

Converging free and open source software tools for knowledge sharing in smallholder agricultural communities in Sri Lanka

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Submitted on 2017, 2 June; accepted on 2017, 11 November. Section: Research Paper

Abstract: In a world where the notion of ‘sharing of knowledge’ has gained much prominence in the recent past, the importance of information and communications technologies (ICTs) to promote sustainable agriculture, especially when combined with mobile and open source software technologies is discussed critically. On this rationale, this study was carried out to explore the applicability of the concept of converging ‘Free and Open Source Software (FOSS)’ to promote sustainable knowledge sharing amongst the agricultural communities in Sri Lanka. A multi-stage community consultative process with a set of designated officials (“*Sponsors*”) and a series of semi-structured questionnaire survey with a cross section of smallholder agriculture farmers (n=246), were carried out in the Batticaloa, Kurunegala and Puttalam districts to gather the baseline data. This was followed by a number of field experiments (“*Campaigns*”) with the farmers (n=340) from same geographical areas. The two FOSS, namely: (1) “FrontlineSMS” for ‘Text Messaging’ and (2) “FreedomFone” for ‘Interactive Voice Responses’, were applied to evaluate the effectiveness of knowledge sharing within the farming communities. It was found that FOSS intervention increases the ‘Text messaging’ and ‘Voice Call’ usage in day-to-day agricultural communication by 26 and 8 percent, respectively. The demographic factors like age and educational level of the farmers have a positive influence on the knowledge sharing process. And also the ‘Mobile Telephony’ was the most extensive mode of communication within the communities. The outcome of analysis, as a whole, implies that,

with a fitting mechanism in place, this approach can be promoted as a “drive for positive changes” in agriculture-based rural communities in developing countries like Sri Lanka, and those in South and East Asia with similar socio-economic and cultural perspectives.

Keywords: Agricultural community, FOSS; Information, Knowledge sharing

Introduction

Agriculture is considered as major driving force of an economy in developing countries. In many developing countries the majority of the population often depends on agriculture for their livelihoods. Yields from agriculture are very low when comparing agriculture between developing and developed countries. A major cause for this is the lack of information and knowledge about farming for smallholder producers (FAO, 2015). Further constraints and limitations on traditional agricultural extension methods as well as high costs of information provision have been cited as barriers to improving the livelihood of farmers in developing countries (De Silva *et al.*, 2011; Rivera *et al.*, 2009).

Therefore, knowledge sharing in support of sustainable agriculture has been identified as a vital activity that faces numerous challenges today (Aker, 2010). It is argued that the use of ICTs can play a key role in sharing knowledge, connecting farmers to information to enable more effective resource use, stimulate agricultural innovation and create resiliency within agri-food systems (De Silva *et al.*, 2011; World Bank, 2011). Incorporation of ICTs into agricultural systems could, therefore, be taken as an effective solution to overcome such issues.

Many authors (Gow *et al.*, 2013; Rashid *et al.*, 2016; Shove *et al.*, 2012) pointed out that ‘free and open source software’ platforms can play a greater role in participatory design processes in knowledge sharing approaches. The adoption and use of digital information services as such is, however, closely related to how well these services are aligned with the everyday social practices of people (De Silva *et al.*, 2011). We may, therefore, suggest that an existence of such services satisfies a ‘necessary’ condition, but is not ‘sufficient’ to foster the development and deployment of new services effectively.

There were plenty of agricultural knowledge generated through various domains like Universities, Research stations and Departments in Sri Lanka in different forms. However, the smallholder agricultural communities in the country, especially in less-developed rural areas, have persistently been suffered by issues related to receipt of appropriate knowledge and information pertaining to agriculture on time. This has mostly been accumulated to the inefficiencies associated with the mode of dissemination (De Silva *et al.*, 2011; Jayathilake *et al.*, 2015).

Also, the agricultural technologies and developments should reach farmers in its best form and through the most economical route (right information to right people at right time) otherwise transforming sustainable agriculture into productive systems would become an unrealizable effort. Therefore, the relevant agricultural knowledge repositories should come up with new technologies and developments and further attention must be taken to expose them to the potential farmers. Gow *et al.* (2013) and Shove *et al.* (2012) points out the significance of incorporating this concept with the ICTs to share the knowledge effectively.

This study examined the applicability of the concept of converging two FOSS namely FrontlineSMS (FLSMS) and Freedom Fone (FF) to promote sustainable knowledge sharing in ICT-enable farming communities in Sri Lanka. FrontlineSMS is FOSS that enables users to connect a range of mobile devices to a computer to send and receive Short Message Service (SMS) communication. The software works without an internet connection by connecting a device such as a cell phone or GSM (Global System for Mobile communications) modem plugged into the computer via the USB drive with a local phone number. FLSMS can send and receive messages, group contacts, respond to messages, and trigger other events. If internet access is available, FLSMS can be connected to online SMS services and set up to feed incoming messages to other web or e-mail services (FrontlineSMS, 2013).

FreedomFone is FOSS that enables to create and share audio content using IVR (Interactive Voice Responses), voicemail and SMS. FF allows to create two-way phone-based communication services to interact with any audience, in any language, at any time and without recourse to internet or other media. Without any geographical limitations, FF can be used in any country with mobile network coverage and runs on Linux distributions that are based on Ubuntu and Debian. (Clark and Burrell, 2009).

Materials and methods

During a national workshop conducted by the Wayamba University of Sri Lanka in collaboration with University of Alberta and LIRNEasia under the theme of 'Agriculture Knowledge Mobilization', three institutions working closely with the field level, namely Janathakshan (non-governmental organization) in Batticaloa, the Department of Export Agriculture (DOEA) in Kurunegala and the Ag-Voice federation (AVF) in Puttalam, were selected as the 'Sponsors' for this multi-phased study.

Series of discussions and meetings were held with communities from Janathakshan, DOEA and AVF sponsors. During each of these meetings, the research team was able to identify a major problem from its community and in turn, immediately furnish quick solutions by configuring ICTs (FLSMS/FF) and testing with the community, called a 'rapid prototyping' exercise. This rapid prototyping practices was a process

of trial and error with quick turnaround times with ICTs used. Testing and refining a technology platform quickly helps to keep up interest and momentum, reduces costs, and provides immediate feedback on the design of the system in order to improve it for users. FLSMS and FF were used as its starting point. This was envisaged the community's knowledge and hands on experience of using these FOSS applications activities.

A face-to-face interview supported by a pre-tested structured questionnaire was conducted with a purposively selected sample of 246 farmers from Janathakshan (N=98), DOEA (N=85) and AVF (N=63). The 'LIRNEasia Teleuse@BOP4' (LIRNEasia, 2012) instrument was adopted, in particular, for the purpose of preparation of questionnaire to gather information pertaining to the socio-economic and demographic data of respondents as well as their behavior on agriculture information seeking. The survey provided insights as to how, when, and why ICTs were used in their daily lives, for example.

Identified divisions were committed to move ahead with the "campaigns". A campaign is an activity that runs for a certain period of time (i.e. 3 to 4 months) with a specific objective to reflect the information sharing need and wants of the respective communities. Each community ran two parallel campaigns comprising 340 smallholder agricultural producers (farmers). Majority of them cultivated vegetables and export agricultural crops such as ginger, pepper and cinnamon. Additionally, they grew rice and maize.

After the campaign, another series of face-to-face interviews, supported by previous semi-structured questionnaire were carried out with same participants (n=246), and the "pre" and "post" campaign survey data and technology usage data from the 'messaging software' deployed in the campaigns were analyzed. The amount of agriculture related SMS transferred and voice message recorded were used for measuring knowledge sharing. The whole process was carried out during April 2014 to Aug 2015 for about 17 months uninterruptedly. The Kruskal-Wallis tests were applied in particular to assess whether farmers' agricultural information seeking (through ICTs) is correlated with their level of age, education and household income. The nature of data on campaign effect is dichotomous, thus, logistic regression was applied to analyze the SMS usage and Voice usage that determine the campaign effect.

Results and discussion

The findings from the present study showed that the majority (178, or 72%) of the farmers were males in the surveyed communities. The Table 1 depicted the gender, age and literacy level distribution of the survey community in baseline survey. The mean age of respondents was 48. The majority of the respondents were middle aged, where 128 (52%) were between 30 to 44 and 63 (26%) between 45 to 74 years. Few

respondents, 25 (10%) were below 30 years, and 30 (12%) respondents were above 74 years. As a whole, these farmers are in their middle ages possessed more ICT devices and used more SMS and voice calls for their day-to-day activities. Therefore these findings agree with that of Lwoga, who argues that middle age farmers acquire ICTs effectively (Lwoga, 2011).

Table 1 - Gender, age and literacy levels distribution of the respondents by community in the baseline survey

DEMOGRAPHIC DATA	COMMUNITIES			
	Janathakshan	DOEA	AVF	Total
<i>Respondents surveyed</i>	98 (39.8%)	85 (34.6%)	63 (25.6%)	246
<i>Age</i>				
<30	7	5	2	14
30 - 44	24	20	18	62
45 - 59	34	35	10	79
>60	33	25	33	91
<i>Mean age</i>	46	51	48	48
<i>Male : Female ratio</i>	59 : 39	68 : 17	51 : 12	178 : 68
<i>Education</i>				
<i>Illiterate</i>	6	1	1	8
Grade 0 to 4	41	26	30	97
Grade 5 to 9	39	42	26	107
Grade 10 to 12	12	16	6	34
<i>Literacy: illiteracy level</i>	92 : 6	84 : 1	62 : 1	238 : 8

Considering the income level, the majority (149, 60%) of the farmers were in lowest income category (less than LKR: 180,000), 73 (30%) of the farmers were in middle income category (between LKR: 180,000 - 360,000) and the rest were (24, 10%) in the highest income category (higher than LKR: 360,000). By considering the education level, the majority (238, 97%) of the respondents had some level of formal schooling and this means that the majority could also read and understand simple instructions.

Especially, the outcome of Kruskal-Wallis test used to assess whether farmers' agricultural information seeking is correlated with their level of age, education and household income shows that the four levels of age used in the analysis were statistically significant (chi-square= 28.665, $P = 0.0472$, $df=3$). This implies that farmers' agricultural information seeking behavior changes with their level of age.

These findings agree with that of Lwoga, who argues that age has impact on knowledge seeking (Lwoga, 2011).

Similarly, the four levels of education used in the analysis (i.e. Illiterate =3%; Grade 0 to 4 = 40%; Grade 5 to 9 = 43%; Grade 10 to 12 = 14%) were statistically significant (chi-square= 26.435, $P = 0.0398$, $df=3$). This implies that farmers' agricultural information seeking behavior changes with their level of education. Also, the three categories used to assess the effect of annual income in this respect were not statistically significant (chi-square= 35.225, $P = 0.1132$, $df=2$) implying that farmers, irrespective of their wealth, seek agricultural information to the same extent.

It was found that more than 92 percent of farmers in the community used at least one of any modes of phone to take or receive a telephone call over in the recent past, and nearly 68 percent of farmers use their own mobile phone/s for this purpose, in particular. This highlights the potential to introduce and utilize ICT-enabled devices for sharing information, especially through telephony.

The ICT-enabled knowledge sharing campaign was evaluated with the 'Actor Influenced Matrix' (AIM) which is depicted in Figure 1. In DOEA and AVF campaigns, all actors were positively influenced. The outcome of AIM demonstrates that the effectiveness of sponsors was closely associated with the level of influence of the factors examined through the evaluative framework. It was revealed that within this approach, each of these factors, including the sponsoring organization, the farming community in concern, and the technology familiarization possess a greater impact on the success of a campaign.

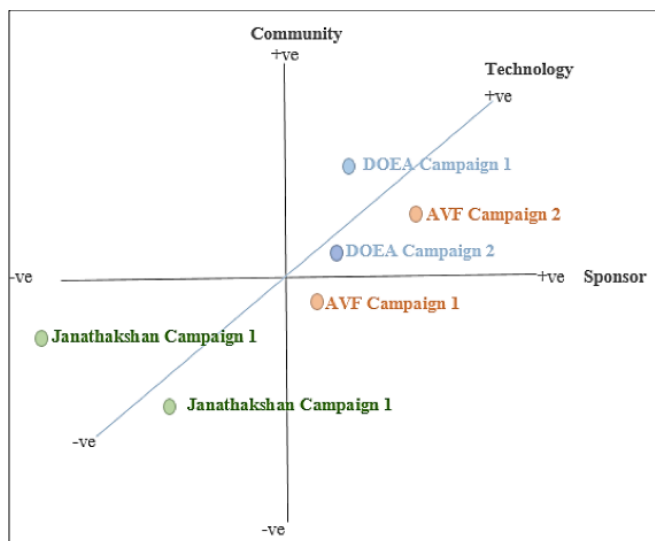


Figure 1 - Actor Influenced Matrix on campaigns

Figure 2 summarises the usage of ICT-enabled devices for sharing information by these communities with respect to “before” and “after” the campaigns. It shows that FOSS intervention increases the use of ICT-enabled devices or services, especially ‘Text messaging’ (SMS) and ‘Voice call’ usage in day-to-day agricultural communication by 22 and 8 percent, respectively. Further, the outcome of analysis implies that if the mode of communication one selects for this type of task is “not in the people’s existing workflow”, the chances of its adoption by these communities are comparatively low. In fact, this low cost free and open source ICT interventions can be taken as a reason as to why ‘mobile telephony’ (voice & SMS) is the popular and dominant mode of communication within the farming communities.

In the logistic regression the likelihood ratio chi-square of 52.26 with a p-value of 0.0001 shows that our model as a whole fits significantly and both SMS usage ($z=2.61$, $P>|z|=0.029$) and IVR usage ($z=2.43$, $P>|z|=0.015$) are statistically significant. This implies that farmer’s SMS usage and IVR usage have significantly effect on the knowledge sharing by FOSS implementation.

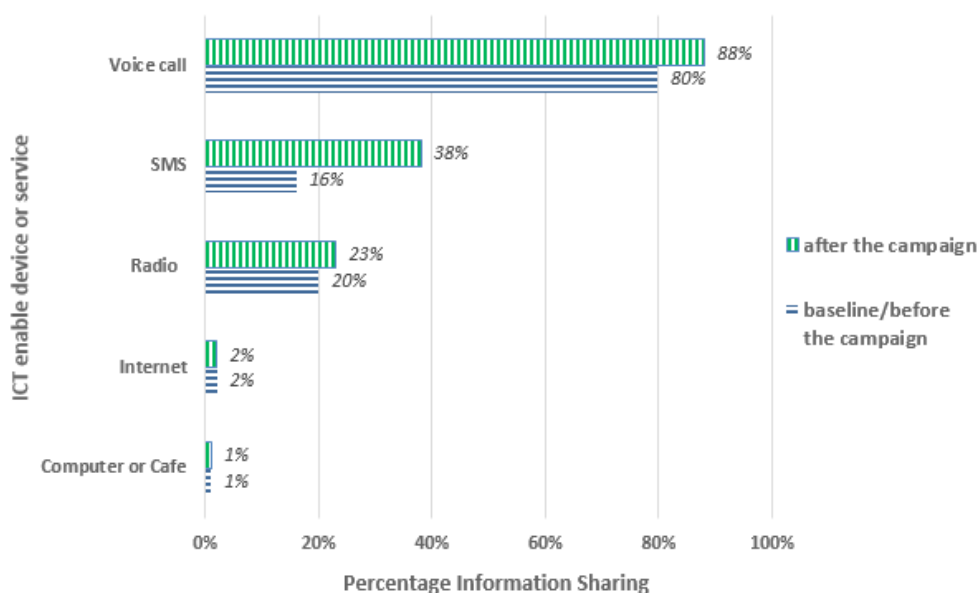


Figure 2 - Comparison of the ICTs use in knowledge sharing before and after campaign.

It was identified that this FOSS deployment was quite successful as the farmers got the cheap reliable agricultural information of the project. This intervention can be promoted, with necessary modifications like capacity development and

introduction of comprehensive training modules for further learning, to work as a drive for positive changes in the livelihood of agriculture-based rural communities. In capacity building process developing and delivering a course curriculum that addresses both technical and community engagement aspects was identified as very important for local innovation with low cost ICTs. Once developed, this approach can play an imperative role in advancing knowledge sharing, starting from the lowest socio-economic category in farming communities.

Conclusions

The outcome of this multi-phased research study highlights that the applicability of the concept of FOSS deployment to the farming communities in the said districts plays a prominent role to change the way farmers communicate and get solutions to their burning issues in agriculture. This FOSS deployment can be usefully conceived of as a micro-level innovation system. The stakeholders work on these criteria, thus, may come up with appropriate user-friendly packages targeting specific farming communities. Further this shall be regulated by relevant line Ministries working for agriculture to make sure 'right information is shared' to 'augment the level of usage'.

Acknowledgement

The authors express their appreciation to the Ag-Voice, Federation Department of Export Agriculture and Janathakshan for their invaluable contributions made and their commitment to this project.

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