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DIGITAL FARMER FIELD SCHOOL (DFFS): EXPLORING ALTERNATIVE COMMUNICATION AND EXTENSION OPTION FOR DAIRY FARMERS OF BHUTAN

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ABSTRACT: The study was conducted to explore DFFS as an alternative innovative communication and extension option for dairy farming communities in Yoeseltse gewog (block) under Samtse Dzongkhag (District), applying a perspective of responsible innovation to enhance extension policies and strategy of the Department of Livestock. A case study approach was adopted to gain in-depth insight into how the three multi-level stakeholders conceive the present situation of dairy extension service, the dairy extension problems and constraints, and what the farmers' and the extension agents expect from the dairy extension. The case study was operationalised through (a) open prototype trial of DFFS in groups and individual prototype trial & discovery (b) free discovery exercise and (c) semi-structured individual interview. The findings showed that DFFS is feasible in Bhutan. The operational skills shown by the farmers in operating the prototype was commendable. Hardware wise, all the respondents owned mobile phones, but the issue of access in terms of mobile and internet connectivity was still a concern in some pockets. A broader policy support for ICT development in the country exists but policy focus for use of ICT in rural agriculture extension system is needed to give impetus to the conventional extension system. There is a need to upgrade the ICT skills of the extension agents. In order for DFFS to become successful, it needs close collaboration among media designers, developers, and film makers. A longer-term solution would be to include DFFS in the extension and communication course curriculum at the College of Natural Resources (CNR). DFFS could be a highly effective means of service delivery during lockdown situations in the future.

Keywords: Dairy Farmers; Digital Farmer Field School; extension and communication; responsible innovation

1. INTRODUCTION

The majority of Bhutanese households rear livestock and it was estimated over 77 percent of the households own cattle in Bhutan (Department of Livestock [DoL] 2011). Crossbreeding local cattle with higher yielding exotic dairy breeds is considered an important approach in dairy husbandry intensification worldwide (Samdup et al. 2010). Delivery of efficient dairy extension service gets hampered due to rough topographical terrain, scattered and remote rural settlements. Extension service centres in Bhutan are mostly located at the road point and around 32 percent of the rural population walk for 2 - 6 kilometres to avail services (RNR Statictics 2015). Breeding services such as artificial insemination (AI) are time bound and delay in providing AI services results in huge production losses. This influences and impacts on timely provision of dairy extension services. This situation calls for a re-think of the conventional agricultural extension systems and consider other options for service provision to the farming community for optimum production in the context of changing world dynamics.

DFFS is an innovative interaction model based on audio-visual contents, which fits the needs of illiterate farmers based on Farmer Field School (FFS) principles. DFFS mediates interaction between farmers in groups and extension workers back in their office. Farmers document, seek and consult problems related to their farm and the extension workers provide support through the tablet from his office. DFFS prototype is based on a tablet with the features to make calls, send pictures and messages and view educative videos on good farming practices. As per FairMatch Support (2016), farmers showed keen interest and a high level of motivation to use DFFS in Sierra Leone. A promising sign is

that farmers were able to use all the functions of the DFFS to take pictures of diseased cocoa pods, discuss pest and crop management amongst themselves and with the extension workers.

Similar comparison can be drawn between the difficulties of reaching extension services due to Ebola outbreak and the restriction imposed on movement and gathering of people in Sierra Leone and the difficulty in reaching the extension services to scattered and remote settlements of Bhutanese farmers. The prototype testing proved successful despite the network connectivity and changing problems in Sierra Leone. It would be worthwhile to explore DFFS options in Bhutan. Since Bhutan has better network connectivity and electricity, the possibility of DFFS to succeed in Bhutan is higher compared to Sierra Leone. Thus, the research project was aimed to explore DFFS as an alternative innovative communication and extension option for dairy farming communities in Bhutan, applying a perspective of responsible innovation to enhance livestock extension policies and strategies.

2. MATERIALS AND METHODS

A case study approach was adopted to gain in-depth insight into how the three multi-level stakeholders policy makers, extension agents and the dairy farmers conceive the present situation of dairy extension services, the dairy extension problems, constraints and what the farmers and the extension agents expect from the dairy extension. It was also to explore what alternative innovative communication and extension options DFFS can provide to the dairy-farming households of Bhutan. The case study was operationalised in a series of events for three groups of stakeholders to explore and understand the response of the stakeholders on the options of learning and communication with DFFS in Bhutan.

2.1 Open prototype trial of DFFS in groups and individual prototype trial and discovery

Two DFFS prototypes (two Prestigio tablets) developed for cocoa farmers of Sierra Leone was received by the researcher from the developers in the Netherlands. With these prototypes it was possible to have an open prototype trial for the case study in Bhutan. The prototypes were also used for the free discovery exercise and individual prototype trials to observe how the stakeholders handled and operated the prototype, its content and the functions.

A total of 15 members of *Kuenphen Yargay Detshen*, a dairy group turned up for the open prototype trial at the Livestock Extension Centre (LEC) at Yoeseltse gewog. It started with an introduction of the researcher and expression of appreciation for their participation. The research objectives and the purpose of the open prototype trial was also explained to the participants. The individual prototype trial by the individual respondents of policy makers, extension agents and the non-group dairy farmers took place before the interviews. The open prototype trial in groups or individual prototype trials were aimed at giving first-hand experience of the DFFS prototype and the functions

2.2 Free discovery exercise

The open prototype trial was followed by free discovery exercise by the research participants themselves. The participants in Yoeseltse *gewog* were split into two groups of seven and eight members each and received one prototype each for the group. The handling of the prototype and their reactions to the prototype was observed and recorded by the researcher by using a camera and notebooks. This provided an opportunity to record the reactions and raise questions on the prototype. The free discovery exercise was done in two steps. Initially the participants were made to discover the DFFS in the groups and the researcher observed the process of free discovery exercise. Later on the researcher engaged more interactively with the participants in discussing and answering the questions.

2.3 Semi-structured individual interview using topic lists as a guide

The policy makers, extension agents and the non-group dairy farmers were interviewed separately at separate locations and at different times. The individual interviews for the policy makers were held at Thimphu. Individual interviews for the extension agents were held at the District Veterinary Hospital (DVH), Samtse and non-group dairy farmers were interviewed under Samtse gewog. For the dairy group, individual interviews were conducted at the LEC, Yoeseltse gewog. The interviews were done using topic

lists as a guide for semi-structured interviews. The topic lists for the interview using the six steps or the ladder of inclusive innovation (Heeks, 2013). Three representatives of the *Kuenphen Yargay Detshen*, and three non-group dairy farmers of Samtse gewog were interviewed to see if there were difference in views on the dairy extension systems, problems and constraints and their expectations. The representatives of the dairy group shared their own views and the views of the groups were discussed. The representatives from the non-group dairy farmers expressed their personal views. In order to gain insight from the extension agents' perspective, three livestock extension agents of Samtse Dzongkhag were interviewed. For the policy level, one representative from the Policy and Planning Division (PPD) of the Ministry of Agriculture and Forests (MoAF), one representative from the DoL and one from the National Dairy Development Centre (NDDC) were interviewed.

2.4 Data analysis

Data collected from the interviews were recorded in the notebook and the voice recording was done in mobile phone. At the end of the interview each day, the voice recordings were transcribed verbatim and translated into English. These were then reviewed for content understanding and identification of useful comments and notations made during the interview. Data collected everyday were categorized based on the themes (structural and post structural inclusion, inclusion of process, inclusion of impact, inclusion of consumption and inclusion of intent) used in interview and entered into the Microsoft Excel sheet in order to make information clearer and systematic for analysis. The data including observations and notations were developed into preliminary descriptive and interpretive categories based on evidence presented in the transcripts, literature reviews and the conceptual framework used to guide the research. A narrative account of the case study will be presented along with photos and voice recordings as evidence.

3. RESULTS AND DISCUSSON

3.1 Current situation: Rural extension and Farmer Field School (FFS) in Bhutan

The policy makers and the extension agents had a uniform definition for the rural extension system. However, the farmers used differing terms as compared to the extension agents and the extension system partly because the local languages contain more exhaustive technical terms. Farmers usually called the extension agents as '*Sanam babu' ('Sanam'* literally means agriculture, '*babu'* means a respectful title or form of address for a man, especially an educated one) or '*Gonor babu' ('Gonor'* means livestock*).* Farmers also considered extension agents as a source of knowledge and skills covering remote areas on foot and carrying extension bags. One of the dairy farmers commented:

"Though the development has come, still many extension services are provided by walking and carrying bags, as not all the farmers are by the road side. The development has not yet defeated the remoteness of our place" (Dairy farmer6, Samtse).

No proper terms were available in the local languages to explain and describe FFS by the dairy farmers. They just termed FFS as '*Sanam jongdar'* meaning 'agriculture training' which clearly indicated that the respondents relate and understand FFS as a training method only. They do not refer to extension in the context of communication or knowledge exchange. Similar finding was reported from Nepal where the author stated that the FFS was seen just as a training in which farmers learn about the pest management (Westendorp 2012). FFS is not seen yet as a tool to educate local people with practical knowledge, to enhance their capability for informed decision-making in response to the context driven problems.

Views and experiences on FFS shared by the policy makers shed a different perspective as compared to the FFS concepts defined in the literatures. FFS is being viewed mostly as an extension method rather than as an established concept on knowledge creation, learning and communication. It is viewed as a non-formal farmer to farmer contact, sharing of experience and marketing. Similar views were shared by the respondents from the policy levels. One of the respondents of policy makers stated:

"FFS as such is not formalized as one, but informally what I could say is, farmer to farmer contact has been going on through farmers'

study tours, some farmers from one region are taken to another region and through that contact they tried to share their experiences, hands on experience. So far as I know, that is the only institutions I can remember of as FFS" (Policy maker2, Thimphu).

The officials working in the government offices related the experience of FFS especially with the agriculture sector which was implemented mainly in the form of demonstration plots, lead farmer concept and Integrated Pest Management (IPM). The Livestock Extension Agents termed FFS as a "better learning platform" for both the farmers and the extension agents because they come together and learn practically like research activities. But, but they agreed that FFS was not practiced in livestock extension systems contrary to what was reported by Westendorp (2012) about FFS or *Krishak parsyala* as it is called in Nepal, is a familiar concept all over the Nepalese organisations. Westendorp also reported that the government had adopted FFS as a key extension method and many NGOs work with FFS techniques. She claimed that all the NGO and farmers all over Nepal can talk about FFS uniformly.

3.2 Policy support on ICT use in agriculture extension and the intent of DFFS use in dairy farming in Bhutan

Policy makers were interviewed to gain insight on the policy support of Information and Communication Technology (ICT) use in the agriculture extension system. They mentioned that there was definitely policy support for use of ICT in agriculture. They, however, felt that the use of ICT as such has not been attempted strongly, but the policy supports are engrained in the Government-to-Citizen (G2C) services, an initiative of the government to take ICT to the people. One of the policy makers said:

"In terms of ICT in agriculture, definitely Ministry of Agriculture and Forests is very much for it. Globally everything now has to move forward and it is all like IT based e-learning concepts. The policies of the ministry are also in line with that and moving forward with our farmers and how do extension agent report to the Ministry and line departments and Agencies" (Policy maker1, Thimphu)

Through the G2C services initiative, Community Centres (CC) were established at every gewog so that the rural people can benefit from ICT. However, the efficiency as per the policy makers was "questionable". Although it was started some four years ago but if you look at the implementation in the field, it is still at an infant stage. It was also felt that to have digital services in our extension system, institutions with appropriate infrastructures and equipment should be in place at all levels; only then can we talk of digitalization. They were also of the view that we must educate the famers, the extension agents and even the policy makers in digital application. However, the broader policy support of the government lacked focus. Not much is mentioned on the development and use of ICT in rural extension and communication., which are basically interactive module of ICT use. Most of the ongoing ICT works in the ministry were aimed at gathering information; on progress report submission and report generation.

The use of ICT in livestock services is currently limited to areas of animal health, disease reporting and strengthening of farm management systems. In the dairy sector, ICT use was only initiated in the National Cattle Identification System (NCIS) for the dairy farmers group. The farmers were educated on how to enter the data, but not in terms of using tablets and other devices. An attempt was being made to see how efficiently feed and fodder services could be delivered through the use of ICT. All the respondents were of the view that DFFS can be used in diverse areas and is not just restricted to livestock and dairy extension systems. Report findings indicate that in livestock, definitely DFFS could be used in reporting disease outbreak; diseases that could led to epidemic situation, so that it could be reported on time, for collective measure and timely remedy.

The findings conform to the finding of Heeks et al. (2014) in which they stated that inclusive innovation should consider more policy focus, policy process and structures. They also suggested that a more reflective point of departure for policy that seeks to understand the actors, perspectives, and politics of inclusive innovation rather than to advocate a one-size fits all policy menu. The impact of such broader policy initiative is not to the desired level, going by the feedback received from the policy makers. To a certain level, it has helped providing

paperless public services like applying for permits, census upgradation and issuance of birth certificates but not in enhancing the extension service delivery system in the country.

3.3 Structural changes in introducing DFFS in Bhutan

The policy makers were also of the view that it is important to understand the organisational structures that would be actively involved in the introduction of DFFS in Bhutan. Unless the institutions, individuals and the stakeholders responsible for taking up the DFFS innovation are competent and well organised, inclusion of structures may not be affected.

The Information and Communication Services (ICS) under the MoAF caters to the communication of information of extension innovations to the farmers through the line departments of the ministry - agriculture, livestock and forest. The line departments also have their own ICT experts. One of the policy makers highlighted that the government is already in the process of re-structuring and strengthening the ICS. So, in a way the government support is there and a political will to improve ICT usage and the whole statistical system in the country is under some sort of structural change. One of the policy makers remarked;

"In terms of MoAF, there is already political will and some work under way in terms of developing apps, e-agriculture and things like that, so there is definitely movement in that sense and also because some of the apps as I have mentioned earlier were not too technocratic. So, it will be easy for extension agents to use and that are suitable to our farmers to use also. I do not see much of real structural changes that are needed. What is more needed immediately is once we agree on a kind of apps and a kind of information we collect, massive and aggressive reach out advocacy and awareness campaign is necessary" (Policy maker1, Thimphu).

Policy maker2 insisted that it is crucial to have institutional arrangements in place, not exactly new but reinforcement especially in the data information division in the department and strengthen the capacities of the staff. The need to strengthen the use of applications and database and also application program that we are going to promote now was also expressed by the respondents. So, in a way, the policy makers were convinced that the existing structures may be enough to shoulder the implementation of DFFS, but needs strengthening and reinforcement of their roles. However, developing the DFFS and making films need specialized expertise. To call it the inclusion of structures, the policy makers felt to strengthen the capacity of the staff in the areas of DFFS and filming.

3.4 Problems and constraints in conventional livestock extension system

As per the policy makers, the existing system of placing three extension agents (livestock, agriculture and forest) in every gewog seemed not justified and irrational as priority area for the livestock and agriculture differs. The extension staff placement is not done as per the priority activity of the area. It was found impossible to cover all the gewog by one livestock agent alone. This gives opportunity to innovate and explore for alternative options to fill the gap of extension staff shortage and to provide timely services.

An integrated approach to RNR extension system initiated in the early 1990s seems to have disintegrated as the present extension system is more of sectorial specialists rather than as communication for rural innovation specialists. As the policy do not support placing more than one extension staff in every gewog for extensive coverage, alternative extension delivery options like DFFS would play a crucial role under such circumstances.

3.5 Technological aspects

Methods such as open prototype trial, free discovery exercise and individual interviews were used to observe and find out the level of mobile and smart phone use. For the internet and mobile connectivity, the researcher also tested the access personally on route to the study area.

From the interviews it could be concluded that the confidence of the policy makers on the mobile phone and internet connectivity in the Dzongkhags and gewogs was rather high. One of the policy makers passionately claimed that "as e-connect or our internet access has improved a lot, there is almost 3G coverage throughout the

country, so I think there should not be much problem in getting implemented".

Despite claims from the telephone companies and the policy makers on the full coverage of internet and 3G mobile connectivity throughout the country, the ground realities in the field remains different. Over and above the feedback and comments received from the farmers, the internet connectivity was also tested and confirmed by the researcher on five trial stops en-route to the study area. Except at the researcher's residence, the connectivity, especially the internet was very poor at all trial stops.

Mobile connectivity was very poor at *Sauriney*, which is at a strategic point among all the places in Samtse. The farmers here make the best use by walking and facing the northern mobile tower and southern mobile tower to make and receive calls. The poor mobile connectivity will have an impact on the usage and implementation of DFFS in future.

Similar to the findings of Witteveen et al. (2016) from the DFFS prototype testing in Sierra Leone, material access was not a problem as every member of the group owned a mobile handset in the research area. However, the mobile and internet connectivity is still a problem despit the claims of full coverage by the policy makers and the telephone companies.

As every farmer of the community have mobile phones, it may qualify to consider financial aspects of inclusion of consumption. But looking at the mobile network and internet connectivity, it may not qualify it to be called inclusive consumption. The high call charge was another cause for concern to not qualify it as inclusive consumption.

The study found that "hardware" wise, the digital divide seemed non- existent in the study area as all the members in the community owned mobile phones. The mobile phones they owned were mostly small screen. The respondents were uncertain on the views of the affordability of bigger screen mobile phones. But they were mostly positive as one of the respondents pointed out that;

"The device may be expensive, but it should not be left to the government for purchase of device. People should be able to buy such devices to get timely service to improve our livelihoods" (Dairy farmer3, Yoeseltse).

Though indication of dependency on subsidy was evident from the way the respondents expressed, it was also evident that farmers are ready to bear the cost of bigger screen mobiles if it benefits them.

3.6 Open prototype trial and free discovery exercise of DFFS by the dairy farmer

Based on the open prototype trial and free discovery exercise deployed to see, understand and record the response of the dairy farmers on the DFFS, a total of 15 members (10f & 5m) out of the 21 registered members of the *Kuenphen Yargay Detshen* participated in the open innovation display. The oldest participant was 61 years old and nine of the participants were above 36 years old and are categorised as the elder participants. Rest of the six participants were in the age range of 24 to 35 years, who were categorised as younger participants. The participants showed keen interest in the concept of DFFS itself and the functions. After the introductory remarks of the open prototype trial, the DFFS prototype was provided in groups to facilitate a free discovery of the device. The participants were divided randomly into two groups with an equal mix of both the young and elder participants and were given a prototype each. With little hesitation at the beginning and a slight persuasion by the elders in the group, the younger participants took the lead in fiddling and operating the prototype.

Figure 1: DFFS open prototype trail at Yoeseltse Gewog Samtse

The elder participants took the back seat in operating the devices. Most of the elders tried to

persuade the younger participants to operate the device. Contrary to what was observed from testing of DFFS in Sierra Leone, no "shock or paralysis" was observed upon handling over the tablets, but rather a hesitation in the beginning (Witteveen, et al., 2016). After they could fiddle and find out where the power buttons and other navigations buttons were, the younger participants took over the operation of the device. In the process of watching and navigating the content of the DFFS prototype, a sense of agreement was observed among the participants. They were mostly nodding when they navigated the prototype. The elders liked the character of Fatu and the way she conveyed the message, but they complained of the language used in the prototype as it was in Krio language.

The extension agents were very much in favour of having such innovative communication devices in our extension system. The extension agents also agreed that DFFS would not only improve efficiency of services delivery to the farmers, but they were also of the view that DFFS and use of such devices would enhance their self-esteem. One of the extension agents also view DFFS as a tool that can help achieve the national goals.

3.7 Implications of introducing DFFS in Bhutan

A lot of interest and enthusiasm was created by the idea of DFFS alone, among the respondents. ICT has never been explored as an extension tool in Bhutan besides data collection and report submission. As DFFS was new to Bhutan, respondents were asked to share their views and opinions on the implications DFFS could offer in future if Bhutan adopts the DFFS innovation. Judging from the responses received from the respondents and the interest generated by the DFFS after the open prototype trials and free discovery exercise, there was general consensus that DFFS could bring tremendous benefits not just to the dairy farmers, but also to other farming communities and other service providers such as health and education sector. All the respondents felt that DFFS could enhance the extension service delivery particularly in the context of Bhutan that is limited by natural barriers and remote settlements.

One of the dairy farmers from Samtse said he didn't see any negative implications as such. He felt that we need such technologies so that our livestock extension officers could speed up the services. All the dairy farmers liked the concept and admitted that it would benefit both the service providers and beneficiaries. Farmers will benefit more as they will get timely services. As the implication of DFFS has not been studied widely, only the DFFS prototype testing in Sierra Leone has been reported (Witteveen et al. 2016), and comparative information is not yet available. Despite a positive and open interest farmers are also cautious of the innovation and possible compromise that could arise in the process of adopting the innovation. The respondents felt that the device might infringe into the privacy of the farmers' life. Sharing videos and recordings might get their privacy compromised and expose personal information. Creating awareness on the responsible use of the technology was found to be critical. Such inhibitions and hesitations seem natural as people always associate new innovations and ideas with both positive and negative effects.

The issue of corruption case presently being investigated at the previous proposed study site clearly indicate that corruption exists and such events could affect the groups and the farmers' livelihoods. The most positive scenario is to assume that such devices could open up obscurity and corruption and help strengthen transparency in the group.

3.8 Inclusion of process in the development process

In order to understand the process of farmers' participation in the consultation process of development, the stakeholders were interviewed. Heeks et al (2013) called it inclusive innovation only if the excluded group is involved in the development of the innovation. Recognising and knowing if there were any excluded groups or individuals from the developmental discourses and planning process would give some ideas on how people are engaged in innovation, design and development of innovation like DFFS.

A mixed reaction from the policy makers on the status of marginalization of vulnerable groups from the development discourses were indicative that there exists an excluded group of people from the development discourse and consultations. There were also claims from some dairy farmers that they were not involved in the

meetings and consultations by the policy makers which supported the above mixed reaction of the policy makers that the exclusion exists in Bhutan. Heeks is also of the view that not the entire group could be involved. But the more you involve people, the better is the consultative, design and development of the innovation process.

Heeks (2013) also argued that the underlying frames of knowledge like our own language are the foundations of power which determine societal outcomes. In order for the innovation to be inclusive, it has to be created within a frame of knowledge and discourse that is itself inclusive. One of the female respondents clearly expressed her dislike and her inability to comprehend the *Krio* language used in the prototype displayed earlier before the interview.

Inclusive innovation is beyond physical involvement of people. Rather incorporating and including the local language into the device under local context is crucial for the DFFS to succeed. The design principle should take care of such inclusion and should encompass larger interests rather than the individual interests.

3.9 Expectations of the extension agents and dairy farmers

In the process of interviewing, the policy makers and the extension agents discussed many expectations from the government. An indent is collected every year for the planning process, the needs and the expectations by the line departments and agencies in a participatory manner. The policy makers know the expectations of the extension agents and the farmers. This enables the line departments and agencies to prepare and explore for funding and to build strategies to implement the needs and the expectations. The expectations of the extension agents and the dairy farmers were collected from the digital technological perspective.

According to one policy maker, the extension agents expect the line department and agencies to upgrade their knowledge skills every now and then because they always have to cope up what is happening around the world. Most farmers in Bhutan have access to television facilities and the farmers are much aware of the developments around the world. The policy maker remarked felt that:

"The farmers feel the development is taking place around the world and when they see such things they go and ask our extension agents and the extension agents in turn tell us they need such development trainings, upgradation of knowledge and skills" (Policy maker3, Thimphu).

The policy maker reminded that if the extension agents do not keep themselves abreast of the development practice in and around the world, they will fail to deliver such services to the farmers. This can only be done through the internet and digital technology to meet the expectations of the extension agents and the farmers in this digital world. With the changing production outcomes of farmers from self-sufficiency level to commercial farming, the expectations of the farmers were also high according to one of the policy makers. One key factor to stimulate farmers is market, where we have to provide assured market. This according to the policy maker is to connect every stakeholder in the chain through a transparent information system. He elaborated that:

"A common platform for the stakeholders that can be generated is through digitalization because the flow of information should be kept from input supplier with consumers then all the stakeholders along the chain will feel that they are not deceived. They work and they plan based on free flow and transparent information. Through that the most important thing for survival of institution is trust, that trust can be based through free and transparent flow of information. I feel that farmers' expectations are high, our expectations and aims are high, objectives are also high and we hope this digital information which we are trying to introduce can complement well" (Policy maker2, Thimphu).

One of the senior dairy farmers who is a former a *Gup* (Block administrator) in the gewog said that given the limited budget and the capacity of the extension agents, the service provided is satisfactory. But he said farmers' expectations, wants and needs are increasing. He narrated:

"With more and more trainings and advocacy like today, people become more aware and their needs and wants increases. This demands more specialised services and in different ways. With the pace of development of our country the

demand for specialised service will increase" (Dairy farmer3, Yoeseltse).

4. CONCLUSIONS & RECOMMENDATION

The prototype development and testing in Sierra Leone supported an exploratory study to the DFFS as an option of an alternative extension and communication technology in Bhutan. The individual interviews with the policy makers and the extension agents concluded that the FFS concept and the rural extension terminologies have assumed different connotations to different people working in the ministry. A well-defined understanding of FFS and the rural extension is lacking. Formalising and having a uniform understanding could help mainstream the concepts into the Bhutanese extension systems for articulated knowledge creation and exchange. A broader policy support for ICT development existed but a clear policy focus and mention on the use of ICT in rural extension and communication system was missing. This policy focus is needed to give impetus to the RNR extension system. This might enable the ministry and the agencies to solicit budget support to plan and implement ICT in the agriculture system. Structural changes many not be required to implement DFFS but certain courses like media design would be required. A long-term solution would be to include DFFS in the extension and communication course curriculum at CNR. It was found that a single extension agent in a gewog was impossible to cover all villages in the gewog. Since the policy does not support to increase the number of staff, options like DFFS could offer an alternative under such circumstances. In order for DFFS to take effect successfully, a separate team and a unit or the "back office" setup is crucial to respond to the farmers' queries and to direct the messages to relevant experts. DFFS could be combined with the current extension system so that it complements rather than supplementing the conventional extension system. Moreover, it is of high importance to respect the local language to make conversations in DFFS. With every farmer owning mobile handsets, material access does not appear to be a problem in the research area. However, despite the claims by the policy makers and the telephone companies, the mobile and internet connectivity is still a problem. There was a general consensus among the respondents that DFFS could bring tremendous benefits to the farming communities and other social service providers such as health and education sector in efficient delivery of the services. It was also felt that, DFFS could enhance the extension service delivery particularly in the context of Bhutan that is limited by natural barriers, remoteness and scattered settlements. However, although DFFS may be feasible in Bhutan, setting up feasibility criteria and consideration on cost implications are important prior to implementing it. Other criteria to consider are internet and mobile connectivity and access, literacy level of the users, affordability of the device by the users and group and place for implementation. Based on the feedbacks, DFFS could be initially implemented in enhancing the heat detection and improving breeding efficiency in dairy cattle, reporting disease outbreaks on livestock, NCIS and feed and fodder development services. DFFS could be highly effective as a means to provide services to the farmers during disaster or pandemic situations when movement of service providers are regulated or even restricted.

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