

# Developing Contemporary Rural Communication Services in Indonesia. Prototype Testing of Digital Farmer Field School (DFFS)

Nurdahalia Lairing

Research center for Communication, Social Ecological Learning and Sustainable Environment (CoSeLSe),  
University of Muhammadiyah Enrekang – South Sulawesi - Indonesia

## Abstract

In Enrekang district, South Sulawesi - Indonesia, the regional government, the University of Muhammadiyah Enrekang, the district offices of agricultures, environment and livestock decided to collaborate in response to the challenges of sustainable food production in the district. They opted for a Living Lab partnership to synchronise efforts of the different governmental rural service providers to improve access of farmers to information, communication, and extension for sustainable food production and environmental protection through the design and development of a Digital Farmer Field School (DFFS). Digital Farmer Field School is an android-based learning platform installed in a tablet used by farmer groups and extension officers for knowledge sharing and co-creation as an alternative to conventional extension services. This paper reports on the DFFS prototype v1.0 testing with its end users.

The DFFS Prototype v1.0 was developed in conjunction with training in the Design and Development of Digital Farmer Field School for the local design team in 2022. The prototype of DFFS Enrekang applies learning principles of conventional Farmer Field School (FFS) and design principles from the perspective of responsible innovation. The user centered design (UCD) adopted by the DFFS design team involves close consultation with farmers and the extension officers as its main users through field-based user testing. Adopting and implementing a vision on UCD was a new experience to all involved.

The prototype testing of DFFS Enrekang v.1.0 involved farmer groups from two sub districts and extension officers. Testing with farmer groups was focused on testing their ability in navigating the DFFS functions, whilst testing with extension officers was aimed to test if they came to grips with the concept of DFFS and could envision their role in DFFS. The results showed that the users were able to navigate the DFFS functions as instructed by two main characters in the DFFS prototype. The extension officers realized that the DFFS will change the way they work and therefore they suggested these changes to be reflected in their key performance indicators. As the content of DFFS functions and features are still to be developed, the farmers also provided input on the priority information needs to be included in the DFFS and agreed to be involved in the future testing of these contents. Surprisingly, female farmers and male farmers came with different information needs to which the design team will take into account in the content development. An unexpected result was the surprise of both extension officers and farmers about their ability to be engaged with something so unfamiliar such as *prototype testing*, a completely unfamiliar term as can be discerned in the statement “*we have become IT experts today*”. For further DFFS content design and development, it is recommended to make use of available resources which is affordable and intuitive, and based on the information needs identified by farmers.

## Keywords

Rural Communication Services, User Centred Design, Prototype Testing.

## Introduction

Digital Farmer Field School (DFFS) is an android-based learning platform installed in a tablet used by farmer groups and extension officers for knowledge sharing and co-creation as an alternative to conventional extension services. This paper elaborates the prototype testing of DFFS version 1.0 in Enrekang District (DFFS Enrekang), South Sulawesi – Indonesia.

The paper starts with the background to the design and development of the DFFS Enrekang as an innovative way to address the challenges in sustainable food production and environmental protection.

The Living Lab approach which brings the inter-institutional context of the DFFS initiative into motion, is presented in the following section. A description of the design and development of DFFS which leads to the prototype testing is followed by a description of the DFFS prototype testing.

## Background

The initiative of DFFS Enrekang began with an assessment in 2018, aimed to gather information in relation to general farming practices and agriculture extension activities in Enrekang district and to seek aspirations or ideas in relation to the design and development of a digital farmer field school in Enrekang<sup>1</sup>. The assessment report (Lairing & Witteveen, 2018) described that agriculture development in Enrekang district is facing a complex array of challenges in delivering high production without destroying the environment. The fear of losing production due to pests and other plant diseases have led farmers to apply chemical pesticides excessively. In addition, farmers limited information on soil condition have led them to apply fertilizer ineffectively.

Farmers are able to express need access to communication platforms and the ability to exchange up-to-date information on different techniques and technologies for increasing productivity and diversifying into more commercial crops, real-time weather reports, cropping patterns, and soil and water management to cope with climate variability. Amplifying the production chain, farmers need technology on crop and food storage and processing to add value to their raw produce, and marketing linkages to maximize profitability. Farmers also indicated to search for environmental sound practices as they observe landslides, river pollution and question health impact of fertilizers and pesticides. All farmer groups involved in this assessment possessed and used mobile phones as exemplified in figure 1, the women group in Baroko subdistrict. All these mentioned topics feature on the agenda of the different institutions who are active in rural Enrekang while facing problems of mobility, staff training and other scarce resources which inhibit realising well established goals in terms of extension, communication and farmer learning oriented activities.



*Figure 1. Female farmers from Baroko subdistrict showing their phone.*

---

<sup>1</sup> The result of this assessment was presented in IAMCR Madrid, Spain in 2019.

The COVID-19 pandemic made this unbalance situation even more complicated. The implementation of social distancing in response to corona virus makes limited mobility of goods, services, and impacting the job of rural extension officers. This context enhanced the ambition of the local government from different offices of agriculture, livestock and fisheries and environment with the local university UNIMEN to explore new avenues to overcome these issues which resulted in a plan to design and develop a Digital Farmer Field school. As it was realised that this would require a joint inter – institutional effort the Living Lab approach gained interest.

### **Living Lab Enrekang**

A Living Lab approach is defined by many authors differently, but they generally agree on Living Labs as open innovation or co-creation processes in real-life setting involving government, academia, civil society and industry. This approach is considered as relatively new in agriculture and environmental sectors and its showing promising results (Beaudoin et al., 2022).

Living Lab Enrekang was initiated in 2020 as an innovative approach in response to the farmers needs through synchronous efforts of different institutions in providing rural services. Soon after the start of the Living Lab, the partners agreed to start the design and development of a Digital Farmer Field School (DFFS) as digital platform for rural communication. The Covid-19 pandemic brought the District Health Office on board of the Living Lab and more recently the disaster management office joined the Living Lab team.

The Living Lab approach to DFFS Enrekang serves as a knowledge broker among farmer groups, relevant government agencies and research organizations. It focuses on co-creation, prototyping, testing and scaling up the DFFS which offers joint-value to the involved stakeholders in different level. For DFFS design and development, the Living Lab Enrekang cooperates with the Dutch partner Van Hall Larenstein University (VHL). The development of DFFS creates an essential collaborative action and learning for the institutional partners in the Living Lab configuration. This also elaborated by (Ståhlbröst & Holst, 2012; Westerlund & Leminen, 2011) that it is widely agreed that Living Labs require collaboration and learning between all societal actors.

### **DFFS Enrekang**

The DFFS Prototype v1.0 was developed in conjunction with a training for the local design team in the Design and Development of Digital Farmer Field School in 2021 - 2022. The design and development of DFFS Enrekang applies learning principles of conventional Farmer Field School (FFS) and design principles from the perspective of responsible innovation. The DFFS prototype was installed on five tablets (Samsung Galaxy Tab A8 LTE) provided by the key living lab partner and used by small groups of farmers in an off-line mode serves as a learning space for farmers and extension officers on sustainable food production. The design and development process of DFFS Enrekang guided by design principles (Lairing et al., 2021) which co-constructed by the living lab partners at initial stage of DFFS.

The DFFS Enrekang is aimed to facilitate interaction between farmer groups with staff in the back office that provide opportunities for training and coaching on application of good agricultural practices, economic aspects and broader environmental aspects as well as to address the challenges encountered

by farmers in their farm. The DFFS also allows farmers and staff at the back office to interact through phone calls, text messages, voice recorded and exchanging pictures or videos.

The user interface (UI) design of the tablet builds on a narrative with two farmer characters. Mr./ pak Ahmad and Mrs./ibu Siti were developed to guides the user(s) to navigate the DFFS tablet. These two characters were chosen based on local context and also to ensure equal gender representation of farmers in agriculture sector.



Figure 2. Opening Screen DFFS v1.0

The DFFS opening was designed to give a general overview of major components of DFFS. The opening screen (see figure 2) features icons (in Bahasa Indonesia) of agriculture practices, environmental practices, fisheries practices, library, health info, camera and music in local colour schemes and animations.

The DFFS back office (kantor DFFS) is designed to be managed by the DFFS team to provide support and advice to the farmers as well as to answer specific

questions from farmers. The back office would also be responsible for downloading and processing recorded information sent to DFFS for used in monitor the relevance of the content provided, support content creation by farmer users and connect with the wider knowledge system. The back office would also play a crucial role in facilitating periodic updating of the tablet and otherwise support the use of the DFFS by the farmer groups. In the back office there are also two characters representing extension staff and these are pak Amir and ibu Rida who will respond to any queries from the farmers.

The prototype was designed with an opening screen with links and buttons that lead to a second and a third level of information. The tablet was prepared with a SIM card for interactive functions such as phone calls and text messaging.

## Methodology

The DFFS prototype testing with farmer groups and extension officers were done in October 2022 and was considered as an integral part of design and development process of the DFFS and it was considered as adhering to the normative value *“we do not want to disappoint farmers”* which was adopted by the Living Lab partners.

The testing with extension officers and other institutional staff members was organized in a workshop setting at UNIMEN campus in Enrekang, involving 20 extension officers from district agriculture office and eight field staff representing living lab partners. The testing was focused on the ability of navigating the DFFS functions and on their understanding to the DFFS concept and clarify their role in DFFS management especially for the back office.

This was followed by workshops with farmer groups on two locations involving over 50 farmers (male and female groups) representing farmer groups from Baroko sub district and Anggeraja sub district, Enrekang district. All testing activities were facilitated by the same group of DFFS design and

management team members. The participants first worked with the DFFS tablet and later engaged in a serious game to simulate the functioning of their activities in the back office.

The testing with farmers was focused on testing the usability and ability of end users in navigating the DFFS functions and the features available in the DFFS. The testing was initiated with a short interactive session to give participants an idea on the background of the workshop and introducing how the DFFS looks like. Afterwards they were divided into five small groups facilitated by DFFS team members and asked to operate DFFS application on it and navigate all the functions available on the DFFS tablet including making real-time phone calls to ibu Siti and pak Amir at the back office. During this process of testing, participants were observed regarding their ability to operate the tablet and how they navigate through the DFFS interface by clicking or tapping on the icons and move to the next level of information structure. They were also observed on how they interacted with other fellow farmers in a group. Following this testing, the farmers also consulted on the key information needs to be included in the DFFS contents.

## Result and Discussion

### *Testing with Extension staff*

The extension officers and other institutional staff members were able to operate the DFFS tablet smoothly. They were able to navigate all functions available in DFFS. After experiencing first-hand how to use the DFFS, they discussed their roles in DFFS management. The Extension officers realised that the digital learning environment offered by DFFS will fundamentally change the approach of rural communication services subsequently imply to the role of extension officers. With conventional agricultural extension, the extension officers operate as driving force in the process of rural communication and training whereas in the DFFS their roles need to be redefined.



*Figure 3. DFFS prototype testing with extension officers*

*DFFS is great innovation as it aligns with current development of technology. Everybody became familiar with distance learning since the Covid-19 pandemic. For the DFFS to be used continuously and meet the information needs of farmers, we, as extension officers, need to upgrade our skills in managing digital learning platform and content creation. (Sub district extension officer, female)*

*I see that the DFFS will change our roles in rural communication services. These changes need to be formalized and reflected in our key performance indicators (District extension officer, male).*

After the testing of the DFFS tablet the extension officers and other institutional members engaged in a serious game to experience DFFS in operation. All participants were divided in 2 farmer groups, the back office, the DFFS design team, the DFFS management team and the university team and received response cards to communicate with the other groups. Each round in the game started with a question

card submitted by a farmer group and handed over to the back office which initiated a series of activities by response cards simulating the communication between the parties involved.

Regarding the role of extension officers in the back office in responding to farmers questions, the testing showed convincing evidence that the staff were quite optimistic that the majority of question can be answered by staff at the back office.

*90% of the questions from farmers can be handled by extension officers. If they can't, it will be diverted to the subject specialist available in each office (District extension officer, male)*

Participants in the farmer group observed the dynamics and reflected in the after action review their observations describing that many activities and communication between different groups involved. They added a remark on the importance of going back to farmer groups in case an issue raised could not be understood unambiguous or in full detail.

The main reflections of the back-office group were:

- Rida and Amir must really understand the division of tasks.
- Amir/Rida must fully understand the wishes of the farmer group or the group's problems  
Complaints/problems raised by farmers need to be answered quickly.

The university group took a role as researchers and concluded:

- The back office must provide clear and firmer information if accompanied by photos and videos.
- The flow of coordination must be clear so that the information provided from farmers is uniform and comes from one source, namely the DFFS.

The design team came to major reflection on the relevance of multimedia material to respond to questions on pests and diseases:

- Requires facilities and infrastructure in designing/making broadcast materials needed by farmers.
- The design team need to be trained in digital literacy, especially on multimedia designs.
- It requires IT personnel to make videos and animations.

The management team focused on synchronization of tasks and activities:

- Provide an overview of the work of the management team. When farmers raise issues with DFFS
- Collaboration of each stakeholder in facilitating any problems faced by farmers.
- The Management Team facilitates teamwork related to solving budget-related issues.
- There needs to be a clear division of tasks between the management team, DFFS Design team, and UNIMEN.

### *Testing with Farmer groups*

The enthusiastic and eagerness of farmers to participate in the prototype testing indicate the readiness to adopt the DFFS. Farmers in all groups were able to operate and navigate the DFFS functions successfully as instructed by the pak Ahmad and ibu Siti in the opening screen. They were initially watch the animation video of pak Amir and Ibu Rida providing instruction on how the DFFS works and then tried on their own to tap on icons on the screen. There were no major issues encountered by farmers in navigating the DFFS. Based on Van Dijk model (van Deursen & van Dijk, 2009), this is a good indication that DFFS design aligns with psychological access and skill access of it users. The majority of farmers own smartphones individually even though network is not always available and stable in their area. They use smartphones to play music and take pictures. To contact relatives or friends, they go to places where cellular networks or the internet are available. In fact, many of them are active social media users such as Instagram, Facebook and WhatsApp groups. During the process of this prototype testing, some of them were busy taking pictures and uploading them on their social media reels. This also confirms the findings during the initial assessment (Lairing et al., 2019) that DFFS has the potential to be developed in Enrekang district because farmers already have the ability to use digital media in their daily lives.



*Figure 4. DFFS prototype testing with Female Farmer group in Baroko subdistrict*



*Figure 5. DFFS prototype testing with male farmers group*

Farmers were excited to see camera and music on the DFFS. In daily life, they have used camera on their smartphone to capture their daily activities. A woman showed some photos on her phone taken from her coffee trees that were infected by “unknown” diseases. She reported that she has shared that pictures in her social media group and seek advice from her fellow farmers but no one came with solution yet. This such issue can be addressed through DFFS, because once the queries and pictures sent to pak Amir or ibu Rida at the back office, they will follow it up with expert from relevant office (e.g

district plantation office). The expert will follow up with further investigation and response to the case reported.

During the navigation testing, it was observed that the size of tablet used for DFFS testing was too small (display 8 Inch) to be used by a group of five people. The reason to choose this type of tablet was because is widely available on the market with affordable price so the farmer groups could afford to buy on their own budget. However, this need to be reconsidered as it is not effectively used as a group learning platform which is contrary to FFS principles.



*Figure 6. DFFS tablet used by a group of farmers.*

As part of application of user centred design approach, the agenda of prototype testing also included the discussion to identify and prioritize user's information needs to be included in the content of each section of DFFS. Table 1 provides information of prioritized information needs by female and male farmer groups

Table 1. List of Farmer's information needs to be included in DFFS.

<b>Section/ feature</b>	<b>Information needs listed by male farmers</b>	<b>Information needs listed by female farmers</b>
Info Sehat	Information on how to prevent and control indigestion such as Gerd	How to protect the body when spraying and fertilizing
	Information on how to treat uric acid	A safe and healthy way to cleanse the body after evening pesticide spraying
	Information related to rheumatic	
	How to prevent stunting	
	How to prevent and treat heart attack	
	Information	
	Treatment of food poisoning	
Treatment of pesticide poisoning		
Environmental Practices	Handling of plastic waste in the farm	Organic and an organic waste management
	How to prevent and control dengue fever	Environmentally friendly pest and disease control
	More profitable processing of agricultural waste	Utilization of agricultural waste
	How to deal with water scarcity	
Agricultural Practices	Farming practices that respond to climate change	Pest and disease control in horticulture
	More economical farming system horticultural commodity	Post-harvest processing when production is abundant, and prices drop
	Mapping of planting time of each commodity in the district	Use of the backyard for family food sources
		Marketing of agriculture products
Fisheries & Livestock practices	Guide to fish farming	Guide to fish farming
	Innovative crop-livestock integration	Fish food processing
	Type fishes suitable for high land	Prevention and control of ticks in cattle
	Fish and Animal disease prevention and control	Goat milk stimulation
	Guide for profitable fattening	
	Livestock waste management	
Proposed additional features	Market information of agriculture commodities (Availability of commodities and prices)	How to connect with other farmer group from different areas
	Weather forecast	



The table above shows that male and female farmers have similarities and also different information needs. The discussion following the prototype testing process provided new insight to the staff regarding these farmers' different needs for information. As one DFFS design team member said, *"we often assume that the information needs of farmers are the same and therefore we tend to provide generic information without trying to understand what information specifically needed by these groups. And from today's discussion I knew that even though the topic is the same, men and women have different interests to the specific training content."*

The design processes of DFFS apply user centered design (UCD) aimed to address the specific context, culture, behaviors and expectations of the DFFS user groups. This process has postered co-creating solutions, and continuously gathering and incorporating users' feedback. For this respect, the farmer and DFFS design team agreed to meet again and test the DFFS contents as soon as they are available. This agreement was symbolizing with signing a "contract" by farmers and the DFFS team.

### **Conclusion and way forward**

In the situation of limited alternative scenario in rural communication system in Enrekang district, DFFS Enrekang provides an alternative interface for interaction between farmer groups and extension officers as well as create an opportunity for different stakeholders in rural communication services to synchronize their services through DFFS.

The prototype testing of DFFS Enrekang v1.0 provides convincing evidence that both extension officers and farmer groups were able to operate and navigate the DFFS functions. Farmers, male and female, young and old, showed and expressed a keen interest, a high level of motivation and ability to use the DFFS.

The extension officers recognized that the DFFS will change their roles as well as the way they work. The digital innovation is perceived as potential to address current issues related to sustainable food production, however these changes need to be reflected in the policy document that set as corner stone for the DFFS to continue. The discussions seem to indicate an increasing interest for DFFS as complementary and innovative for a contemporary way of rural extension as compared to a more reluctant view on DFFS in earlier workshops when it was first time introduced in 2019. The extension officers were questioned the DFFS as a threat for conventional rural extension jobs. This more positive attitude related to the experience during the testing process as it becomes tangible that DFFS creates new opportunities for knowledge creation and exchange between the users and the design team. The DFFS prototype testing is that it enhances the participation of both female and male farmers in providing input to design and content of DFFS which highly reflect their needs.

In discussion with the farmer groups three types of information in relation to DFFS communication were distinguished:

1. Information that is relatively stable and can be on the tablet more or less permanently (e.g. the planting calendar, info about fertilizers).
2. Information that needs to be updated daily (e.g. information about weather conditions and market prices and availability of products on the market).
3. Information that is not available on the tablet and for which the farmers can call the back office.

Such distinction will support a further elaboration of an information typology to elaborate a management system once a DFFS is operational. This aligns with results of the prototype testing with extension in which it was concluded that the cooperation of the design team in the back office is very important. And then a clear job description is needed between the parties involved in DFFS, including the design team, management team, UNIMEN and farmers. All of this will affect the flow of communication in response to requests/information from farmer groups.

As agreed with the farmers, the design team has to feel accountable to develop content for the DFFS based on priority information needs listed by farmers. It is recommended to further design and develop materials that is affordable and intuitive design, making creative use of available resources and iteratively tested.

The results of the serious game on DFFS management with extension officers and institutional staff members indicated the importance of paying dedicated attention to the management of DFFS in full operation. The activity clarified the flow of activities the diverse requirements and responsibilities for different groups involved. It is recommended to use this game or a similar approach in future workshops to activate the awareness of DFFS as the game makes participants experience and practice a responsible innovation approach as dimensions such as anticipation and responsiveness (Stilgoe et al., 2013) were articulated during and after the game.

Adopting and implementing a vision on UCD was a new experience for all involved. An unexpected result was the surprise of both extension officers and farmers about their ability to be engaged with something so unfamiliar as *prototype testing*, a completely unfamiliar term as can be discerned in the statement made by an extension officer “*we have become IT experts today*”<sup>2</sup>.

## References

- Beaudoin, C., Joncoux, S., Jasmin, J. F., Berberi, A., McPhee, C., Schillo, R. S., & Nguyen, V. M. (2022). A research agenda for evaluating living labs as an open innovation model for environmental and agricultural sustainability. *Environmental Challenges*, 7(December 2021), 100505. <https://doi.org/10.1016/j.envc.2022.100505>
- Lairing, N., & Witteveen, L. (2018). *Assessment Report. The project of Design and Development of a Digital Farmer Field School for Coffee Value Chain in Enrekang District, South Sulawesi - Indonesia* (Issue November).
- Lairing, N., Witteveen, L., Busa, Y., Bagenda, A., Bagenda, M., & Addi. (2021). Co-constructing principles for Digital Farmer Field School Enrekang Design in South Sulawesi - Indonesia. *E3S Web of Conferences*, 306, 1–9. <https://doi.org/10.1051/e3sconf/202130603013>
- Lairing, N., Witteveen, L., & Fliert, E. van de. (2019). *Assessing the Potential for a Digital Farmer Field School supporting local innovation in the Coffee Value Chain in Enrekang District, South Sulawesi, Indonesia. Paper presented at the at IAMCR 2019 conference in Madrid, Spain, July 7-11, 2019.*
- Ståhlbröst, A., & Holst, M. (2012). The Living Lab Methodology Handbook. *Social Informatics at Luleå University of Technology and CDT – Centre for Distance-Spanning Technology*, 76.

---

<sup>2</sup> <https://youtu.be/zQj3L6bBdw0>

[http://www.ltu.se/cms\\_fs/1.101555!/file/LivingLabsMethodologyBook\\_web.pdf](http://www.ltu.se/cms_fs/1.101555!/file/LivingLabsMethodologyBook_web.pdf)

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy*. <https://doi.org/10.1016/j.respol.2013.05.008>

van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2009). Improving digital skills for the use of online public information and services. *Government Information Quarterly*, 26(2), 333–340. <https://doi.org/https://doi.org/10.1016/j.giq.2008.11.002>

Westerlund, M., & Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. *Technology Innovation Management Review*, 1(1), 19–25. <https://doi.org/10.22215/timreview/489>