



## Wageningen UR, Science Shop

Kusheh, na minem Fatu, en mi na koko farmer  
Hello, I am Fatu and I am a cocoa farmer

A Digital Farmer Field School for training in cocoa production and certification in Sierra Leone

Loes Witteveen, Margriet Goris, Rico Lie and Verina Ingram

Report 330  
April 2016



**WAGENINGEN UR**  
For quality of life



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## Colophon

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A Digital Farmer Field School for training in cocoa production and certification in Sierra Leone

Report number 330

Dr. L. Witteveen, Drs. M. Goris, Dr. R. Lie, Dr. V. Ingram  
Wageningen, April 2016

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FairMatch Support develops sustainable supply chains. From our offices in The Netherlands and West Africa, we support companies in finding new sources and producers in finding new markets. We are most emphatically present where the chain link is weakest. Our underlying philosophy is: high quality standards, realistic profit distribution and long-term collaboration. Our worldwide network of local partner organisations is an integral part of our organisation.

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Knowledge, Technology and Innovation (KTI) studies processes of socio-technical innovation and transformation. The focus is on communicative and socio-political dynamics that are involved in the production, exchange, integration and use of scientific and other knowledge. KTI specialises in interdisciplinary research and design.

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Wageningen UR, Science Shop supports non-profit organisations by implementing research projects with a potential societal impact in the fields of nutrition and health, sustainable agriculture, water management, environmental quality and processes of social change.



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# Preface

*Our function before the Ebola epidemic was to prepare farmers for certification, cocoa certification. We were working basically in the eastern region of Sierra Leone, Kenema, Kailahun and Kono.*



**Figure 1** Mohamed Fofanah

*On May 24th 2014, we had a team of trainers working in Buedu, which is located in Kailahun district, eastern region of Sierra Leone. They were training farmers, and most of the training was done on the farm or out in the local court bari. For this training, we usually cluster the farmers in groups of 25 and in some cases 35 depending on the amount of farmers we are targeting. In May, whilst our trainers in Buedu were training farmers in good agricultural practices and certification compliance, rumours of people dying of an unknown ailment started circulating around. During that time, we heard about people dying, people were sick and didn't know the reason why. At that moment one of our partners that we were working with (Welthungerhilfe) withdrew all of their staff from that area. So we contacted our external partner, and they advised us to also withdraw our staff from Buedu. At that time, our knowledge base of the Ebola epidemic was very low; as a matter of fact we didn't know that it was Ebola. So we thought it would be something that will just pass over and we will come back and continue conducting our training. To our surprise that was not the case. So we recalled our staff from the field and asked them to come back to Kenema and at that moment all of our training activity came to a halt. A few weeks later, there were certain government policies disallowing assembly, or gathering of people in groups. We followed and obeyed those policies and stayed in Kenema. As the situation got worse, during the early phase of the outbreak all of us were a little bit traumatised and devastated because of how fast the Ebola epidemic was getting out of control in the regions that we were working.*

*We waited for about a month. The situation wasn't getting better and was getting worse by the day. We contacted our partner, which is FairMatch Support in the Netherlands. And we expressed our frustration about not being able to carry out our activity since we were working on a timeline, preparing farmers for their final audit.*

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*We told them that we have certain pending topics that we need to cover and were wondering how we will be able to facilitate the training now that we have restrictions on movement and assembling. Also we were afraid. At that particular time, during the Ebola epidemic, Kailahun was the main hotspot. We were afraid also to go there. We expressed our fears that all the gains that we have made regarding the training on certification will be lost and we need a system that will ensure that we continue the process. So the managing director and the project manager said that, since it would be basically impossible to have contact with farmers at that particular time, it would be very good to come with some type of innovative ways to be able to get to the farmers without you risking yourself of catching the Ebola virus.*

*Mohamed Fofanah. Managing director of Jula Consultancy, Kenema. Sierra Leone.  
Transcript of interview fragments recorded on 17 January 2016.*

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# Summary

This document reports on the development of a prototype Digital Farmer Field School (DFFS) called *Kusheh, na minem Fatu, en mi na koko farmer* (“Hello, I am Fatu and I am a cocoa farmer”). The DFFS provides an ICT-based alternative to traditional agricultural extension. More specifically, it offers a tablet-based substitute for the face-to-face certification training for cocoa farmers in Sierra Leone. The fact that gatherings of more than five people at a time were not allowed as a consequence of the Ebola outbreak triggered the development of the digital alternative to group training for cocoa farmers.

In 2014, FairMatch Support, a developer of sustainable supply chains, contacted the Wageningen UR Science Shop. Because of the Ebola outbreak in Sierra Leone, FairMatch Support wanted to explore alternatives for the conventional certification training for cocoa farmers. *Jula*, a local business development service in cocoa development, is a partner of FairMatch Support in Sierra Leone and, in cooperation with the research group Knowledge, Technology and Innovation of Wageningen University, responsible for the testing of the prototype DFFS.

The report describes the design of the first prototype and its testing, which took place in Kailahun and Kenema districts in Sierra Leone, January 2016. During the testing, the DFFS and its specific Farmer Field School-based learning strategy was received very positively by the cocoa farmers and other value chain actors. Farmers, male and female, young and old, expressed a keen interest and a high level of motivation and ability to use the DFFS. The DFFS appeared to be culturally and technologically appropriate and aligned with operational and strategic communication skills. A promising sign is that farmers can use all the functions that are available on the tablet, which include making real-time phone calls about farms issues to the trainers in the back office. The narrative structure with *Fatu*, a female cocoa farmer as principal character, seems to be a valuable contributory factor enhancing farmers’ motivation.

The development and testing of the prototype leads us to conclude that the DFFS creates new opportunities for knowledge creation and exchange. A particular strength of the DFFS is that it enhances the position of both female and male farmers as regards playing a more autonomous role, and that training can be highly adapted to their needs. Some elements of the DFFS have potential for stand-alone use: the films and the regular interactions between the farmers and the back office through the tablet.

It is recommended that an affordable, intuitive design be further developed and iteratively tested, making creative use of available resources.

This report and all films on the prototype are available at the project website of the Wageningen UR, Science Shop, <http://www.wageningenur.nl/nl/project/A-digital-farmer-field-school.htm>. Also watch the film *Cocoa Training in Times of Ebola, Sunday Morning Reflections of Mohamed Fofanah* available on the same website.



# 1 Introduction

FairMatch Support and Welthungerhilfe are partners in the Agriculture for Development (A4D) project of the Ministry of Agriculture in Sierra Leone. The A4D project aims to contribute to the reduction of poverty in Sierra Leone through increased agricultural production and quality of produce. With the outbreak of the Ebola virus in Sierra Leone, all group activities involving more than five people were prohibited: "Public meetings and gatherings will be restricted with the exception of essential meetings related to Ebola sensitization and education" (State House, the Republic of Sierra Leone, 2014). This consequence of combatting the Ebola epidemic seriously hampered efforts to enable farmers to access better markets for cocoa, as the training and advisory activities implemented by Jula Consultancy for cocoa farmers were suspended.



**Figure 2** Billboard in Kenema

Because of these Ebola prevention policies, new media and communication strategies were required to maintain cocoa-based livelihoods and ensure the supply of certified cocoa. In response to this paralysing situation, FairMatch Support contacted the Knowledge, Technology and Innovation Research Group of Wageningen University to explore alternatives to the conventional certification training for cocoa farmers in Sierra Leone.

Wageningen University and Research, The Netherlands, supported the search for alternatives in response to Ebola with a [Science Shop project](#). The project aimed to design an alternative learning space for cocoa farmers, to formulate design principles to guide the development of a digital learning environment as an alternative to support cocoa farmer groups and service providers to improve cocoa production and receive certification.

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The Science Shop project resulted in the design and prototype development of the Digital Farmer Field School. This document reports on the development of a prototype Digital Farmer Field School called *Kusheh, na minem Fatu, en mi na koko farmer* ("Hello, I am Fatu and I am a cocoa farmer"). It describes the design of a first prototype and its testing, which took place in Kailahun and Kenema district in Sierra Leone, January 2016. The aim of this report, based on the experiences and the insights obtained, is to support decision making by Jula Consultancy and FairMatch Support about certification training and service delivery to cocoa farmer groups. The wider context of this research is positioned in the field of interface design of information technologies for novice and low literacy users to deliver rural, agricultural services.

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## 2 Digital learning to certify Sierra Leone cocoa farmers in times of Ebola

Cocoa is one of the four main export commodity crops in which Sierra Leonean smallholders engage, along with rubber, coffee and palm oil. The cocoa harvest is from June to January, with most of the harvesting done at the end of the rainy season from August to October. Productivity is currently low, with on average around 400 kg of cocoa per hectare per farmer, obtained mostly from low-yielding Amelonado varieties, which are over 60 years old. The neglect suffered by many farms during the Sierra Leonean civil war (1991–2002) affected production levels and quality. The crop has potential however, with rising global demand and pre-conflict successes: cocoa exports reached between 12,000 and 18,000 tons, with an export value of \$11.36m, around 85% of agricultural earnings in 2007 (Government of Sierra Leone, 2010).

In 2014, around 13,000 farmers organised in farmer groups and cooperatives were working towards UTZ, Organic and Rainforest Alliance certification with a step-wise plan to increase the number to 30,000 cocoa farmers by 2016. FairMatch Support, a developer of sustainable supply chains, and its Sierra Leonean training partner Jula Consultancy, supported these farmer groups with training and audits. If farmers are certified, this can increase their income – as a higher ‘premium’ price is paid for certified cocoa. Ingram et al. (2013, 2014a, 2014b) indicate that there are a number of other economic, social and environmental benefits from cocoa certification that support farmers to improve their production methods sustainably and aim to raise cocoa yields.

The certification process consists of face-to-face contact between farmers and trainers during a series of meetings and in-the-field training and demonstration activities. These support farmers’ good agricultural practices and prepare farmers to establish the required activities and meet the certification standards. Monitoring and auditing also take place on-farm, where farmers’ knowledge and farm practices are visually and physically checked against the certification scheme standards.

A wide range of challenges hamper certification training and the delivery of other services to cocoa farmers. The distances between service centres and farm communities, the efficiency of conventional agricultural extension services, the limited capacity of cocoa producers to purchase such services, socio-cultural aspects such as illiteracy and lack of availability of training materials in local languages, and limited transport facilities have led to a search for alternative services and alternative service provision systems. This search for alternatives became imperative when the Ebola outbreak interrupted the certification training given by Jula Consultancy in Kailahun, Kono and Kenema districts. The potential loss of income from (uncertified) cocoa is disastrous for farmers’ livelihoods, given the economic crisis. The embargo on certification training and other service delivery provision to farmer groups in Eastern Sierra Leone added to the urgent need to search for alternatives.

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### 2.1 A learning space for Sierra Leonean cocoa farmers in times of Ebola: An innovative extension model

The Ebola outbreak coincided with a broader debate regarding the effectiveness of current extension models used for the training of smallholder cocoa farmers. Digital learning environments are increasingly recognised as potential contributors to agricultural knowledge and extension systems. The analysis of contemporary cocoa knowledge and training systems in Sierra Leone resulted in a preliminary design of a ‘computer-based school’ to provide a learning environment using small digital touch screen tablets that could be used by farmers in small or large groups. The computer school idea evolved into creating a Digital Farmer Field School (DFFS), the first initiative of its kind to open up digital learning to people with low literacy in Sierra Leone.





**Figure 3** Health Clinic

A tablet was selected as the optimal technology interface. A small, handheld tablet allows diverse applications to be used offline, with regular online updates and options for interaction with service providers in back offices online. A tablet was preferred to a mobile phone because of its larger screen size, the lower costs involved and the assumed collective character of a tablet compared to the more individual character of a mobile phone. In online mode, tablets can be used for self-organised group training, supported by viewing short films about certain agricultural, certification and other practices. Another distinctive element was a tablet's ability to allow a visual approach, given farmers' low literacy levels and also to allow the visual identification and documentation of pests and diseases. Where possible, interaction with support staff in a back office could be facilitated, through phone calls, exchanging pictures and voice messages.

The design was envisaged to facilitate interaction between farmers in groups and with staff in the back office. Doing so would create opportunities for training, coaching and monitoring on cocoa quality and address the challenges encountered by rural farmers in supplying their cocoa to the global cocoa chain. Besides training and coaching on agricultural and economic aspects, support on social aspects, broader environmental aspects, and monitoring and certification purposes could be incorporated in the design.

Achieving such a digital learning environment constitutes a revolutionary change to conventional, face-to-face linear approaches, whereby extension agents and trainers operate as the driving force in processes of rural communication and learning. Achieving a learning environment whereby farmers, meeting in groups in their own community, would be able to access a recognised platform of knowledge sharing and learning responding to their own needs, at their own pace and according to their own learning dynamics could lead to substantial innovations in communication. The position of the rural farmers could be strengthened to enable them to become more active participants in agricultural knowledge systems and the value chain, also implying a reconfiguration of the system and a repositioning of the role of extension workers, trainers, auditors and field monitoring officers.

The design and development of the DFFS prototype took place between May and December 2015, when the first prototype was produced. Although the Ebola epidemic had slowed by November 2015, and the state of emergency was lifted with the last officially reported case in January 2016, the WHO has warned that more flare-ups are expected. Although the urgency due to Ebola has reduced, the need to provide alternative learning environments is still high. This led to a revision of the Science Shop project to answer the research question "What can the digital learning environment of the Digital



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Farmer Field School add to current agricultural and certification training in Sierra Leone?" by developing and testing the DFFS prototype.

FairMatch Support decided to support the testing by farmers, and in January 2016 staff members of Wageningen University, Jula Consultancy and FairMatch Support engaged in testing the prototype. The objective was to assess the usability of the user interface and the attractiveness (user motivation) of the DFFS prototype, as perceived by cocoa farmers and service providers, and to explore the potential of a tablet-based learning environment to enhance cocoa certification in Kenema region, Sierra Leone. The testing focused on farmers and on the major service delivery providers: trainers and field monitoring officers.

Section 3 describes the prototype design, elaborating on major concepts explored to design the Digital Farmer Field School. The section answers the question: "What design principles guide the development of a digital learning environment to support cocoa farmer groups and service providers for cocoa production and certification?" Section 4 describes how the design principles were operationalised and resulted in the development of a prototype. The last sections describe the testing and the resulting outcomes. The report concludes by looking at ways forward and already anticipates the question: "What are the implications for the conventional service delivery system if the Digital Farmer Field School is implemented?"



### 3 The prototype Digital Farmer Field School

The documented activities of Jula Consultancy provided the basis for exploring alternatives for farmer learning and training for certification in times of Ebola. There was a limited amount of information available about rural livelihoods and medium and smallholder farming systems in Eastern Sierra Leone. Governmental responses and interventions focusing on smallholder and medium-size producers and agricultural service delivery in Eastern Sierra Leone during the Ebola crisis are still unknown and would be useful to include in a subsequent phase of the project.

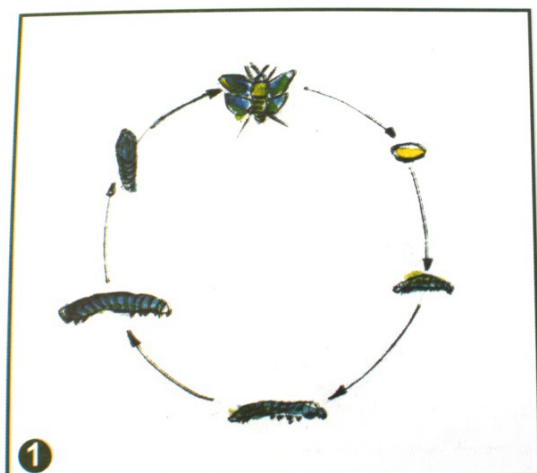
To gain insight into the current rural communication systems, an overview was made of materials used in Sierra Leonean cocoa certification. Certification training manuals are comparable in their content and structure. Most materials are produced for agricultural extension workers or certification trainers and focus on activities, which, when implemented in a step-wise approach, lead to certification. Figure 1 provides an example. Most manuals have four modules: cocoa certification, agricultural practices, environment practices and social practices. Most manuals also provide explanatory details for service delivery staff about the use of the manual, the curricula and guidelines for trainers.

The materials use both text and visual material to support training and inform farmers. Drawings in black and white and colour aim to suit the needs of (semi) illiterate audiences. Most visuals in the manuals are of low quality design.



Figure 4 Step-wise approach to certification (Dohmen et al., 2014)

The twofold aim of trainer guidelines and training material means that the existing manuals play to two different audiences: literate trainers and farmers with a low literacy level. Most of this material is unsuitable in a digital learning environment for autonomous use by cocoa farmers. A detailed analysis of the visual material indicated that basic good design principles for low and illiterate adult audiences were not adhered to (i.e. modelling of insect life cycles in a way that assumes an education with basic biological models (Figure 3) and pointing finger representations, as if the cocoa farmers are children in school (Figure 4).



**Figure 5** Modelling of insect life cycles (David, 2007)



**Figure 6** Pointing finger representation (Tetty & David, 2010)

If it were possible to re-use the visuals used in the existing manuals, it is unknown whether the authors would be willing to offer their materials under Creative Commons, allowing reworking and adaptation. So far, we have not managed to follow up on copyrights.

No films produced in a West-African context have been found showing high levels of identification and visual narratives for cocoa producers that might be used without further introduction or facilitation. Also, in the case of using existing films, copyright is an issue.

Radio is considered a major popular and accessible interface especially in urban areas (BBC Media Action, 2015), and the potential of radio has attracted renewed attention because of the effective role that it played during the Ebola outbreak (personal conversation with Hassan Jalloh, UNDP Media Sierra Leone office, 17 January 2016). However, radio was assumed to compensate insufficiently for the current live encounters between cocoa producers and training and advisory services. Record keeping for certification and issues of pest and diseases are just a few of the aspects that require visualisation and communication between farmers, service providers and traders.

The digital communication context in rural areas in Eastern Sierra Leone is that connectivity and electrification is either absent, unreliable or just limited, and farmers do not all have mobile phones. This situation discounted immediate activation of a phone-based application – a decision reinforced by the realisation that a textual interface would not align with prevailing literacy and educational levels.

The design of an alternative system to replace the conventional system because of the Ebola epidemic soon focused on the creation of a learning space that would give farmers access to an offline/online platform, and that would align with the requirements of cocoa certification and training and with farmers' generally limited participation in formal education and prevailing learning styles. It was not the ambition to replace the conventional system; rather, the ambition was to design an alternative system that would be supported (or fed) by the conventional service providers, that could be used by farmer groups in a more autonomous way and that offered alternative options for interactive communication between farmer groups and service providers.

The design of the prototype was inspired from the very start by Farmer Field School (FFS) learning principles and the context of cocoa certification. Given that FFS is the main agricultural extension model in Sierra Leone in the context of cocoa certification, basic aspects of FFS were converted into design principles for the digital learning environment. The concepts 'responsible innovation' and 'interface usability' contributed further inspiration and guidelines to the interface design. These major perspectives are explored with a focus on articulating design principles for developing the Digital Farmer Field School and the operationalisation of these in the prototype.

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## 3.1 Farmer Field School approach and Cocoa Certification

The Digital Farmer Field School is inspired by FFS learning principles operationalised in a digital learning environment. The group is recognised as the essential element in the FFS approach (Anandajayasekeram, Davis, & Workneh, 2007; Braun & Duveskog, 2008; van de Fliert, 1993). Groups can differ in age, gender and other socio-cultural aspects, but find common ground in their rural livelihoods. Groups are formed on the basis of a crop or a commodity or on the physical proximity in a rural farming community, and the field is considered to define the curriculum, providing the training material and the training context. The original FFS approach was developed with a strong emphasis on Agro-EcoSystem Analysis. Facilitation is seen as an essential element to make the FFS operational and connect with relevant outsiders. After Sierra Leone's civil war, the government (Ministry of Agriculture, Forestry and Food Security) and non-governmental organisations launched the Farmer Field School initiative in 2002 with the aim of improving food security.

Both cocoa certification in general and the Jula certification guide present a general outline for certification: farmers have to organise in groups, need to be trained up to certification standard and prepared for inspections and other auditing activities.

The FFS approach and certification training coincide in their focus on organising and supporting farmer groups to standardise good agricultural practices, including integrated crop and pest management, facilitated by outsider interventions. Aspects where FFS and certification may differ, such as the limited value chain and quality approach of FFS as compared to certification, are not considered as confounding aspects, but rather may relate to different roots. Also, in the FFS approach, an increasing focus on issues of quality and market linkages is discernible. See Table 1.

**Table 1** Design principles stemming from FFS and certification

Aspect	Design principle
Farmer Field School is a group-based approach.	The interface should provide and facilitate opportunities for group activities.
Farmer Field School is linked to IPM.	The DFFS focuses on integrated pest and crop management aspects of agricultural practices and certification.
Farmer Field School follows the season by observation, documentation and analysis.	The DFFS supports observation, documentation and analysis of the current situation of the crop.
Farmers need to organise in groups for certification and certification training.	The interface should provide and facilitate opportunities for farmers to organise themselves in a group.
Certification training has four major chapters.	All four certification chapters need to be recognisable in the digital learning environment.
Certification training is related to a value chain approach.	The DFFS creates insights into the whole value chain.
Certification is achieved with training and evaluated by external audit systems.	The DFFS provides outside facilitation and supports the audit system.

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## 3.2 Responsible innovation aspects

Responsible research and innovation is defined by Von Schonberg (quoted by Stilgoe, Owen, & Macnaghten, 2013, p. 1570) as:

*A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).*

The authors further elaborate on questions that represent aspects of societal concern and interest and thereby describe responsible innovation as the “deliberate embedding” of questions of process. To make this operational, the authors propose four dimensions that provide a framework to characterise a “more responsible vision of innovation”: anticipation, reflexivity, inclusion and responsiveness (Stilgoe, Owen, & Macnaghten, 2013, p. 1570).

The Digital Farmer Field School has been developed with the ambition of being framed as responsible innovation, as it is envisaged that attempting to comply with responsible innovation characteristics will enhance its relevance and appropriateness. Framing and documenting the development of the Digital Farmer Field School from a responsible innovation perspective is also deemed to contribute to the empirical understanding of this concept, especially at the meso/micro level of governance of service provision to rural communities.

To view the Digital Farmer Field School development as responsible innovation in action, the dimensions as elaborated by Stilgoe, Owen and Macnaghten (2013) have been operationalised as design principles for the interface and as criteria for the innovation process as a whole. See Table 2.

**Table 2** Design principles stemming from responsible innovation

<b>Responsible innovation dimension</b>	<b>Design principle for the interface</b>
Anticipation	<p>The interface provides access to training and certification in times of Ebola and beyond.</p> <p>The design usability for farmers should correspond to their competences, and developers are aware of their accountability for this.</p> <p>The interface should contribute to seeking scenarios of desirable futures and will increase resilience and increase farm profits.</p>
Reflexivity	<p>The interface is continuously shared with potential users and not further developed if relevance and feasibility seem to be low.</p>
Inclusion	<p>The interface is developed for users whose diversity is recognised in the design and where possible in co-creation with end users and other stakeholders.</p>
Responsiveness	<p>The interface development recognises diverse actor groups and is alert to the creation of new interdependencies and agenda-setting mechanisms, also recognising institutional rigidity.</p>

### 3.3 Interface usability contextualised for farmers, service providers and developers

Current views on the ‘digital divide’ in sub-Saharan Africa and Sierra Leone provide good reasons not to imagine any intervention using digital interfaces in rural Eastern Sierra Leone, although these same authors also imagine digital futures (Fuchs & Horal, 2006; Ohemeng & Ofusu-Adarkwa (2012); Sam, 2015). However, in the design and development of the prototype, the digital divide is not addressed from an international perspective. Also, the additional urban–rural divide and other contributing divides such as gender and education are not added, although these are thought relevant in the case of Sierra Leone (Sam, 2015).

From the digital divide perspective, major concerns in terms of interface usability focus on the farmers, whereby the adopted responsible innovation perspective at meso/micro level obliges designers and developers to accept the current level of interface usability as a point of departure for their designs.

Three main actor groups are distinguished in the cocoa production and service provision knowledge system; cocoa producers, service providers and the group of traders and cocoa buyers. The cocoa

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producers or farmers in the Kenema region in Sierra Leone are organised in groups for certification of their cocoa produce as Fair Trade, UTZ, RFA or other standards. Farmers are male and female; they have a low literacy rate and limited familiarity with a digital learning environment. Mohamed Fofanah wrote: the “majority of the farmers that we train at the grass-root levels are fully-fledged illiterate or functionally illiterate” (email correspondence, 3 March 2015).

Trainers and other staff members of Jula Consultancy engaged in certification training and monitoring for cocoa farmers are the second actor group in the Digital Farmer Field School. They play a role in the Digital Farmer Field School facilitation and facilitate the back office interactivity. The role of traders and cocoa buyers is important, even though their function or role was not quite clear to the designers and developers. It is assumed that they are engaged in training and information provision and have a definite interest in the quality of the certification training.

Van Dijk’s digital technology model (Van Dijk, 2005; Van Deursen and Van Dijk, 2009) is a recognised model to explore interface usability. This model focuses on four types of access:

1. Motivational access (motivation to use digital technology)
2. Material access (possession of computers and Internet connections)
3. Skill access (possession of digital skills)
  - Operational skills (individual knows how to use ICT),
  - Formal skills (individual knows how to manage some functions of ICT such as hyperlinks and menus),
  - Information skills (individuals know how to search, choose and assess information in ICT), and,
  - Strategic skills (individuals use ICT effectively to achieve professional goals)
4. Usage access (usage time).

Motivational access was split into internal and external motivation, thereby assuming that the conditions during the Ebola epidemic constituted a major motivation for all actors involved.

The aspects of material access (possession of computers and Internet connections) and usage access (usage time) were not considered extensively in the DFFS prototype development and were not prioritised during testing. Material access is assumed and known to be very low, and further problematising was considered to be relevant for the further development of the prototype. It is considered that aspects of material access are part of a dynamic situation, as possession of digital media and connectivity are growing fast all over the world, and Sierra Leone is no exception. At the same time, it is recognised that, with the increase in connectivity, the question of the widening or deepening of digital gaps or divides will be more urgent.

It is, however, realised that these aspects will be high on the agenda in decisions on further development, whereby the enabling environment requires to be studied carefully, using a definition such as: “An enabling environment is a set of interrelated conditions – such as legal, organisational, fiscal, informational, political, and cultural – that impact on the capacity of development actors such as civil society organisations to engage in development processes in a sustained and effective manner” (Thindwa, 2001).

Skill access was a major criterion to consider during the development and also during the testing of the prototype. Van Dijk’s classification was not, however, considered fully appropriate for the context of Sierra Leonean farmers. Whereas van Dijk’s model – in our interpretation – has mostly been applied and developed for a Western, urban context and for individual users, the Digital Farmer Field School is designed for a completely different context and is aimed at collective use by diverse actor groups in a shared knowledge system.

Van Dijk’s model influenced the view on the open or closed character of the digital system to develop. The current DFFS design has a ‘closed’ architecture; the Digital Farmer Field School has a quite strategic focus on cocoa production and certification, seeking to enhance motivational access for this specific use. It can be opened to related functionalities such as adult literacy classes but will not have the ambition to open up to all potential functionalities of the worldwide web.

Van Dijk’s interface usability model was adapted to the situation in Sierra Leone as a means to formulate design principles focusing on the group of farmers and the groups of trainers. Motivational access and skills access were considered as major aspects. Somewhat opportunistically, the latter was differentiated into two major skills: operational skills and strategic information skills. See Table 3.

**Table 3** Design principles stemming from interface usability adapted from Van Dijk (2005) and Van Deursen and Van Dijk (2009)

<b>Aspect</b>	<b>Design principle</b>
<b>Motivational access (motivation to use digital technology)</b>	
Internal motivation	The interface aligns with and/or enhances the internal motives of farmers and service providers to use the Digital Farmer Field School.
External motivation	The interface aligns with and/or enhances the external motives of farmers and service providers to use the Digital Farmer Field School.
<b>Skill access (possession of digital skills)</b>	
Operational skills (farmers and trainers know how to use the tablet)	Farmers and trainers should be able to explore, access and navigate the interface.
	The interface design should provide a logical sense of orientation.
	Navigation actions are basic and consistent.
	Elements that constitute noise, complexity and distraction are removed where possible.
	The prototype will facilitate task completion of basic activities with the tablet in the role of digital facilitator.
Strategic information skills (farmers are able to seek, find and deal with information on the tablet)	Farmers document pest and diseases and share their questions and concerns with service delivery staff and trainers.
Strategic information skills (service providers are able to seek, find and deal with information on the tablet)	Service providers are able to await and respond to farmers’ incoming calls and messages (operational back office).
	Service providers are able to deal with new interactions because of the Digital Farmer Field School.
	Service providers are able to manage and produce content for the Digital Farmer Field School.

### 3.4 Design principles for the DFFS

The previous section described how the general interface design of the prototype is firmly based on FFS learning principles with a focus on collective action and observation of events on-farm. The established structure of cocoa certification training into four areas provides another basic structure. The responsible innovation concept provides a framework of design principles to which designers and developers should adhere. The Van Dijk model proves supportive in defining design principles for interface usability, especially for the illiterate and novice users in the farmer groups, whereby we reworked the model differentiating between internal and external motivation, operational skills and strategic information skills.



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The design principles can then be summarised as:

1. The Digital Farmer Field School creates a relevant knowledge system materialised in a digital interface for cocoa production and certification:
  - a. The Digital Farmer Field School aligns with Farmer Field School principles.
  - b. The Digital Farmer Field School is relevant for certification.
  - c. The Digital Farmer Field School provides motivational access; the design provides and/or enhances both internal and external motivation to use the Digital Farmer Field School.
2. From the responsible innovation perspective:
  - a. The Digital Farmer Field School design aligns with the operational skills of its users (farmers and service providers).
  - b. The Digital Farmer Field School design aligns with the strategic information skills of its users (farmers and service providers).

Although not considered as a direct design principle for prototype development, it needs to be mentioned that:

To further develop the DFFS, it is imperative to focus on material access (possession of computers and Internet connections) and the enabling environment.

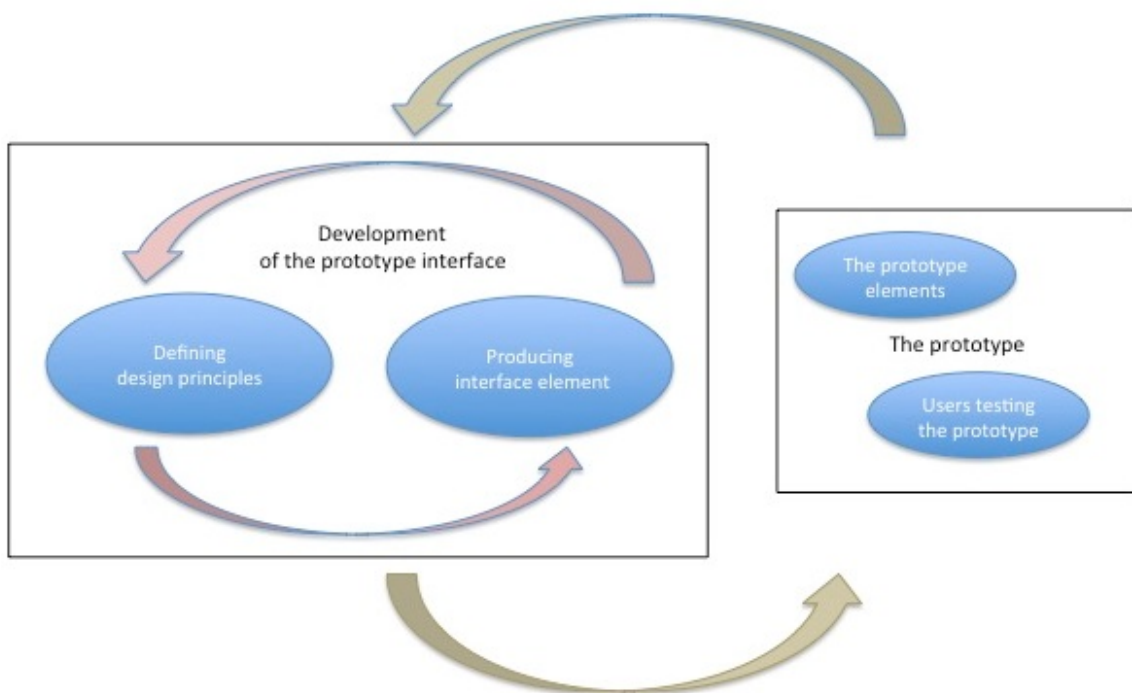
The next section describes the development of the DFFS for the case of cocoa production and certification in Eastern Sierra Leone.

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## 4 The DFFS: “Hello, I am Fatu and I am a cocoa farmer”

The DFFS aims to increase farmers’ income by giving farmers access to a digital learning place for knowledge management, for participation in certification activities and to further safeguard crop performance.

The design principles as described in the previous section were operationalised in the production of interface elements such as animations and films, applying iterative loops as modelled in Figure 4. This model sought to forestall ‘blaming’ less literate and novice users and to maintain a responsible innovation focus on usability as a task for which the developers and designers of the interface were accountable. This way of working aligns also with authors such as Medhi et al. (2011) and Steyn et al. (2014) who emphasise the irrelevance of designing textual interfaces for low literacy and novice users.



**Figure 7** Iterative feedback and inspiration loops in the DFFS prototype development

The prototype development is documented in a portfolio full of sketches, drawings, scripts, transcripts and translations with scribbled notes everywhere. The designers and developers sought interaction with prospect users, cocoa experts and native speakers.

Below, we elaborate on the general operationalisation of the design principles exemplified for the Digital Farmer Field School interface for cocoa production and certification in Eastern Sierra Leone.

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### 4.1 “Hello, I am Fatu and I am a cocoa farmer”

A main feature in the DFFS design is the narrative structure created around an animated farmer field school group constituted of familiar characters personalised by first person singular narratives. The leading character is Fatu, a cocoa farmer representing, together with her farmer group, cocoa farmers

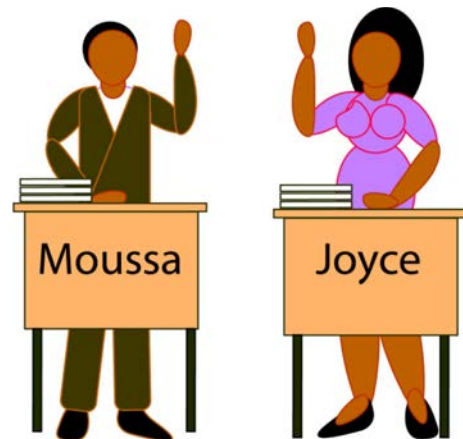
in Eastern Sierra Leone in general. She is a common character; she is not young, not old. Specific characteristics regarding her family and farm are not further specified to increase opportunities for identification. The name Fatu was selected after an Internet search of common names in Sierra Leone and considering cultural, religious diversity and the melody of the name.

Fatu was deliberately created as a female farmer to sidestep gender debates and issues and align with the recently formulated Sustainable Development Goals. To further provide opportunities for identification by a diverse audience, Fatu's farmer group, organised in a Farmer Field School, is a mixed Farmer Field School, thereby presenting options to bring diverse characters on stage.



**Figure 8** Fatu's farmer group

Two characters were created to represent the back office, which can be contacted by phone, SMS, and other digital means of contact or messaging such as Skype, Viber, telegram or Whatsapp. The female character is Joyce, the male character is named Moussa. The implications are that the service provider is required to employ male and female support staff members who communicate as these characters do: "Good morning, I am Joyce/Moussa, can I help you". The main characters are considered representative of the Muslim/Christian distribution within the Sierra Leonean population. The addition of more characters is being considered in the further development of the DFFS, such as traders, certification monitoring staff and other services.



**Figure 9** The back office with Moussa and Joyce

Although certification training initiated the development of DFFS, the scope of the design is reaching even further. Given that low literacy in relation to texts and digital devices and other socio-cultural determinants will influence other aspects of rural livelihoods, the tablets can provide access to other applications or facilities. The design of the digital learning process seeks to motivate and facilitate literacy in terms of promoting reading, writing and tablet use. One way of achieving this is to search actively for options to combine visualisation of a certain practice with a voiceover text spoken by the animated figure and with the same text visible on-screen in writing. Contrary to the understanding that a linear design provides an optimal navigation structure for low literacy users, the design foresees a linear start followed by a branched structure. The ambition is to create a learning environment that has a positive impact on literacy in all its aspects. This is possible, as Fatu will guide users through the Digital Farmer Field School. The users will use the tablet in a group of farmers, depending on existing conventions and practices.

## 4.2 The DFFS design aligns with the operational skills of its users

A visual approach to the interface was selected on the basis of the design principles of inclusion and interface accessibility. The narrative and visual approach resulted in films and animations with dialogues and voiceover text in the local language, Krio. Also, the intention to focus on integrated pest management called for using visual elements and visual tools so as to provide pictures of pests and diseases. Given the projected group use and the principle of designing quite a lot of visual material

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that needs to be viewed in a (small) group, it was decided to design the interface for touch screen tablets because of their larger screens as compared to smart phones. We also considered the fact that smart phones are currently as absent among farmers as tablets, so in either case access to the material requires external intervention or provision support. Furthermore, given the mature age of cocoa farmers and the common lack of reading glasses, we considered that tablets were a better option than smart phones with their smaller screens.

The opening screen of the prototype shows Fatu and two rows of icons. On the upper screen row, the places Kushe, Certification, Agricultural Practices, Social Practices and Environmental Practices are visualised with a screenshot from a characteristic animation. The Office and The Market are positioned in the lower screen row as well as the buttons: Library, Music, Photos and Film, Voice Recorder and Camera. The prototype as used for testing in Sierra Leone was uploaded with material in the most common local language, Krio.

The design of the January prototype was presented in a two-page handout that was used during the workshops with Jula staff. See Annex 1.

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### 4.3 The DFFS design aligns with the strategic information skills of its users

The prototype did not aim to be complete but was required to have grounded and promising quality to make the outcomes of the testing relevant. Even though it was developed in the Netherlands, the prototype has certain features of co-creation by involving two groups that are relevant for the Digital Farmer Field School. Two cohorts of international students of Rural Development, Communication and Innovation taking the MSc course at Van Hall Larenstein University of Applied Sciences participated. The 2014/2015 cohort, a group of rural development professionals working and studying in the field of communication for rural innovation, contributed to initial ideas and developed the film *Looking at the Photos from the Cocoa Farmers*. The 2015/2016 cohort explored a first version of the current prototype and contributed further suggestions. They also contributed with the film *A Visual Manual*. Both films are part of the prototype. Another group of contributors were Dutch citizens originating from Sierra Leone. One of these female participants is the main character in the film *Salamatu Visits the Cocoa Processing Plant*. Others participated in the translation of the English texts of the animations and films to Krio and contributed suggestions.



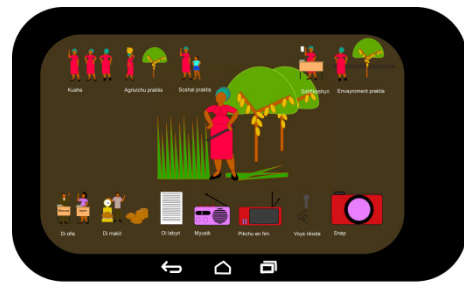
**Figure 10** Salamatu Bangura visits the cocoa processing plant Crown of Holland, the Netherlands

On the basis of experiences in the process of designing the Digital Farmer Field School, it was realised that the development of a 'computer school' as a place of learning and change requires strong reframing of persistent interpretations of agricultural extension and rural service delivery, even from a perspective of Farmer Field School or privatised rural communication services. Common discourse such as 'good practices', 'teaching' and other mandatory speech tends to creep into the production of interface elements. Fatu, who does not talk about 'best practices' but rather about 'practices' and 'the way we do things', exemplifies this. This issue came strongly back on the agenda while the voiceover was being written in the Krio language. For example in the film *Looking at the Pictures of the Farmers*, the original (English) script stated that farmers were "reporting about a disease" this was translated to Krio as "Farmer dem wae complain". By doing so, the action verb 'reporting' was changed to 'complaining', which activates a different relation between farmers and service providers.

## 4.4 Testing the DFFS in Sierra Leone, January 2016

Testing the prototype with users was considered as vital for responsible innovation. However, a risk was that the prototype could raise unrealistic expectations and also be misconstrued as testing the skills and competences of actor groups, or the text, visual and digital illiteracies of farmers. Despite these risks, testing was nevertheless undertaken as an important step in a process of co-creation and possible further development of a DFFS by the partners (WUR, FairMatch Support, Jula Consultancy) and the local farmer groups.

The DFFS prototype was developed and uploaded on three tablets (Prestigion MultiPad 8.0i) (courtesy of Van Hall Larenstein University of Applied Sciences). It 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 for interactive functions such as phone calls with a SIM card.



**Figure 11** The DFFS Home screen

The testing focused on two actor groups: cocoa farmers with whom Jula Consultancy was working and service providers, mainly trainers from Jula Consultancy. The Dutch team comprised Ewoud de Groot (FairMatch Support), Loes Witteveen (KTI/WUR) and Margriet Goris (KTI/WUR). Mohamed Fofanah (Jula Consultancy) coordinated the Sierra Leonean team responsible for the preparations and organisation in Kenema.

The activities during the testing were organised as workshops with farmer groups and workshops with trainers from Jula Consultancy.

These workshops and additional experiences sought to contribute answers to the following questions:

1. What are the implications for the conventional service delivery system if a digital learning environment such as the Digital Farmer Field School is implemented?
2. What design principles proved relevant for the development of a digital learning environment to support cocoa farmer groups and service providers for cocoa production and certification?
  - Does the design align with Farmer Field School principles?
  - Is the design relevant for certification?
  - Motivational access (motivation to use digital technology)
  - What internal motives have farmers to join the Digital Farmer Field School?
  - What external motives have farmers to join the Digital Farmer Field School?
  - Skill access (possession of digital skills to navigate the tablet)
  - Operational skills: individuals are able to operate and navigate the tablet
    - Are farmers able to explore, access and navigate the interface?

- Is a sense of orientation recognisable?
- Do certain navigation actions become a routine or a convention?
- Is the home screen/return button recognised and functional?
- Which elements constitute noise, complexity and distraction?
- Is task completion of basic activities with the tablet in the role of digital facilitator achieved?
- Strategic information skills: individuals are able to search for and activate specific applications:
  - Taking a photo of a farmer group (group dynamics).
  - Taking a photo of some current specifics on the cocoa farm (group dynamics: discussion on selection, resulting photo).
  - Formulating a question to be shared with The Office ('Moussa' or 'Joyce') with the tablet or by phone (depending on availability, provided by the research team).
  - Discussing the films.
  - Making phone calls from farmers to The Office and vice versa.

The results are reported in the same order. Although we did not expect to do so, we also gained insights on material access, which is also reported.

In anticipation of the workshops being crowded and dynamic, quite a lot of the activities were recorded with a film camera after an explanation to the participants and requesting consent. The informed consent procedure sought alignment with the principle of visual informed consent (Lie & Witteveen, 2015) and consent was also documented on paper. In the farmer villages, most farmers did not sign, but put an inked fingerprint. Photographs were also taken. The consent procedure confirmed the low level of literacy.



**Figure 12** Memuna Jalloh with informed consent papers

Information and observations were also documented on paper on the spot and afterwards. Some interviews could be recorded in a more systematic way after collective testing activities had finished in the villages, some interviews with staff members were conducted in the office of Jula Consultancy, and Mohamed Fonanah was interviewed in Freetown on the day the Dutch team departed.



## 5 Results and discussion

### 5.1 Implications for the conventional service delivery system if DFFS is implemented

According to the list of participants, 22 Jula staff members participated in the first workshop. From this group, 17 also participated in the second workshop. Some of the Jula staff stayed in the office for formal duties and for the roles of Joyce and Moussa in the back office. Other Jula staff accompanied the researchers to the villages for obvious reasons and for translation, facilitation and participation in testing the prototype as a tool for training. The number of Jula staff present at the workshops in the villages is not documented. In total, 18 participating Jula staff submitted a written report after the workshops in the villages and before the second workshop with Jula staff. See Table 4.



**Figure 13** Rebecca Kaidaneh in the role of Joyce

**Table 4** Participants in workshops with Jula staff

Date	Location	Male	Female	Total
11/01/16	Kenema	16	6	22
15/01/16	Kenema	12	7	19
	Total	28	13	41

The reports and observations indicate a high level of enthusiasm on the part of Jula staff for the DFFS during the testing. They felt challenged by the digital innovation and recognised the potential for the cocoa knowledge systems as a whole and for the involved farmers in particular. Although they recognised that it would change the training approach and their functioning, in the reports Jula staff predominantly described opportunities and articulated enhanced relations with farmers:

*This approach represents a radical departure from earlier agricultural extension programmes in which farmers were expected to adopt generalised recommendations that had been formulated by specialists from outside the community to concise and precise information on the tablet. (Trainer, male)*

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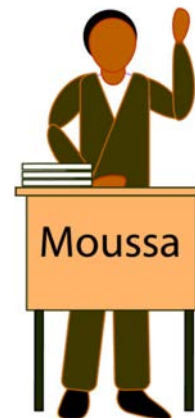
*Another aspect also I learned was the interactive approach between farmers' group and Joyce with Moussa as an example of Jula in the back office by asking and raising concerns about disease problems and responses. Those questions and concerns were responded to within a very short period. (Trainer, male)*

*DFFS creates a room for good relationship between the farmers and Jula Consultancy Ltd. (Intern, male)*

*I also learnt that the DFFS brings a cordial relationship between the farmer and the office by expressing their problems through phone calls. (Intern, female)*

*The DFFS prototype creates a direct link between farmers and Jula Consultancy Ltd. (Training coordinator, male)*

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Moussa (Jula staff): Hello lady.

Farmer: I see people making money out of their cocoa but for me that is a different story, when I go to my farm, I see empty shells all around eaten by monkeys and now I cannot even afford to pay school fees for my children.

Moussa (Jula staff): Please talk?

Farmer: Yes, I tried different means to protect my cocoa from monkeys like the Ebola gears on a scarecrow and now it is forbidden to kill the monkeys. It is such a difficult situation because you can't look after the cocoa farm all the time if you have your rice farm on the other side on which you have to look after well. Even the monkeys are very much earlier than the imams calling prayers in the morning.

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**Figure 14** Phone conversation during testing of the Digital Farmer Field School in Nekabo

Jula staff members taking on the role of Moussa and Joyce in the back office confirm the experiences and observations in the villages:

*I received phone calls from different farmers. It creates a constant link between the farmer in the field and the Jula office. Through audio messages recorded by the farmers, it makes Jula's office address the concerns of the farmers. (Trainer playing the Joyce role, female)*

*Questions asked by individual farmers during the Digital Farmer Field School prototype testing were like: What can I do if my cocoa trees get continuously wilted and die? Charles Abdulia asked this question. A farmer called Satta Sullaiman of Nekabu village asked the back office to help her find a way to prevent monkeys from destroying her cocoa pods (pest control). (Training coordinator playing the Moussa role, male)*



## 5.2 Relevance of design principles in a digital learning environment

A total of 86 farmers, undertaking Jula Consultancy's certification training, participated in the three villages (see Table 5). The total number of people present exceeds these figures by far as the workshops were organised in places with more or less public access. Male participants are in the majority (60%), which seems to be more than representative of the situation of certification training participants. At the office of one of the traders, evidence was provided that, although most contracts are with male producers, contracts are also signed with female producers.

**Table 5** Participants in workshops in villages

Date	Location	Male	Female	Total
12/01/16	Bunumbu II	21	3	24
13/01/16	Kambema	12	11	23
14/01/16	Nekabo	19	20	39
	Total	52	34	86

## 5.3 Alignment with FFS principles

Their very presence and the dynamics of the workshops in the villages for the prototype testing provide convincing evidence that the farmers operate in groups of some kind. Initial hesitations are ascribed to the presence of unknown international outsiders and uncertainty about the content and approach of the workshop. The relations between farmers and Jula staff were observed as friendly and polite, common to the researchers. It was observed as surprising to see how enthusiastically both groups could react on managing to make the phone calls. According to the observations, it is concluded that a tablet carries potential to be spontaneously used as a collective device.

Jula staff acknowledged the ability of the Digital Farmer Field School to enhance observation by farmers, and this links to a main characteristic of Farmer Field School:

*Farmers are motivated to document pests and diseases and share their concerns with service delivery staff and trainers and expect a response. (Trainer, male)*

*Farmers were able to explain their problems which affect them. This was done through recording voice messages. It also helps field monitors and trainers to have access to information and documents that provide background knowledge in certification. Service staff are motivated to respond to farmers' inputs such as photos. (Field monitor, male)*



**Figure 15** Watch part of this scene in the film *Cocoa Training in Times of Ebola Sunday Morning Reflections of Mohamed Fofanah*

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## 5.4 Relevance for certification

Farmers expressed eagerness for, and appreciation of, (certification) training. Special observations relate to the impact of the film *Salamatu visits the Cocoa Processing Plant in the Netherlands*, which shows the unloading of the cocoa beans and the following processing into cocoa powder through the eyes of a Sierra Leonean woman in the plant. This film was viewed with great interest and resulted in lively conversations and speeches about the relevance of hygiene and food safety, as described by one of the trainers:

*It also helps the farmers to take care of their cocoa processing because of the foreign materials found in the cocoa plant video from the tablet. (Secretary, female)*

The relevance for certification was also recognised and confirmed during meetings with traders and other involved stakeholders. It was also suggested to search for a merging of the Digital Farmer Field School with the Tracing and Mapping System.

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## 5.5 Motivational access (motivation to use digital technology)

Farmer: Can you please open it?

Female farmer: Of course, I like it and I even want to press on it.

Farmer: It is a phone, can you just open it?

Young farmer: Touch there.

Farmer: Do you see her, this lady she is a cocoa farmer.

[All of them are laughing]. This is a farmer, a harvester of cocoa.

Female farmer: This is a cocoa programme and this is the kind of thing we want to do.

Mama, it's time for cocoa business!



**Figure 16** Conversation during testing of the Digital Farmer Field School in Bunumbu II

The design and development of a narrative structure with Fatu seems positive and seems to meet its objective. Recognition is given to the specific gender motivation through the Fatu character.

*I see Fatu introducing herself and also the other farmers too. I also learnt that Fatu was showing me how to use the tablet. (Intern, female)*

*Fatu is a female farmer who shares her experience with other farmers on how to use Digital Farmer Field School. Also encourages more female farmers to take part in the training. (Field monitor, male)*

Farmers mentioned internal motives for joining the Digital Farmer Field School. Some of the farmers mentioned issues relating to the recognition and relevance of their work. By watching the film *Salamatu Visits the Cocoa Processing Plant*, farmers became (more) aware that they were producing edible products, and the reactions of farmers indicate that they felt more responsible and motivated to deliver good quality. One farmer stated:

*I learned that it is very good for food consumption. When processing cocoa in terms of harvesting, fermentation, you should take into account all those factors which are good. So it is really nice to plant cocoa. (Farmer, male, Bunumbu II)*

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Farmers recalled what they had been learning in the (certification) training. They showed an interest in (certification) training. The farmers were triggered by the new technology, as one farmer noted:

*It is nice to touch a computer. (Farmer, female, Bunumbu II)*

In addition, farmers expressed an interest in learning to write and calculate. There is a prominent motivation to enhance literacy. For female farmers, identification with Fatu also played a role.

Farmers expressed also external motives for joining the Digital Farmer Field School. On several occasions, in different ways, farmers stated that they lacked confidence in traders' operations and would like to have more insight and opportunities to control the mechanisms involved.

Jula staff mentioned internal motives for joining the Digital Farmer Field School. Jula staff, see above, expressed motivation to support farmers as they currently have limited options to visit them and identify opportunities. Jula staff also expressed uncertainties resulting from a potential Digital Farmer Field School, as they feared losing their job.

Jula staff had also external motives for joining the Digital Farmer Field School. They all agreed with the director of Jula that they should think progressively towards the future. Some of them foresaw opportunities to encourage the youth to engage in cocoa production with such types of innovation and development.

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## 5.6 Operational skills: farmers are able to operate and navigate the tablet

We observed first reactions of shock or paralysis upon handing over the tablets. One farmer stated in a plenary session "I had never expected to ever touch a computer in my entire life". Often, a younger farmer initiated or suggested the search for the power button. The power button on this tablet is uncomfortably small, almost invisible, maybe also influenced by the fact that most of the farmers do not have (reading) glasses. The volume button also is difficult to find and operate.

The main navigation buttons used were the Home and Return button, with the Home button ranking first. It was, however, also often observed that both buttons were used equally, returning to the Home screen and starting afresh.

Providing a full-colour printed A4 version of the opening screen supported operating the tablet in the workshops with farmer groups. Tapping on the screen to enter the next level or open an application proved to be a major challenge. This seems to be a kind of 'muscle learning' skill that requires some confidence and persistence. If you tap too softly, nothing happens, but, if you tap too long, the settings of the buttons open up. Also, it was suggested that the term tapping should be replaced by the term touching for instance.

We mostly limited ourselves to tapping to navigate the screen. Scrolling and zooming were not presented as a navigation option. Swiping was needed to activate the opening screen and was not always easy, but the participants generally managed to do it. This does not mean that these navigational options were not used, as proved by one farmer group who managed (by chance?) to put a picture of their group as wallpaper on the opening screen.

When a user tapped on a film or animation, the prototype showed an option screen requesting the user to select Photos or Video Player; this was perceived as confusing and thereby created a sense of uncertainty.

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Jula staff appreciated farmers' responses in terms of operational skills, as expressed in their reports:

*I got insight about the new technology. [I] gained knowledge on how to use the tablet. With the tablet, farmers can view photos and films, can record audio messages, farmers can take photos and make films with the tablet. (Trainer, male)*

*Farmers were excited about the Digital Prototype training. Farmers' participation was great. (Trainer, male)*

*I realised that farmers were excited about the Digital Prototype. Farmers were quick to accept innovation that has something to do with audio-visual. I realised that farmers who cannot read and write will learn faster with the aid of audio visual. (Field monitor, male)*

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## 5.7 Strategic information skills

The capacity of the Jula staff to deal with the reconfigured position of the back office deserves a mention. In the first workshop, the Joyce and Moussa concept needed quite some attention for the Jula staff to become familiar with the mechanism from the farmers' perspective. Quite some time was spent on role-plays to practise the situation of being contacted by farmers.



**Figure 17** Role play at Jula office

Somewhat unexpectedly, we had the opportunity to experiment with making a short instruction film in the field on pruning. The experience of filming with a crew made up of a director and a cameraperson, requiring silence from non-actors, was very quickly taken up. This is interpreted as promising for further on-farm film production.

In all villages, farmers managed to take pictures of their group. On two occasions, the tablet was used in the field. One farmer group took pictures of black pod disease and tried to connect to the back office to discuss the disease. Twelve audio recordings were made by farmer groups, mostly dealing with pest management.



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Several farmers expressed a keen interest in learning more about the cocoa value chain and the market through the Digital Farmer Field School. One farmer was even disappointed that there was nothing yet in The Market place on the prototype, *Di makit*. The same farmer stated that he had learned a lot. Referring to the film *Salamatu Visits the Cocoa Processing Plant*, he noted:

*In the video we saw the removing of all the foreign materials from the cocoa. It is an indication that we should not dry our cocoa on the ground. So we learned a lot from the video we saw. (Farmer, male, Bunumbu II)*

In all villages, farmers reacted very enthusiastically to the option to phone the back office. It was surprising how quickly Moussa and Joyce became familiar to all, and farmers were quite decisive, for unknown reasons, about phoning either Joyce or Moussa. It was shared that Moussa is a good name in Sierra Leone but “he must be a foreigner, most likely a Guinean”, otherwise his name would have been written as Musa. In an updated design, the local writing of names should be adhered to, with a Musa and a Joyce in the back office.

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## 5.8 Material access (possession of computers and Internet connections)

The observations and responses of farmers to the question, “who has a phone?”, showed that a phone is more than a device. Farmers perceive the hardware as a combined device, which is charged with electricity, with credit and with connectivity. The enabling environment also refers to issues of electrification and connectivity. Charging facilities are provided by mobile telecentres who charge 1,000 Leones (as at 12 January 2016) or are brought by motorbikes to a nearby town (Kenema) for the same 1,000 Leones for the phone and a collective price of 10,000 Leones for the transport of the batch of phones. Farmers indicated that they used the phone to stay in touch with relatives.



**Figure 18** Type of phone possessed by farmers and mobile telecentre with charging facilities

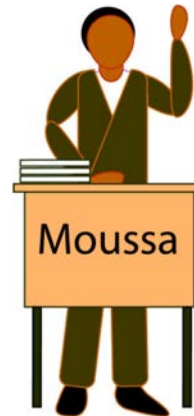
We did not discuss the aspect of credit, except for some observations such as the comment that people beep others hoping that they will reply. However, farmers’ reaction on this matter indicated that this is an issue as they tended to lower their voice and look down to the ground, and found it more difficult to talk about. If one watches back the footage of the testing, this becomes evident.

Connectivity is limited, although farmers show a dynamic interpretation of connectivity. They accept the absence of connectivity as a static service and actively search for connectivity when it is known that this search is likely to be effective. We witnessed such searches for connectivity by walking around a village. One farmer added on such an occasion that they would not do this during the night,

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as leaving the premises of a house might not be safe. We also joined a search for connectivity uphill. Farmers climbed uphill searching in several spots for connectivity. If they could not find it, they climbed further until connectivity was found.

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Farmer: Hello.

Moussa (Jula staff): How are you doing?

Farmer: I am doing fine.

Moussa (Jula staff): How is the farm work going?

Farmer: We are the ones calling, we are here in Kambema, standing on the mountain.

Farmer: I am calling you concerning our farm. We have some worms that eat the cocoa from the roots. And some animals that eat the cocoa.

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**Figure 19** Phone conversation during testing of the Digital Farmer Field School in Kambema

A major technological problem was the quality of the sound system. The prototype was developed with the idea of the small group of four or five farmers using the tablet's audio system. External speaker sets were able to provide sufficient amplification but were not available for each tablet.

Regarding material access for Jula staff, most of them do possess a smart phone. No further inquiries were made about pricing, ownership and use during the testing. Skyping with the Jula office is not possible because Internet access is slow and unreliable.

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## 6 Conclusions

The extreme situation consequent to the Ebola epidemic created an opportunity for revolutionary rethinking of the current system. The Digital Farmer Field School provides an alternative interface for interactions between farmers, trainers and traders, and this in turn allows for more articulated knowledge exchange and creation.

The first research question was: "What can the digital learning environment of the Digital Farmer Field School add to current agricultural and certification training in Sierra Leone?" The development and testing leads us to conclude that the DFFS creates new opportunities for knowledge creation and exchange. A particular strength of the DFFS is that it enhances the position of both female and male farmers to play a more autonomous role and that training can be highly adapted to their needs.

During the testing, the impact and implications of the DFFS prototype learning design was received very positively by the cocoa farmers and value chain actors. The DFFS prototype seems effective in balancing the local context and meeting the needs of certified cocoa value chain stakeholders.

Although it appears that the DFFS has potential for use with crops and certification schemes other than cocoa, further study is required to assess how applicable this is for other commodities and for more diverse farm-based livelihood systems. Literacy training – if adapted to adult farmers – also seems to be one of the opportunities to which the DFFS could be adapted.

The second research question: "What design principles guide the development of a digital learning environment to support cocoa farmer groups and service providers for cocoa production and certification?" is answered with a leading reference to the success of the narrative approach and the characters in the DFFS. The character Fatu was welcomed as if she was a familiar figure, and Moussa and Joyce in the back office were also warmly received. 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 DFFS prototype appears to be culturally and technologically appropriate and aligned with operational and strategic information skills. The narrative structure with Fatu seems to be a valuable contributory factor enhancing the motivational access of farmers. It should be noted that this is a prototype and that supporting data behind all the subject areas has not been provided. Aspects such as The Market have not been developed beyond an icon on the opening screen. This is also a complex subject area, with conflicts of interest.

A promising sign is that farmers used all the functions and loops in the DFFS prototype, such as making real-time phone calls about their farms to the trainers in the back office. The material components of a DFFS package should contain a tablet, speakers, a good protective cover, a SIM card or other options for interactivity and connection.

In response to the question about the current situation of material access in rural communities, it seems that, despite the bleak situation in terms of the cost and limited availability of Internet and electricity, it is the perceptions of those involved in the testing that more availability and affordable services will come on stream. Cocoa traders reacted positively to the proposed model with a special interest in the options for monitoring and auditing. It has been suggested that farmer groups could purchase the hardware from the premium payments as a collective investment. A tablet was perceived as more effective for collective use than mobile phones, which are considered private or family-owned devices.

This project focused on the cocoa value chain and the crises situation consequent to Ebola. The evidence obtained indicates promising scenarios for Digital Farmer Field Schools for other value chains and crops. A DFFS could also be valuable in situations where farmers are far from rural communication and other services, or where services are not available because of other constraints and boundaries. Contemporary examples include conflict areas or socio-cultural contexts, whereby, for example, female farmers are prohibited from engaging in group training.





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## 7 Ways forward

The Digital Farmer Field School was initially developed in response to the Ebola outbreak. The prototype version was enthusiastically received, seems feasible and promising, and is regarded by the partners in this project as a success.

We consider that combining the DFFS with current training and monitoring activities could be a way forward that mixes the best of both approaches. Rethinking how agricultural and certification learning occurs and how training is delivered requires further attention. It is recommended that a next step could be to test and evaluate face-to-face training and direct communication and the DFFS as complementary and mutually supporting tools. In the case of a further Ebola outbreak or if a similar disruptive scenario occurs, a stand-alone version of the DFFS could be developed further. Elements of the DFFS, such as The Market, can also be tested as stand-alone modules. Other elements of the DFFS also appear to have potential for stand-alone use: the films and the interactions between the fictional and live farmers and the back office. It does not appear feasible or desirable to develop a closed digital interface like the DFFS with the aim of delivering a complete environment where all aspects of cocoa production and certification are addressed. It is therefore recommended to elaborate a sound strategy for learning, information sharing and knowledge creation that activates and supports all involved actors' capacity to implement good practices, thereby contributing to a knowledge circulation community with enhanced agency for all actors in the value chain.

We propose the dissemination of this report and the prototype, using the network of the Advisory Committee members and a dedicated Wageningen website, and presentation of this project at suitable gatherings (i.e. conferences, seminars or meetings related to cocoa, certification and learning) to collect feedback and generate ideas and resources to further develop the DFFS.

The DFFS can be enhanced by linking up with the Tracing and Mapping System (TMS) system, developed for buying agents, field officers, warehouses, IMS officers and traders. It is foreseen that such a link will have a synergetic impact by enhancing interaction between direct stakeholders in the value chain. Experiences so far indicate that the Digital Farmer Field School, if combined with the Tracing and Mapping System, would work best as a closed system.

It is recommended to elaborate a set of technological norms for the tablet in relation to volume, battery capacity, moisture tolerance and other practical aspects. Other aspects to consider in the enabling environment relate to charging options, such as solar panels, connectivity and maintenance.

No capacity seems to be currently present in Sierra Leone in terms of technological, conceptual and artistic skills to create films and animations. Hassan Jalloh (UNDP Media Freetown) confirmed this, but indicated that there are developments in this field and proposed cooperation. It is therefore recommended to establish further cooperation with a Sierra Leonian institute in the field of media and learning design. The contact established with UNDP media and Fouray Bay College, University of Sierra Leone, might be a promising option. In the context of such cooperation, it is recommended to further study the currently available media products used.

We recommend that an affordable, intuitive design be further developed and iteratively tested, making creative use of available resources.



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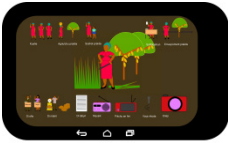



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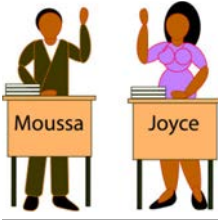



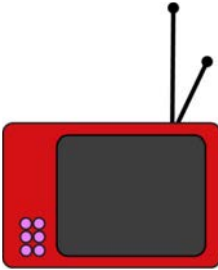

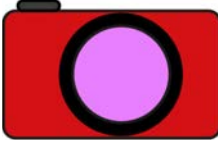
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# Annex 1 Prototype January design

The Home screen	Objective	Content
	<p>Farmers experience a sense of welcoming by Fatu and are interested in proceeding</p>	<p>The Home screen shows a total picture of Fatu, a cocoa farmer</p> <p>The upper row on this screen shows four places for certification training</p> <p>The lower row shows the interactive places with the back office and the traders and buttons for diverse activities</p>
<b>Places</b>	<b>Objective</b>	<b>Content</b>
<p><b>Kushe</b></p> <p>Kushe means hello in Krio. In this place farmers are welcomed to the DFFS and can find instruction for using the tablet and for using it as the proposed DFFS learning strategy</p> 	<p>Farmers experience a sense of welcoming and are able to proceed</p> <hr/> <p>Farmers are able to make operational use of the tablet</p> <hr/> <p>Farmers are able to take a picture and see it again in the gallery</p>	<p>Animation of Fatu welcoming viewers, Fatu introduces herself and her farmers group</p> <hr/> <p>Fatu introduces the DFFS in general terms</p> <hr/> <p>Animation film of Fatu introducing the places and the navigation</p> <hr/> <p>Film that explains the use of the tablet, a visual manual</p> <hr/> <p>Animation film of Fatu welcoming users to the DFFS and encouraging farmers' group to take a picture and retrieve it from the gallery</p>
<b>Agricultural practices</b>		
	<p>Farmers are motivated to document pests and diseases and share their concerns with service delivery staff and trainers and expect a response</p> <p>Service staff are motivated to respond to farmers' inputs such as photos</p>	<p>The film <i>Looking at the Photos from the Cocoa Farmers</i></p>
<b>Certification</b>		
<p>This place is a section about certification</p> 	<p>Farmers have a basic insight and motivation to discuss certification</p> <hr/> <p>Farmers gain insight into the quality aspects throughout the cocoa value chain</p>	<p>This is not operational in the January prototype, except for the picture on the opening screen</p> <hr/> <p>The film <i>Salamatu Visiting the Cocoa Plant</i></p>
<b>Social practices</b>		
<b>Environmental practices</b>		

Places & Buttons	Objective	Content
<p><b>The Office</b> The Office will be the section where all service delivery staff are available in interactive mode</p> 	<p>Farmers are familiar with 'Moussa and Joyce'</p> <p>Farmers are motivated and able to send pictures with the corresponding information and a related question to Jula staff in the back office</p>	<p>Phone call facility for both Moussa and Joyce</p>
<p><b>The Market</b></p> 	<p>This space is not operational in the January prototype, except for the picture on the opening screen</p>	
<p><b>The Library</b></p> 	<p>Farmers have access to training material, certification documents and other files</p>	<p>The Library will provide access to information and documents that provide background material E.g. The official Prestigio manual</p>
<p><b>Button: Music</b></p> 	<p>To provide music during leisure time or group dynamics</p>	<p>Songs will be uploaded</p>
<p>This button is meant for entertainment</p>		
<p><b>Buttons: Photos and Film</b> This button links to the gallery with all photos and films recorded with the tablet</p> 	<p>Farmers can view photos and films</p>	<p>Note: The Prestigio tablet gallery also contains other photos and films</p>
<p><b>Button: Voice recorder</b></p> 	<p>Farmers can record audio messages</p>	
<p><b>Button: Camera</b></p> 	<p>Farmers can take photos and make films with the tablet</p>	





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