0.017***	0.006	0.023***
Normal PPI	0.039	0.001	0.026	0.029	0.079**
High PPI	0.033	-0.025	0.035	-0.078	0.055
Conditional probability (model)	*0.10*	*0.28*	*0.34*	*0.57*	*0.16*
Probability (sample)	*0.11*	*0.28*	*0.35*	*0.57*	*0.18*

Table A.4a: Marginal effects on the probability of implementing individual agricultural practices in the last 12 months/season for dairy farmers

	Increase the size of your dairy head	Increase the area of Napier grass	Feed cows using chopped Napier grass	Spray dairy cows for ticks or lice
SSU viewers	0.046	0.056**	0.090**	0.015
F1D - Education/Usefulness/empathy	0.011	0.032*	-0.009	-0.016
F2D - Entertainment/fun	0.017	0.002	-0.036	-0.004
F3D - Entertainment/friends	-0.009	-0.047**	-0.061**	-0.027
Media_trust (TV news, magazines)	-0.005	-0.013	0.055**	0.059***
External1_trust (Agrodealers, agrivet)	-0.018	0.006	0.036*	0.020
External2_trust (Ag. Extension officer, NGO)	-0.023*	-0.017	-0.004	0.081***
Traditional_trust (friends, family)	0.012	0.012	0.016	-0.007
Farmer´s Age	0.001	0.001	0.005***	-1.E-04
Gender	-0.021	0.011	0.043	-0.026
Primary education	0.064	0.100	0.217**	0.117*
Secondary education	0.089	0.158*	0.241***	0.055
Higher education	0.180*	0.206*	0.216**	0.050
Cluster F1	0.006	-0.022	0.072*	-0.009
HH female ratio	-0.019	-0.011	-0.045	-0.010
HH children ratio	0.146**	0.017	-0.007	0.039
Number of cows	0.017***	-0.002	-0.060***	0.003
Normal PPI	0.017	0.119**	0.287***	0.092*
High PPI	0.004	0.111	0.362***	0.128**
Conditional probability (model)	*0.17*	*0.13*	*0.44*	*0.76*
Probability (sample)	*0.18*	*0.15*	*0.46*	*0.74*

Table A.4b: Marginal effects on the probability of implementing individual agricultural practices in the last 12 months/season for dairy farmers

	Deworm your dairy cows	Treat for mastitis	Purchase supplement feeds or salt licks	Ensure cows have enough water all day
SSU viewers	0.046	0.026	0.088**	0.166
F1D - Education/Usefulness/empathy	-0.030	0.035**	-0.051*	-0.094
F2D - Entertainment/fun	-0.014	-0.2E-4	-0.052*	-0.055
F3D - Entertainment/friends	0.014	-0.025	0.011	0.118
Media_trust (TV news, magazines)	0.050***	0.019	0.067***	0.163***
External1_trust (Agrodealers, agrivet)	0.026**	0.020	-0.015	0.125**
External2_trust (Ag. Extension officer, NGO)	0.070***	0.011	0.036*	0.161***
Traditional_trust (friends, family)	0.021*	-0.007	0.024	0.125***
Farmer´s Age	0.001	0.001	-5.E-04	0.009**
Gender	-0.034	0.019	0.032	-0.023
Primary education	0.013	0.102	0.031	0.663***
Secondary education	-0.044	0.146*	0.007	0.542**
Higher education	-0.029	0.185	0.068	0.435*
Cluster F1	0.097***	0.024	0.133***	0.172*
HH female ratio	-0.028	0.001	-0.111	0.169
HH children ratio	-0.062	0.030	-0.069	0.024
Number of cows	-0.003	0.005	-0.013	-0.046*
Normal PPI	-0.005	0.104**	0.070	0.512***
High PPI	0.032	0.099	0.177***	0.921***
Conditional probability (model)	*0.85*	*0.14*	*0.66*	*0.57*
Probability (sample)	*0.83*	*0.15*	*0.65*	*0.53*