

Adapting ICT tools to rural farmers: the case of Sahel Eco and non-timber forest product enterprise groups in the Tominian district, Mali

Authors: Mary Allen maryallenballo@gmail.com (Sahel Eco), Stéphane Boyera stephane@sbc4d.com (SBC4D), Aman Grewal aman@sbc4d.com (SBC4D)

Executive Summary

This paper illustrates the journey of Sahel Eco, a Malian NGO, in adopting and adapting the use of ICT based tools to deliver better services to their target group of non-timber forest product (NTFP) enterprise groups in the Tominian district of Mali.

In 2010 Sahel Eco introduced an SMS system linked to local radio stations in district and regional towns, to help these isolated rural producers to access new markets. While the system showed some promise, high rates of illiteracy in the target group (70% women) meant it had to rely on a small number of trained (literate, male) intermediaries to send the SMS, and this proved to be one of its major weaknesses.

Learning from these key lessons, Sahel Eco (SE), through the EU funded VOICES project¹ engaged in the development of a second wave of applications in January 2011. The aim was to test the efficacy of the use of a practical ICT solution to addresses the challenge of strengthening producer and other rural organizations and helping them to participate more effectively in national, regional and global markets, reduce transaction costs, acquire productivity-enhancing technologies, and make use of information on domestic, regional, and international markets.

It proposed a solution providing a suite of information and trading service using the simplest communication tool possible - voice.

This paper illustrates the two phases of using SMS and voice based solutions for Agriculture Market Information Systems (AMIS). While the first phase gives critical insights on why SMS based systems have a low uptake in the target community and the associated challenges, the results from the second development phase are encouraging, indicating that many of the challenges can be addressed through a portfolio of voice based services, thereby demonstrating the ability of illiterate farmers, especially women farmers, to use such ICT tools.

They also highlight the important role of community radio in the communication “ecosystem” to reach and include men and women who don’t have even a simple mobile phone of their own. The paper analyses the successes and failures of each of the two different approaches and presents the next steps required to consolidate and scale up similar initiatives. It illustrates how the impact of an ICT tool can vary across different products depending on the state of the value chains and the challenges they are facing.

¹ Refer to: <http://mvoices.eu/>

Introduction: Context

With a population of 14.5 million, **Mali** is one of the ten least developed countries in the World². About 65% of the country is desert or semi-desert and 80% of the work force depends on agriculture.

Mali experienced annual economic growth of about 5% between 1996 and 2010, but the global recession, a military coup and subsequent armed conflict caused a decline in output in 2012. An estimated 453,000 people are still refugees or internally displaced³.

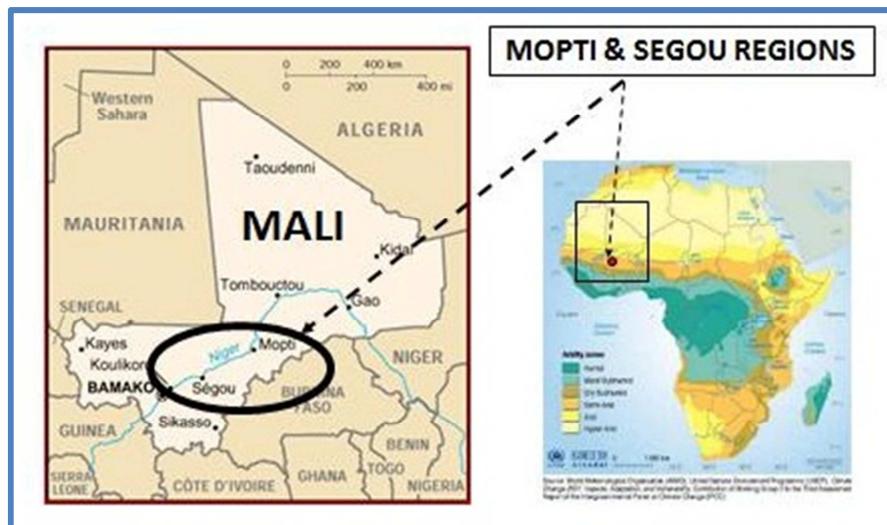


Figure 1: Localisation of the Initiative

Sahel Eco (SE) is a Malian not-for-profit created in 2004. Committed to a vision of resilient livelihoods in dryland areas, SE implements projects which focus on supporting rural people, through training and capacity building, to improve management of the natural resources on which they depend and to develop more diverse and resilient livelihoods. SE works with a variety of organizations across West Africa, to analyze and disseminate lessons learned, promote sound environmental management practices and inform policy debates.

SE's work is focused on the **Segou** and **Mopti** regions where annual rainfall is in the range 400-800 mm. Here the majority of people are agro-pastoralists growing rainfed crops including millet, sorghum, peanuts and cowpea and raising goats, sheep and cattle. Trees on farms and in the small remaining areas of natural forest provide timber for construction and fuel and a diverse range of non-timber forest products (NTFP) such as fruits, leaves and honey. These NTFP can make a significant contribution to household food security, nutrition and income.

In 2005, SE in collaboration with Tree Aid UK, adopted a participatory training approach called Market Analysis and Development⁴, to identify people already harvesting NTFP for consumption and sale in 19 villages in the district of Tominian. As a result they were able to identify and target women and other marginalized/resource-poor individuals as the groups that rely most heavily on NTFP. SE accompanied this group through the MA&D process, helping them to assess the existing situation (Phase 1), carry out market surveys and identify enterprise ideas (Phase 2) and prepare enterprise developments plans (Phase 3). For the men these were predominately organised around honey and for the women, shea butter. In each case they saw an opportunity to earn higher incomes by improving product quality.

² Human Development Index 2012.

³ <http://reliefweb.int/report/mali/mali-situation-overview-october-2013>

⁴ <http://www.fao.org/forestry/enterprises/25492/en/>

SE supported the enterprise start-up phase (Phase 4) by organising training in the techniques required to produce high quality products and by visiting groups regularly to monitor progress and offer advice. They discovered that because of travel costs and other constraints, most producers were still selling only at local markets and, since few buyers would pay a premium price, were limiting production of the high quality product to what the local market could absorb.

The challenge for the m-Agri initiative described in this paper was thus:

How can a farmer living in an isolated rural village, several hours travel on bad roads from the nearest small town reach and identify new buyers for his or her products, in an effective and affordable way?

M-Agri Initiative: Phase 1

Objective

During Phase 1 (2010) of the m-agri initiative, SE worked with Tree Aid UK, to develop and implement a system which would address the challenge of enabling isolated producers of high quality shea butter and honey in 19 villages in the Tominian district, to reach new clients in distant urban centres. The expected outcome was that by growing their network of contacts and negotiating directly with buyers willing to pay a premium price for quality products, the producers would be encouraged to invest time and money in increasing their production, begin to grow their enterprises in a sustainable way and, in the longer term, earn higher and more secure incomes from them.

Technology & systems

With growing availability of mobile phones in rural Mali, SE decided to develop and test an SMS-based system to collect product information and to advertise it via local radio stations.

The key steps and technologies used in this initial system are as follows (see Figure 2)

1. Members of the NTFP enterprise groups with high quality products available send a SMS to Amadou, a staff member at SE's office, giving product details (location, quantity, quality...) and the name and phone number of a contact person.
2. Amadou saves all the messages to his phone and at convenient moments (when there is electricity supply for example) progressively compiles the information in each SMS into a standard Product Table format in an Xcel file.
3. At least once a week, or more frequently if there are a lot of messages, Amadou transmits the completed Product Table to the four participating local radio stations. For the radio in Tominian he simply prints out the table and takes it round to the studio, about 2 minutes from SE by motorbike. For the three other radio stations, in more distant towns, he sends the Excel file by email. However Tominian has no internet connection, so to do this he has to drive about 20 km to the nearest cyber café in the district town of San⁵ to email the Excel file. After the email has been sent

⁵ Later, after Orange upgraded their mobile services in Tominian, Amadou was able to connect to the Internet via a USB dongle and send emails from the office computer

Amadou phones or texts a contact person at each radio station who, if they don't have a connection at the studio must in turn go to a cyber café to get the Excel file.

4. When a new version of the file is received at the radio station, the announcer reads out the information over the airwaves at a pre-arranged slot in the schedule.



Figure 2: M-Agri Phase 1: key steps and technologies

For the system to work effectively, it was also necessary to:

- a) Train a network of 19 literate intermediaries (one per village) to send SMS with the product information in French since literacy rates among rural Malians and women in particular, are very low, often as low as 10%. Intermediaries are all male. They receive a small monthly allocation to pay for the SMS.
- b) Negotiate and sign a contract with each participating radio station to cover the costs of collecting and broadcasting the Product Table communiqués.
- c) Produce and broadcast on each radio station a series of programmes informing listeners about SE's work to support NTFP entrepreneurs and how everyone using the system to advertise has been trained to produce high quality products.

Results

Visits made to product groups in the 19 villages indicated that producers had, as a result of the radio broadcasts, been contacted by new buyers and had succeeded in negotiating sales at

higher prices. For honey they reported selling at prices in the range 1750 – 2000 FCFA per litre compared to 1000 FCFA/liter previously and for shea butter, 1000 FCFA per kilo up from 350 FCFA. Interviews with a few of the new clients indicated that they too were satisfied with the high quality of the products they had been able to buy. Data collected at village level for 3 months of the deployment period, gave a total value for the sales of four of the advertised products in the range of 7,000 euro

Table 1: Sales of high quality products in 3 months of deployment

Product	Unit	quantity	FCFA		Euro
			unit price	total	total
Shea nuts	Kg	6,422	250	1,605,500	2,448
Shea butter	Kg	1,060	1,000	1,060,000	1,616
Néré seeds	Kg	550	550	302,500	461
Honey	Litre	940	1,750	1,645,000	2,508
Total income from sales (3 months)				4,613,000	7,032

But the initial deployment also highlighted a number of limitations, notably related to the reliance on intermediaries to send the SMS. This limits the impact and viability of the system and its potential for scaling up as follows:

- NTFP are traditionally “women’s crops” in Mali and over 70% of the group members in Tominian are women. However as a result of the requirement to be literate in French, all the intermediaries selected are men. Women producers already suffer most from the asymmetries of access to information and markets due to limited mobility, lack of access to finance, and dual burden of unpaid care work at home. They have high demand for market information, but the need for literate intermediaries poses cultural and practical barriers to them using the system.
- There is no inbuilt incentive for the intermediaries within the value chain and this can result in diminished motivation to provide such services. Of the 19 intermediaries trained in 2010 for example only 11 were still active in 2012 and only 5 of these were sending more than 1 SMS a month, on average.
- The need to identify and train intermediaries and the costs associated, undermine the financial viability of the system and make it hard to extend it to other producers.

Another key issue identified during the initial deployment was the need to develop a viable business model to ensure the sustainability of the system.

M-Agri Initiative: Phase 2

Objective

Owing to the perceived potential for mobile technology to radically transform smallholder’ access to critical and timely information, several pilot initiatives similar to the M-Agri phase-1 one have been launched globally. A significant number aim to address asymmetries in the collection and provisioning of market information and provide locally relevant information

like news, classifieds, trade, buy and sell opportunities. Their objectives are to enhance smallholder incomes and increase access to new technical information to improve farming practices. Typically these SMS initiatives assume that the end user is literate and able to fully use the SMS features with ease in the dominant local language.

The results of phase-1 however indicate that literacy is a major barrier in the uptake of such services by smallholder farmers, especially women. Absolute dependence on information intermediaries without any direct benefit linked to their output remains a challenge. Furthermore, Internet access - fixed line or mobile - in rural and remote areas (as was the case in phase-1 in Mali) is either unavailable or prohibitively expensive for the average smallholder. Sustainability and scale up of these pilots is thus compromised.

Phase-2 systems requirement and technology development was part of the EU funded VOICES project. The objective was to

- (a) Analyze needs of marginalized communities not served by existing SMS based solutions
- (b) Design and deploy systems based on the simple interaction of human voices, positioning them as the vehicle for the delivery of agricultural services that cater to the information and economic needs of the NTFP producers.

While acknowledging that this simple yet novel mechanism of information delivery was dependent on locally available technical resources, the approach focused on building local capacity and ownership.

The technology developed under the new initiative was based on mobile voice and web technologies and was given the name **Radio Marché**. The solution itself was an enhanced version of phase -1 designed to automatically generate voice communiqués of the product information as in phase-1, which could then be broadcast over the radio network.

Technology & systems

In phase-1 Amadou entered the product information into a spreadsheet. The spreadsheet was printed on paper and brought to the radio manually for broadcast or sent by email.

In the new system Amadou enters the product information into a web-form on a computer, and then sends a notification to the radio stations. The radio journalists then simply dial a phone number and listen to the voice communiqué, or can login to Radio Marché and listen on line. At a convenient moment she can broadcast the communiqué directly on the radio thereby saving time and enhancing broadcast accuracy.

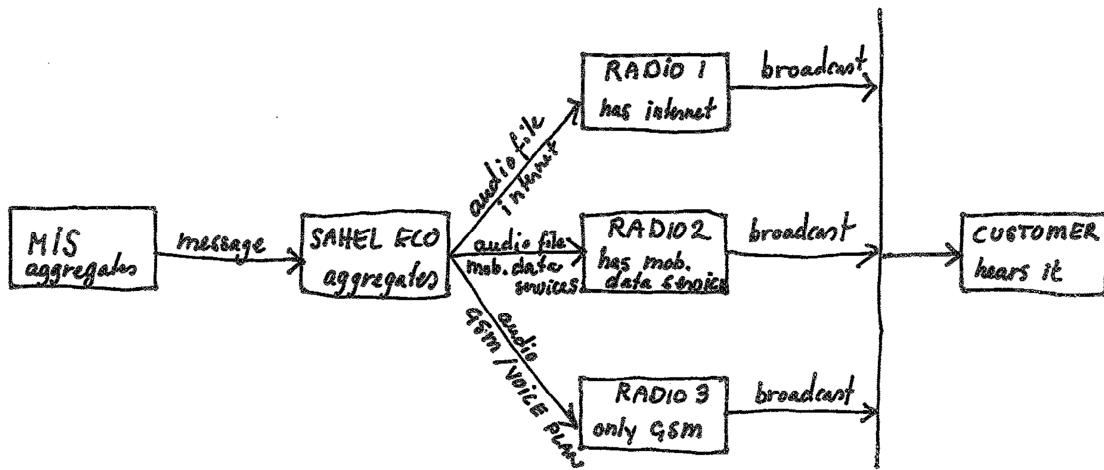
The following work-flow describes the new system developed in phase- 2. Farmers at this stage are still accessing the system indirectly, via Amadou, but he and the radio journalists interact directly with the Radio Marché platform via internet and mobile.



Figure 3: M-Agri Phase 2: key steps and technologies

Key Features:

- (1) *User Interface:* To ensure that the audience had the same sense of personalized user experience to a normal broadcast service, the radio broadcasts were processed using the recorded personal voices of the radio journalists at two of the stations (radio Moutian and ORTM Segou). Therefore though the voice communiqués are computer generated messages, they sound very natural to the audience.
- (2) *Language Support:* Radio Marché incorporated automatically generated voice communiqués in Malian French, Bambara and Bomu, the three major languages spoken in the region.
- (3) *Access:* Depending on the type of connectivity available at the radio stations Radio Marché incorporates the following three scenarios for downloading and broadcast of the communiqué:
 1. Scenario: Download the MIS communiqué AUDIO Broadcast. Prerequisite:- Computer + Internet is available.
 2. Scenario: Download the MIS communiqué AUDIO file directly to the phone and Broadcast. Prerequisite: - Mobile Data Services available.
 3. Scenario: Broadcast directly from the mobile phone at the Community Radio: Prerequisite: - GSM at the Radio Station is available.



Results

Overall the results indicate that the use of voice technology was able to provide solutions to challenges associated with distance, language, illiteracy, localization of productions for the smallholder producers.

Detailed monitoring of phase-2 indicates that producers in 9 villages developed new relationships with buyers and increased sales, particularly of honey and néré (seeds of Parkia biglobosa). From December 2011 to March 2012, they sold products with a total value of over 44,000 euro (cf 7000 euro over a similar period in 2010). Unavailability or disinterest of the intermediary was the main reason given for not using the system in the other 10 villages. Sales of high quality shea butter and tamarind continued but did not improve substantially, despite repeated communiqués.

During an evaluation in March 2012, producers groups reviewed performance of phase-2 and formulated recommendations to enhance future outcomes.

Key takeaways from phase-2 can be summarized as:-

- Use of automatically generated voice communiqués in local languages was acceptable to radio journalists and listeners alike. Sales of products advertised over the system increased significantly from 2010 to 2012 (see the interview of a Honey producer⁶). The staff time and cost for SE to manage the system and for radio stations to access and broadcast the communiqués, were reduced
- Continuing use of SMS to submit product information hinders access due to literacy barrier and limits scale up because of the cost of training. An essential next step is to add a voice-based interface to Radio Marché to enables producers to directly enter product information in their local language.
- The nature and quantity of commodities traded by NTFP producers imply that there is an inherent need for grouped sales of certain products to reach even more distant markets. This is particularly important for the women producers of tamarind and high

⁶ <http://worldplantage.blogspot.nl/2013/05/a-voice-based-trading-system-for-zakary.html>

quality shea butter for which there are few buyers in the regional towns. The technology offering thus has to accommodate for such a feature both on the buyer and producer side.

- Owing to the usefulness of such a service there is a subsequent and urgent need to address issues of cost and scale-up of Radio Marché to make it self-sustainable. These include making the system directly accessible by producers as mentioned above but also opening it up to other radio stations, adding new products and languages and introducing mechanisms to generate income to maintain the platform and pay for broadcast time.

Partnership

During the two phases described in the paper, Sahel Eco partnered with different organisations, and the type of partnerships and the composition explain in part the difference in results. During the first phase, Sahel Eco was working with Tree Aid UK which is not a specialist in technology. As a result, the solution that was developed and deployed, whilst an innovative way of using the basic functionalities of mobile phones, did not include any specific software development but instead made use of tools like Excel with templates and alike.

During the second phase, a new set of partnerships enabled the development of innovative technical solutions based on voice technology. As part of the EU FP7 Voices project, four major partners were involved:

- The staff of SBC4D developed part of the technology solution
- A team from VU University in Amsterdam developed part of the technology solution and drove the development of the requirements
- A team from NWU University in South Africa developed the languages pack for the voice application
- Orange, and more specifically Orange Labs, the research department of Orange at their headquarters in Paris, deployed made available an innovation platform called Emerginov⁷.

Each member played a critical role in setting-up the solution. The first two were instrumental in working closely with SE to identify key challenges and requirements, work with users, develop a series of improvements of the system, develop the business model etc. The third partner was essential to develop the local language support, in particular the ability to generate voice recognition content in e.g. Bambara or Bomu. The fourth partner, the mobile operator was essential to support the deployment of the service.

However, it is important to note that each of these partners has a different degree of importance for the replicability and the scalability of the solution. SBC4D and VU worked hand-in-hand with SE to capture the key requirements. From our perspective, this was a key aspect that must exist in any ICT for agriculture initiative. Should an organization wish to replicate the solution in a different setting, they will need such a partner to adapt and customize it.

⁷ <http://emerginov.ow2.org/xwiki/bin/view/Support/Developers>

The role of NWU was essential to developing the language pack, a set of key tools to support local languages, as part of the EU FP7 research project, VOICES. Now that this project is over, the tools are available and could be easily reused in other contexts, and geographies. Such a partner is essential in a research phase, and in cases where the solution would need to go further with the use of voice technology to implement for example, speech recognition, such a partner will be essential. However, the same solution could be replicated without the need for such a partner.

The role of Orange, in this project, went beyond that of their usual role, as a mobile operator. They were critical in offering an innovation platform to allow rapid prototyping of the different elements of the solution. Here like for NWU, the platform they developed as part of the VOICES research project is now freely available in the open source domain, and therefore anybody could reuse it without the need to partner with a mobile operator for the first phase of the project (prototyping/deployment/validation). Thanks to this platform, it is now possible to deploy, at very low cost, mobile services in almost all channels (web/sms/IVR/etc.). However, it is important to note that a mobile operator (probably in this case, the local instance Orange Mali) would be a critical partner when scaling up the solution to cover a large number of people and communities. What Sahel Eco is using is more a medium size pilot, rather than a real scaled-up solution. It is part of the next steps, after achieving and deploying the missing pieces of the end-to-end solution, to engage with Orange Mali for such a scale-up partnership.

Business Model

Also as part of these next steps, and before the system can be fully functional and sustainable, Sahel Eco and their partners need to develop an appropriate business model based on transaction fees. The current setup enables Sahel Eco to support more farmers or provide enhanced services with the same or fewer resources, thus increasing their impact per dollar, but is fully reliant on donor support to cover costs associated with maintenance and thus vulnerable. Determining who pays what rate and for which services will require careful deliberation and may need to vary according to value of the product, the location of the actor in the value chain, the relative strength of supply versus demand and so on. One approach being considered to cover the core costs of the platform is to offer a portfolio of services to government departments, local radio stations, NGOs, farmer associations and the private sector and enable them to select different tariff options for the end user (free, normal or premium calls) according to the target group and objectives. We have already started identifying and deploying some of these services that will be part of the portfolio, in particular Tabale and Foroba Blon. Tabale⁸ is a voice-based meeting organizer system that enables organization like Sahel Eco to convene a meeting of e.g. farmers by calling them automatically, delivering in their own language the meeting details, and collecting their answer (whether they will participate or not). Foroba Blon⁹ is an Award-winning voice-based citizen-journalism platform that is currently deployed in 5 radio stations in Mali. These tools complement Radio Marché and are critical for the future success of the business model.

⁸ <http://lapin-bleu.net/riviera/?p=325>

⁹ <http://www.ipinewscontest.org/news/foroba-blon-plans-to-revolutionise-journalism-in-mali.html>

Findings

The two phases of implementation of m-Agri solutions by SE provide lots of valuable information from which we have identified a set of best practices that must be taken into account when designing m-Agri interventions.

The first lesson we learnt is the importance of providing services directly to the end-users, without intermediaries. Not only is the development of a network of intermediaries costly, but their motivations as well as the incentives provided are not related to their importance in the overall ecosystem. Moreover, given the requirements for literacy, intermediaries are in most cases men, creating a gender imbalance and barrier for women producers.

The second finding of this study is the importance of identifying the most appropriate technology for the targeted communities. In this case, the use of SMS was irrelevant, and farmers couldn't bridge the gap and learn how to use such technology. In such environment, the use of voice-based solutions is successful, and farmers, even if they have no previous experience with ICT, can bridge the gap and become fluent ICT users.

The third finding is the importance of radio in rural areas. Despite the hype on mobile technologies, radio is still by far the main media in rural areas and it is an essential channel to reach most of agri stakeholders at the local level. We believe that integrating radio in m-Agri initiative is an essential success factor.

The fourth finding is related to the importance of understanding the value chain and the associated challenges. Despite all the effort invested to improve the technology to make it accessible to farmers, the successes and failures of the second phase demonstrate the fact that m-Agri solutions are not a magic wand that can solve all issues. It is just a tool that is able to solve some specific challenges. It is essential to identify clearly the challenges of the considered value chain, and design the technology solution that will tackle the problem at the right level and the right actors. It is clear that one solution does not fit all value chains, and it is almost certain that in different regions, and in different countries, the value chain of a given product will have different challenges that need to be addressed by different technology solutions. However, when there is a good fit between the m-Agri solution and the challenge of the value chain, the impact can be phenomenal.

Finally, it is important to note that, from our perspective, the major success of the second phase is largely due to the development of a partnership between an NGO supporting farmers, but without any ICT expertise, and a set of technology partners, that has lots of experience with mobile solutions, but is not really aware of the context in which they are used. We believe that both partners are critical for the success of the intervention.

Conclusion & Next steps

This paper highlights the journey of Sahel Eco towards integrating ICT and mobile technologies in their operation. The two phases of the intervention allowed SE to identify the technology accessible to farmers. In the case of women farmers with a high illiteracy rate, voice technology is only solution that is able to empower them and allow them to access the mobile services on their own, when they need it, with their basic phone, and in their own language.

The experiences have also underlined the importance of radio as an inclusive media, to reach all stakeholders at the local level. From our perspective, it is essential to integrate both mobiles and radio in successful interventions. Moreover, ICT is a great opportunity for development organizations like Sahel Eco and for cooperatives and private sector companies working with large numbers of smallholder producers, to more easily integrate radio in their program, enabling them to increase their outreach and impact.

The portfolio of tools that has been developed in the second phase of this initiative is very powerful for addressing challenges related to marketing and dissemination at the local or regional level. However, the same tools are not really appropriate to address issues related to outreaching to national or international players, when the local demand does not exist. It is therefore essential to clearly assess the weaknesses and needs of the value chain of the different products, before designing the intervention.

In conclusion, the experience of Sahel Eco in the domain of m-Agri tools is very positive. The process of delivering ICT services to farmers has been established and technologies that are working in this context have been identified. However, the sustainability of the solutions deployed will require a scale-up of the initiative. This will be the focus of the next phase. The challenge is clearly to establish a methodology to train all potential farmers remotely. We haven't yet tested how to build capacities at distance without intervention in each community. From our perspective, radio offers interesting possibilities, and the broadcast of a specific training program on how to use the voice-based tools, is a solution to explore.

Finally, the next phase must also explore how ICT can help to solve the issues identified in for example the value chain of shea nuts and shea butter, where the market is not at the local level but more at the national or international level. We need to explore new approach and use new ICT tools to outreach to these types of actors and also to support development of the local market for these products.

References

- Sahel Eco, <http://www.saheleco.net/>
- SBC4D, <http://www.sbc4d.com>
- The Web of Voices, video on Sahel Eco m-Agri tools, January 2013, <http://vimeo.com/68218759>
- [Zakary Diarra, a Honey producer in Mali, interview](http://worldplantage.blogspot.nl/2013/05/a-voice-based-trading-system-for-zakary.html)
<http://worldplantage.blogspot.nl/2013/05/a-voice-based-trading-system-for-zakary.html>
- “The Web of Radios - Introducing African Community Radio as an interface to the Web of Data” Anna Bon, Victor de Boer, Pieter De Leenheer, Chris van Aart, Nana Baah Gyan, Max Froumentin, Stephane Boyera, Mary Allen, Hans Akkermans <http://www.mvoices.eu/sites/default/files/WebofRadiosExtendedv1.0.pdf>
- VOice-based Community-cEtric mobile Services for social development (VOICES), EU-Funded FP7 Project, <http://www.mvoices.eu/>
- Mobile Web for Social Development Roadmap, W3C, December 2009, <http://www.w3.org/TR/mw4d-roadmap/>
- Demystifying Voice Technologies for Social Development, blog post, Stéphane Boyera, March 2013, <http://stephb.org/2013/03/demystifying-voice-technologies-for-development/>
- Mobile ICT & small-scale farmers?, blog post, Stéphane Boyera, December 2012, <http://stephb.org/2012/12/mobile-ict-small-scale-farmers/>