



Economic Sustainability of ICT Services for the Rural Poor in sub-Saharan Africa

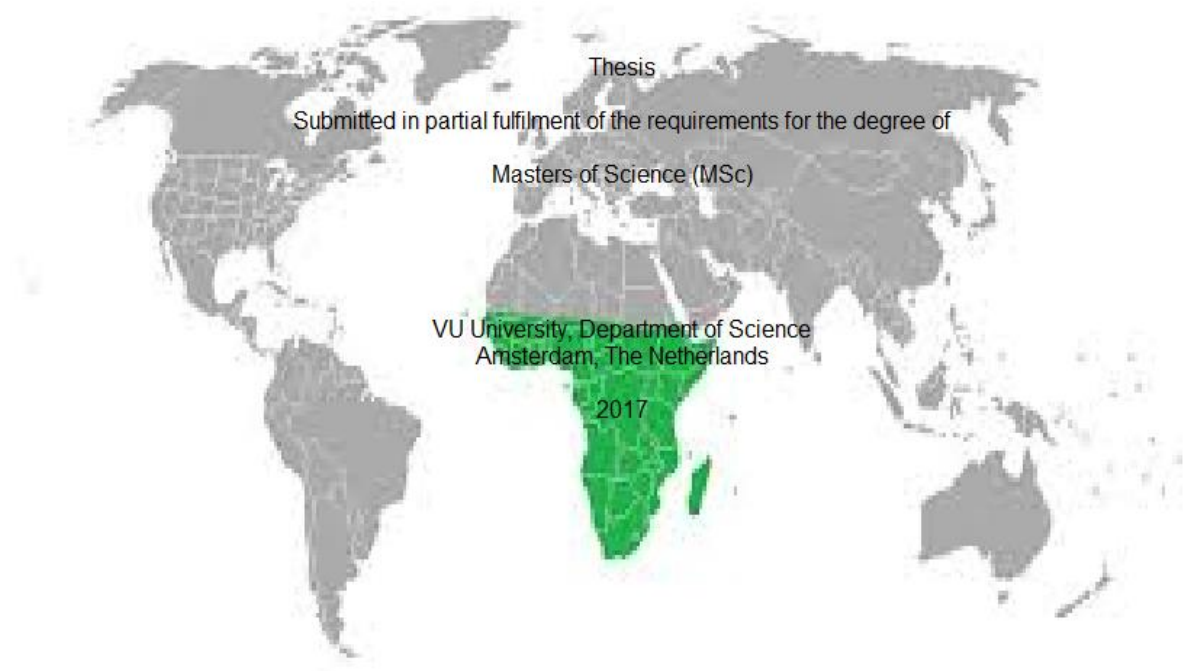
Validating the e3value methodology for a low tech, low resource environment in rural Africa

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Abstract

Despite many efforts, to make ICTs available for people in poor regions of the world, sustaining ICTs as a service, after the end of a donor-funded project, remains a great challenge. Recently, mobile voice-based services have been developed for communities in rural Mali, which have shown promising results, in serving the needs of the local rural communities, but a sound business proposition was still lacking. In this research we show how business models, based on locally collected field data from envisaged business partners and users can help to evaluate profitability for different business scenarios, both qualitatively and quantitatively. We have used the e3value methodology to build these models and shown the appropriateness and validity of this methodology for studying economic sustainability of a service, before its deployment (ex-ante).

1. The Problem and the Approach

1.1 Introduction

ICTs are generally thought to be necessary for social and economic development of poor regions in the world (e.g. Unwin, 2009, UN Sustainable Development Goals 2015¹). Recently, studies have shown that mobile voice-based web services have great potential to serve the poorest in rural Africa (De Boer et al 2012, Gyan 2016, Bon et al. 2016, Bon et al 2017). Several pilot projects, rolled out in rural West Africa have demonstrated the usefulness of context-sensitive ICT services for very poor regions, where there is no Internet connection, there is scarce or no electricity, people are often text-illiterate and have very low incomes (Gyan 2016). Despite the promising results, sustaining these ICT services, after the pilot period, is difficult, given the poor conditions in these low-tech low resource contexts. It is still unclear if local business partners can become local ICT service providers and serve the local population with these ICT services, in an economically sustainable way.

Many sustainability studies of ICT4D projects have been done in recent years however, these studies are always done after the deployment (ex-post), and do not provide an analysis of the expected sustainability, i.e. before the deployment. However, assessing sustainability before deployment is much more useful because it can avoid that unsustainable services are deployed, and it can provide information to improve the business cases.

This study focuses on economic sustainability of mobile web services for rural communities, in the poorest parts of the world, such as rural West-Africa. In wealthy countries, evaluating the profitability of innovative web services has also been challenging in the early days of the Web, i.e. in the mid/end 1990s and early 2000 period. During that time, many e-business ideas have not proven sustainable, and have been discontinued. This lack of success can often be attributed to a lack of a good value proposition (Gordijn & Akkermans 2003).

To this end, the e3value methodology has been developed (Gordijn & Akkermans, 2003). It allows to evaluate economic profitability of value networks, since web services are often delivered by multiple businesses partners at the same time (Gordijn and Akkermans 2001, 2003). The assets of the e3value methodology are that it can be used to do business evaluation for a whole value network, both quantitatively and qualitatively. It can also be used to build and evaluate different business scenarios for a given (web) service.

In this study we want to analyze if the e3value model is also useful for the assessment of economic sustainability of ICT4D information (web) services in a very poor, low tech, low resource environment, such as e.g. rural Mali.

¹ <https://sustainabledevelopment.un.org/about>

1.2 The Problem Statement & Research Questions

The main objective of this research is to find an answer to the following problem statement:

Can ICT services, which have been developed for poor communities in low tech low resource contexts, become feasible and economically sustainable, given the very constrained context of poor infrastructure, low literacy and low incomes?

To get an answer on the problem statement, the following research question need to be answered:

1. *Can we assess the profitability and sustainability of potential ICT services for the rural poor?*
2. *Is e3value an appropriate methodology to build business scenarios and assess business feasibility and economic sustainability, in low-tech low resource environments?*

1.3 Research design and used methodology

To answer these research questions, we set up a the research project. We combined various methods:

Firstly a context analysis had to be done of existing data and literature, and study a recent case in which a web service had been developed and deployed for rural communities in Mali.

Secondly a business model and scenario analysis must be done. This included the design of different business scenarios followed by a quantitative and qualitative feasibility analysis of envisaged business models and web services. To build the models, data were requested from users and business partners in Mali. This was done by submitting questionnaires to key-partners in rural Mali. The questionnaires are in the appendix.

The research included the following sub-objectives:

1. To build business models from the existing case studies, which enable to visualize the given ICT service as an economic value web in which business parties exchange value objects with each other.
2. To assess the feasibility of the business model quantitatively, using quantitative data obtained from the users in Mali.
3. To compare and evaluate different business scenarios for the same ICT service. This allows us to predict feasibility when scaling up the service will occur (scaling up in number of users, or in the size of the system or in the technology used).
4. Analysis and evaluation of different types of business propositions for the same ICT system. The e-3 value provides an indication of the relative profits for each business partner in the value network. This gives an idea on the overall sustainability of the service, depending on the profitability for different actors.
5. By doing the business analysis with e-3 value, this method is validated for sustainability analysis of ICT services in a low-tech, low resource environment such as rural Africa.

1.3.1 Method for context analysis

The context analysis consists of a review of literature on ICT4D and the study of a few case studies from the development and deployment of a mobile voice-based web service (named ForobaBlon) for rural communities in Mali.

The second step required the collection of qualitative field data. To obtain this data, interviews with experts have been conducted. Since it was not possible for me to visit Mali, I submitted questionnaires to researchers who had the opportunity to travel to Mali and meet the users (in 2015 and 2016). These questionnaires are used to gather information from the field, and are answered by the key-users and partners in Mali.

Apart from that a Smartphone App was built, to facilitate the interviews in Mali, see Appendix.

To understand the actual use case, the users, and be able to model the business case, I had to study a case of a field deployment for a web system that had been developed in 2012 for radio stations in Mali.

In 2012 questionnaires about this specific web service pilot named Foroba Blon, had been completed by citizen journalists and radio staff. These questionnaires are included in the Appendix. Studying these questionnaires show how the users were engaged in the building and evaluation of the given web service. This data was used as background information in this context analysis.

1.3.2 Business models and scenario analysis

The business model and scenario analysis consists of a qualitative and quantitative analysis of sustainability. The quantitative data for this model are drawn from existing case materials of a web service development in rural Mali, and from interviews with end-users. For the construction of the business models, the e-3 value methodology was used.

1.3.3 Using the e3value methodology

The *e³value* methodology is a conceptual modelling method and tool to evaluate web businesses.(see <http://e3value.few.vu.nl>). It was developed by Gordijn & Akkermans,(2001, 2003) to evaluate and predict the feasibility of innovative business ideas. It is developed for use in high-tech, networked business environments such as e-commerce in wealthy regions of the world.

Recently e3value has proven to be useful for sustainability analysis of value webs in low resource environments such as rural Africa (Bon et al., 2017). A summary based on these references is described by Bon et al (2017). However, this study has used e3value for a qualitative, conceptual analysis. Quantitative profitability calculations have not been carried out previously, using user data from the field.

The advantage of e3value is that it can visualize business models and demonstrate how multiple stakeholders exchange value in a value web. The e3value method focuses primarily on

modelling economic value exchanges in business networks rather than business processes or information flows in the network. This results in elegant and light-weight models.

Figure 1 shows a very simple example of the e3value model. It shows an actor, (in this case a customer) who buys an ice cream from a snack bar. This simple diagram shows and explains the various concepts of the e3value method. (The following text is an excerpt taken from Gordijn & Akkermans, 2003, 2001.

Each actor in the value network is responsible for a profit-and-loss. In this case the actors are (i) a customer, (ii) an ice cream factory, (iii) a snack bar. Actors can be a single entities, but they can also represent an entire market segment. A market segment can be seen as a set of actors that share the same economic utility function e.g. all customers who buy an ice cream at this snack bar. Market segments are represented graphically in the e³value ontology as a 'stack of actors'. (For the sake of simplicity, the market segment is not represented in this example of Figure 1).

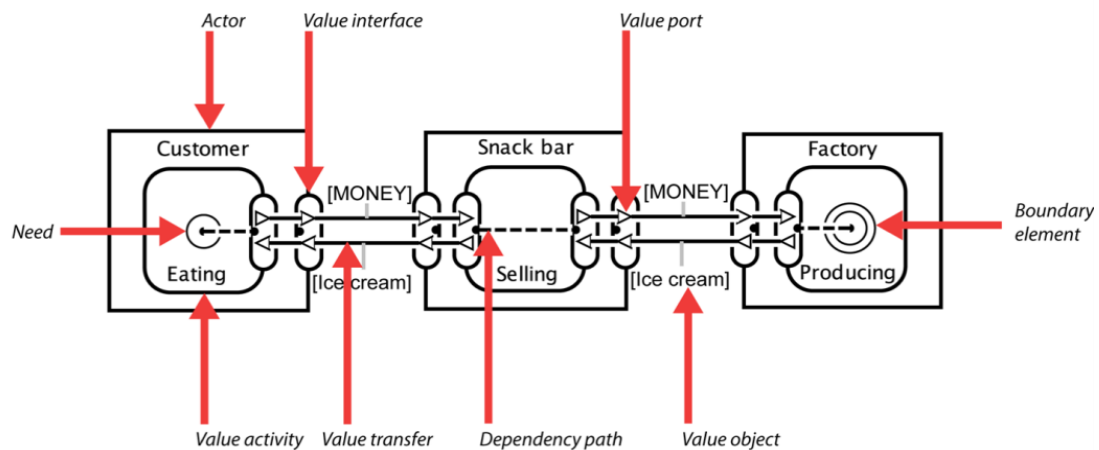


Figure 1. A simple illustrative e³value model, from Gordijn & Akkermans 2003

Actors in a value network exchange value objects. These value objects (in this case it is an ice cream and money) represent an economic value for each of the three actors. Actors exchange value objects via so-called value ports. Value ports are grouped into value interfaces. These value interfaces represent the economic reciprocity, which exists in every business transaction, i.e. exchanging of value objects such as ice cream against money.

For each transaction, the general rule is that an actor is willing to provide a given value object only, in case it gets something in return, which is of equal or higher value. Given the reciprocity principle, when an ice cream is transferred, money is transferred in the opposite direction (Gordijn & Akkermans 2003).

In the e3value method, the customer is the actor who starts the business process: in this case, the customer expresses the wish to have an ice cream. To satisfy this need, an exchange of value objects (ice cream against money) via an interface. This is modelled by connecting the value interfaces by dependency paths. It becomes clear that the snack bar must obtain the value

object (ice cream) from the ice cream factory. A boundary element at the ice cream factory indicates where this value transfer actually ends (which demarcates the scope of the model).

A great advantage of e3value is that it enables to calculate the net cash flow for the business model. It does this for each actor in the model and thus gives the feasibility of the entire value network. This gives an indication if the web service is economically sustainable.

For a value web to exist, every actor has to be able to obtain his or her value. By changing the parameters (cost of the value object, the number of transactions) the break-even point can be easily estimated.

To be able to evaluate the financial sustainability of a business idea using e3value, six iterative steps are followed. In the next section we will give a summary of these steps based on a more detailed description that is found in Bon et al. (2017).

1.3.4 Six steps to evaluate a business model using e3value

The method of building and evaluating a business model consists of 6 steps. In the first step the innovative business idea is elaborated. This means that the identification of the needs of the community is done and that a new ICT system is developed. Also a description of how ICT can help meet the needs of the community, is given. Furthermore the impact of the proposed business idea on the various actors is stated and the needs of the actors with regard to the project and the dependence between the actors is given.

The second step is the representation of the business idea as an e3value diagram. The e3value approach is used to construct a graphical representation of the business idea. In this step it is very important that the stakeholders involved in the business idea agree upon the e3value diagram that represents the idea for a new service. Therefore a series of workshops with the stakeholders will be part of this step.

The third step, after the e3value diagram is agreed upon, the quantification of the e3value model is done. However, it is important that before quantification an agreement upon the timeframe that the e3value diagram comprise, is reached. A timeframe can be one year, a month, a week, or a day. E3value can deal with multiple sequential timeframes e.g. multiple weeks. There are two kinds of quantification. The first one is a quantification as an estimate, this is the case when e3value is used to design an business model. The second one is a quantification based on actual numbers of the business idea, this is the case if the (ICT/web) service is up-and-running. Quantification needs to be done for the number of customer needs per timeframe, the number of actors that are part of a market segment. Furthermore, valuation formulas need to be assigned to value ports of actors where money is exchanged.

The fourth step is to assess economic sustainability from a structural point of view. This means that it is possible to assess economic sustainability by observations, without calculations. It is important that on the longer run every actor receives more money than that in total is spent. If this is not the case and an actor does not make a profit, than the business scenario is not sustainable for this actor.

The fifth step is to assess economic sustainability from a quantitative point of view. The e3value software conducts the quantitative analysis. For each actor a net value flow sheet within a particular timeframe is generated. The envisioned ICT service will only be sustainable if all actors in the network have a positive net value flow, if the net value flow is negative on the longer run, the business will not be sustainable.

The sixth and last step shows that the sustainability analysis is an iterative process. It is possible that a version of an e3value model may not produce a sustainable result and therefore need to be changed including the quantifications for this model. The generated net value flow sheets show which actors experience problems. To produce a positive net value flow for all actors the values must be modified.

1.4 Structure of this thesis

The structure of this thesis is as follows. In Chapter 2 a context analysis is given for ICT services in rural Africa, and especially Mali, on which this study is focused.

In Chapter 3 I describe the case of Foroba Blon, a mobile voice-based web service, built for rural communities in Mali, and for local radio stations who provide services to these communities.

In Chapter 4 I present three business scenarios, using the e3 value method for this radio service named Foroba Blon. One model of the business without ICT, one model for the business, using an ICT system and platform for a modest number of users. A third model for a scaled up version of this service, for a larger number of users. I compare the profitability for the business actors in each of the models.

In Chapter 5 I present two other business scenarios, which are possible for the same web service Foroba Blon, but this case involving large business partners such as a media concern or a big advertiser. These models allow to evaluate the relative profit for each of the partners and show that certain actors make disproportionate large profits in the value network.

Chapter 6 gives a discussion, ideas for further research and the conclusions.

1.5 Contribution of this research

- This thesis shows how to assess profitability and economic sustainability of ICT services for the rural poor before their deployment, based on field data from local users and business partners from the local context.
- It validates e3value as a useful tool for qualitative and quantitative sustainability analysis of innovative web services in a low tech low resource context such as rural Africa.

2. Context of rural West Africa with regard to ICT services

A way to boost economic development is by using ICT. ICT services have supplied a major contribution to economic growth in developed countries (Akkermans, et al., 2011; Bratt, 2009). Commercial ICT services or eCommerce refers to the process of buying, selling, transferring, or exchanging products, services, or information via computer networks, including the Internet (Chaffy, 2007; Wen, Chen, & Hwang, 2001; Turban, King, Lee, Liang, & Turban, 2015). However, this can only exist if there is a sustainable business model.

Africa is the most underserved continent in terms of ICT. Internet is only used by 27% of the African population, against 77% in Europe and 40% for the whole world². However, mobile telephony has been introduced rapidly since the early 2000. Currently 95% of the people in Africa have mobile coverage, even in poor rural regions³.

Recently the importance of mobile web services have been demonstrated in rural areas in Africa (Gyan et al., 2013), de Boer et al., 2015, Gyan, 2016). Knowledge sharing is shown to be important for improve living conditions in poor developing regions. The web is seen as an instrument of empowerment for poor people (Akkermans, et al., 2011; Bratt, 2009).

Africa can be divided into two parts, North Africa and the non-developed Sub Saharan Africa. On development level South Africa is different from the other countries in Sub Saharan Africa and is therefore seen separately from these countries. In 2015, 1.001 billion people where living in Sub Saharan Africa, 62,261% living in rural areas (The World Bank, 2017).

This research focuses on ICT services in rural Mali. Mali is one of the poorest countries in the world (World Bank, 2013), literacy levels are below 50% (World Bank, 2013), and many different languages are spoken. Moreover, in rural regions there is often a lack of electricity, computers and internet (Bon, et al. 2016). A little more than half of the Malian population has to manage with less than \$ 1.25 a day (Unicef, 2013).

Rural Mali has a wide availability of mobile phone networks and phones and community radio stations are common, even in poor rural communities (Bruijn, Nyamnjoh, & Brinkman, 2009; Bon, et al., 2012). The availability of mobile phones and community radio provides an opportunity for people to share information. In addition, the combination of voice and web technologies can improve the way information is shared.

Another opportunity for information access is radio. Compared to other Sub Saharan African countries, Mali has the fastest growing community radio network (Costa, 2012; Madamombe, 2005). During the nineties, the number of community radio stations grew by 2 per month (Costa, 2012). Currently there are more than 110 private radio stations, 78% of them are community radios. Most of these community radios are located in rural areas (Madamombe,

² Source: <http://www.internetlivestats.com/internet-users/>

³ Source: <http://www.itu.int>

2005). There are multiple reasons why radio has become the most important mass communication tool in Mali. There is a widespread poverty, low literacy level, lack of electricity and many local languages are spoken (Costa, 2012; Madamombe, 2005).

The growing use of community radio and mobile telephony led to ideas to develop ICT services that can improve and facilitate the way people communicate.

Currently, mobile web services are used experimentally. From the business side it is interesting to find out whether these services can become feasible and sustainable on the longer run. The novelty of these services and the given context: e.g. lack of computers, internet access and electricity, low literacy level and the many different languages that are spoken (Bon, Gordijn, & Akkermans, 2017) make the introduction of commercial ICT services in rural areas in Africa different and more challenging than in developed countries. It is interesting to explore the opportunities of ICT services, especially in areas where a high tech ICT infrastructure, such as the Internet is not present.

This research uses the case of a mobile voice-based web service to explore whether mobile web services can become feasible and sustainable on the longer run and are these results applicable to other rural areas in Sub Saharan Africa.

3. Foroba Blon,: a Mobile Web Service for Radios in Rural Mali

3.1 Introduction

This chapter describes the case of a voice-based web service which has been developed for the rural poor in Mali, to facilitate and promote citizen journalism, and give a voice to the rural poor. The business partners were small local community radios, who provide all types of information and entertainment, in local African dialects, for the surrounding rural villages. The information given in this chapter is a summary of three unpublished trip reports by the W4RA team from field research in Mali, in November 2011, February 2012 and July 2012. These reports can be retrieved at <https://w4ra.org/foroba-blon-community-radio-in-africa-and-the-web/>.

Figure 2: Logo of Foroba Blon, designed by Victor de Boer



Voice-based Citizen Journalism (aka Foroba Blon) was a project of W4RA, the Web alliance for Regreening in Africa (<http://w4ra.org>). The project has been set up as a collaboration of the World Wide Web Foundation, Vrije Universiteit Amsterdam and the Malian NGO Sahel Eco, Radio Sikiddolo in Konobougou, Radio ORTM Ségou, Radio Seno in Bankass and Radio Moutian, in Tominian. All were Malian radio stations. The project ran from 01 December 2011 to 01 December 2012. It has been continued by VU, and is still running at radio Sikidolo, in May 2017.

The Foroba Blon project was selected as a winner from over 300 projects, by the 2011 International Press Institute's News Innovation Contest. The grant for this project was sponsored by Google. It was set up as a collaboratively developed ICT service in support of knowledge sharing for the rural poor.

The Foroba Blon service, which was developed in close collaboration with these radios, is a kind of "Letters to the Editor" service, in which the radios can facilitate their paper-based system of collecting information from listeners, and using these messages in new radio programs. The key central use case is simply the following:

- The Foroba Blon service makes it possible that the general public (citizens in general) phones in by mobile and put in their message whatever they want to say.
- Apart from that, the Foroba Blon service makes it possible to organize these messages by the radio people including an option to edit and (later) broadcast such messages.

The name chosen for this project is in two words: FOROBA BLON, in Bambara, a Malian language. FOROBA literally means "big field" or "collective field" and the signification is "for everyone"; BLON = the vestibule where the chief receives people in audience.

Together they signify the large room or space where everyone has the right to speak in front of the chief; the truth can be told; but only if you do it respectfully, without insulting anyone. Pronunciation: three short equal syllabi. Fo-ro-ba; then the accent on Blon(di-di-di-daaaaa). It conveys the idea of citizen journalism. DiarraFousseyni from Radio ORTM Ségou suggested this meaningful name for the project. The logo for Foroba Blon was designed by Victor de Boer, as

shown in Figure 2. The name of this little fellow is M. MouribaBonmarché. This name was given by Amadou Tangara, one of its Malian key-users.

3.2 Community radios in Mali: the users/business partners and their concerns

Three radio stations are involved in the project Foroba Blon. These are:

Radio ORTM Ségou (*FM 96.8*), a state owned radio. Radio ORTM Ségou broadcasts programs in French and Bambara, the most widely spoken language in Mali. Radio ORTM Ségou is part of the national organization ORTM (Office Radio Télévision du Mali). It has computers and a 2 Mbps fixed line (DSL) internet connection. The coverage radius of the radio is 150 km. The listeners are regional and diverse: young, old, men and women. Every household in the region owns a radio (powered on battery when there is no electricity). ORTM Ségou has wifi in the office and uses upload facilities to the ORTM server in Bamako. See Figure 3 for an impression of this radio.



Figure 3: Developers and users at the office of ORTM Ségou during the co-creation sessions

They make several programs where people can phone in and leave a reaction or message. Listeners should be able to phone in and leave their message outside the program slot. They also have a weekly programme called “Letters to the Editor” where the reporter reads out letters written in French and Bambara. Non-literate listeners should be able to contribute by phoning and recording their “letter”.

The reporters also need a system to manage the messages. They would like a system where people could leave or access a spoken message on the Web (e.g. Africans in diaspora).



Figure 4: Radio Moutian in Tominian: journalist Bakary Dembelé at work, February 2012

The second radio is Radio Moutian, in Tominian (see figures 4 and 5). This radio is independent and its funding is based on paid airtime for announcements and private gifts from third parties. Radio Moutian has a computer but no internet connectivity. Programs are mainly broadcast in Bomu, a local language in the Tominian region.

Radio Moutian(FM 105.3) was founded in 2008 with funding from a European development agency (LuxDevelopment). The coverage is probably about 100 km. Electricity goes down frequently. Radio Moutian has a computer since October 2011, but no fixed internet connection. (They now use Audacity to make their radio programs). They use a dongle from the mobile operator Orange to go online, but the signal is poor.



Figure 5: Radio Moutian's flag and logo.

Broadcasting an announcement will cost you about 1000 fCFA per minute of airtime at Radio Moutian. People from the neighbouring villages send many messages; especially invitations for weddings at this time of the year. Announcements can be 15-20 minutes long. There are programs about a certain topic "table ronde" to which listeners can phone in and leave a message. This is a burden for the journalists, who have to attend the calls. Many messages are brought on paper by listeners. People like to hear their names broadcasted. Easier management of the audio files on the computer is a wish. The best use case to develop in Foroba Blon is a system where listeners can phone in and leave a message ("Letters to the editor"). Similar to the need of ORTM.

The third radio is Radio Seno in Bankass. This radio is independent from the Malian state and has only analogue equipment. There are no computers, there is no internet connection here, but the radio has many listeners in the region around Bankass. The main language spoken here is Dogon.

The activities of the three above mentioned radio stations are related to three types of end-users or customers:

- (i) NGOs, that buy airtime to broadcast public announcements about informative and educational topics, such as agriculture and public health information. This type of service is usually based on fixed monthly subscriptions to airtime for recurring broadcasts.
- (ii) Non-commercial listeners from the region, who buy a few minutes of airtime and pay a broadcast fee per minute airtime. The information is usually brought to the radio, or communicated via phone and subsequently written down on paper by the radio staff.
- (iii) Journalists or trusted village reporters that phone to the radio and leave local news or interviews on a regular base. In the current situation, all incoming phone calls are attended by a radio staff member and annotated in tabular form on paper.
- (iv) Listeners use to call in on a given time slot (one hour per week) and leave a short voice message (few seconds only) as a reaction to a program that was broadcasted on a certain popular topic. These messages are named “letters to the editors” (LTE)’.

3.3 Building a web service: The Foroba Blon use case

The idea of Foroba Blon is that this service will substitute the paper-based administration done by the radios, as shown in Figure 6.

Date	Heure	Animateur	Nature Appel	Auditeur	Numéro	sexe	localité	Objet
24/11/11	17h47m	Gustave DAKOU	Entrant	Barba Dabou	63031469	M	Sokourani	Il dit qu'il soutient ceux qui pensent qu'on ne peut pas finir d'arracher le stigje
11 -	17h49m	-	-	François Kone	73193378	M	Kankorokuy	Il pense que l'interlocuteur (Badio Sando) ne fait pas avancer l'idée d'arracher le stigje
11 -	17h50m	-	-	Dekou Kone	63656940	M	Tayo	Il n'est pas d'accord avec ce que dit Badio qui pense qu'on ne finira jamais d'arracher le stigje
11 -	17h56m	-	-	Joel Keita	80465377	M	Huanuma	Il encourage chacun à arracher le stigje
11 -	17h57m	-	-	Mougnou Moukoro	63563659	M	Hasso	Il demande de réfléchir par un autre moyen de lutte contre le stigje afin que ça disparaisse le plus vite que possible
11 -	18h01m	-	-	Nothian Diarra	62213649	M	Bonakuy	Il s'engage à arracher le stigje comme activité
11 -	18h03m	-	-	Dany Thera	62473577	M	Makouroulo	Il affirme que les initiateurs de la CRP sont des bien faiteurs
11 -	18h06m	-	-	Sabou Nathani Traora	-	M	Dany	Il encourage chacun à prioriser l'arrachage du stigje
11 -	18h08m	-	-	Adama Thera	70772116	M	Macorokuy	Il s'engage à arracher le stigje chaque année dans son champ
11 -	18h11m	-	-	Da'a Diarra	62245737	M	Gnankandaga	Il affirme que qui veut peut
11 -	18h15m	-	-	Dany Tembèlè	64681769	M	Somokuy	Il apprécie la CRP

Figure 6: The paper based administration done by the radios, before the introduction of the web service Foroba Blon. The message content is written in a few words in the last column, marked as “Objet”.

The envisaged end-users of Foroba Blon are (i) Radio journalists from Radio Ségou and Radio Moutian, and Radio Seno, for whom the system will be developed; (ii) Listeners of the radios who want to use the interactive voice-based system to provide messages to the radio based on interactive programs e.g. “letters to the editor”; (iii) Trusted reporters “animateurs” who help the journalists by making reports in the villages. These reports are broadcast on the radio.

3.4 The architecture of the Foroba Blon system

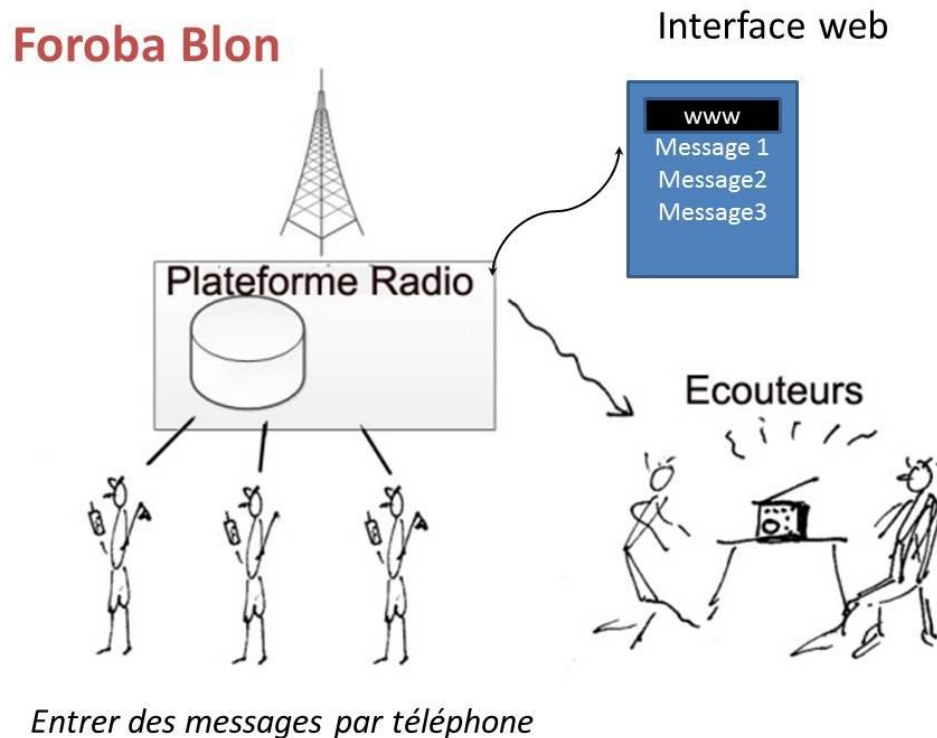


Figure 7: The architecture of Foroba Blon, running on a Radio platform (either the Kasadaka platform or a cloud solution). It shows the platform, its components, the users and their interactions with the system.

The radio platform consists of a server where the Foroba Blon software is running, which can be accessed either by GSM phone or through a web interface (See Figure 7).

The interface to the Foroba Blon radio platform is either purely voice-based, through mobile phone for entering new content. Users of this interface are the listeners from the region entering letters to the editor (LTE). These people only have mobile phones and no access to the Internet. Their calls are answered by the system with a pre-recorded welcome message in a

local Malian voice inviting them to leave their message. For the sake of user-friendliness, the user interface and the dialogue for this category of users is kept as short and simple as possible, since the expected callers will be unfamiliar with interactive voice response systems and may not respond to a complex computer-generated dialogue asking to press buttons etc.

Another category of users of Foroba Blon are the trusted reporters calling from the field. They phone in and leave their spoken report for broadcasting. These users are previously registered, having their phone number, name, address and preferred language in Foroba Blon. These users will be trained to navigate the voice-menu, and use the IVR system, asking to press a button on the phone to confirm or answer a question about their current location, subject of the message, etc. The Foroba Blon system always answers the registered caller in his/her preferential language.

The voice messages are stored as audio files in the Foroba Blon data store, together with meta-information being the date and time of the call, the length of phone call in seconds, the phone number of the caller. Messages from trusted users are linked to the owner, his/her address, and his/her preferred language.

The Foroba Blon Radio Platform also has a “normal” web interface, where internet-connected end-users/customers can access and upload a voice message. Depending of their customer relationship to the radio, they can login to the radio-platform as (i) registered users such as NGOs, and trusted reporters, or (ii) as unregistered users. There is an option to sign up and create a user account by registering the name, phone number, village and preferred language. Unregistered users can access former broadcasts since this is public information.

For the radio user, FB provides a web-based interface, enabling them to manage the data in the data store. It provides a file list where they can access, listen, broadcast, delete files, and add/update/delete meta-information.

The radio station that has no computer nor internet, has only a very limited interface to the RP, since this is the constraint of a voice interface. He receives a welcome message asking if he wants to hear the last 10 messages, or if he wants to manage the welcome messages to the end-users.

3.5 The platform: A local mobile/web platform or in the cloud?

The computer platform that hosts Foroba Blon, is hosted either locally, on a stand-alone computer or “in the cloud”. The platform consists of a voice platform running an open source Webserver (such as Apache) and a local voice interface that handles the voice interaction. The radio platform uses a GSM gateway. This device handles incoming and outbound calls and streams the voice messages to and from the phone.

The voice-based radio platform could in theory be physically hosted anywhere in the world, on any server, which is connected to the Internet. However, in actual Malian case this is not possible. Firstly, the radio platform has to be accessible using an inexpensive local Malian phone number. Secondly, the web service accessed over the internet must be accessible locally. The local connectivity is usually of low bandwidth and high latency, making voice web services hosted in datacenters in the US or Europe, too slow for proper deployment in Mali. For these two reasons, the system has to be hosted locally in Mali. In the absence of good and reliable

datacenters or hosting providers in Mali, the radios can decide to deploy the service locally at their premises. The name of this platform is Kasadaka⁴

3.6 Sustainability of Foroba Blon: an issue

The Foroba Blon service has been iteratively co-created by the W4RA team and the local radios in Mali. One important issue was the economic sustainability of such a service. Are the radios capable of financially maintaining this service? Will it scale up when more users start to use the service? How many users are needed to make reach a financial break-even point (i.e. when are the incomes for the radio equal to the costs of having this service)? Are there different business models possible? These questions came out of the above research and will be tackled in the next two chapters.

⁴ See: <http://wm.cs.vu.nl/blogs/kasadaka-1-0/> and <http://www.kasadaka.com/>

4. Evaluating three Business Scenarios for the same radio service

In this chapter we evaluate the economic sustainability of the radio service Foroba Blon, which has been described in the previous chapter. We present three possible scenarios that show how a local business — initially a paper-based system run by local providers and used by local users — can be gradually scaled up by introducing ICT/web services and if this has the potential to further scale up, when more users start using it, and a more advanced/expensive platform is being introduced.

The e3value methodology allows us to calculate the break-even point for each of the three scenarios and demonstrate potential profitability and economic sustainability of the service.

The quantitative data used in these three models have been provided by business partners and key-users in Mali.

4.1 The Basic Customer Model scenario

This model represents the current business of the four community radios (described in Chapter 3). The actors are: a customer in a rural community, a village reporter, a radio station and the local phone company. Table 1 shows the optional goals of these actors.

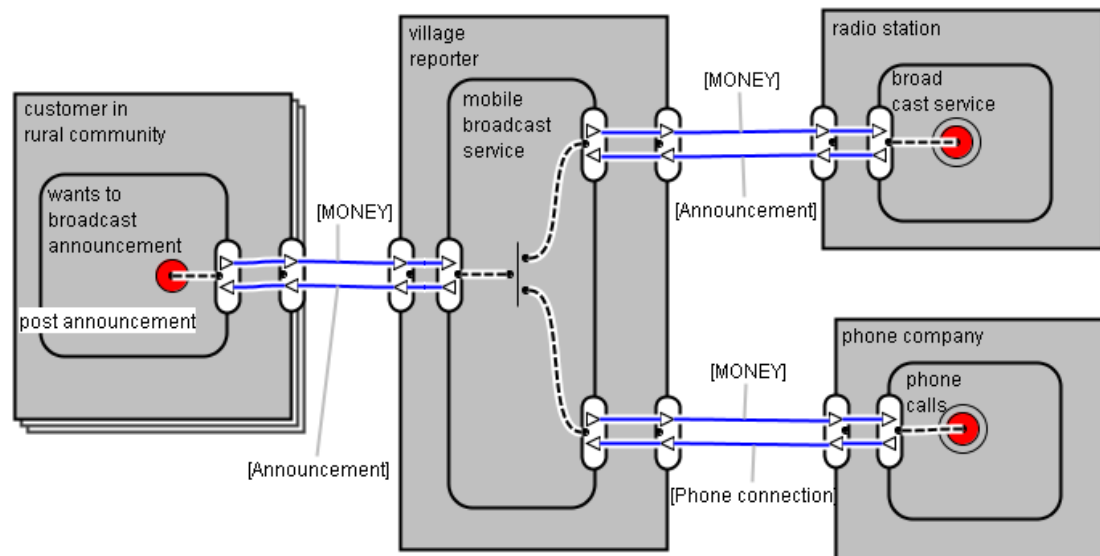


Figure 8: e3value model for the Basic Customer Model

Table 1 Actors and corresponding Optional Goals for The Basic Customer Model

Actors	Operational Goals
Customer in rural community	Wants to broadcast an announcement
Village reporter	Provides phone access to customer as a business
Radio station	Informs the listners and broadcast announcements
Phone company	Provide phone connection to the village reporter

The customer is a person living in a rural community in Mali and has the need to announce a message to other people in the area. The customer wants for example to broadcast a message on the radio because there is an upcoming wedding. By reporting this on the local community radio, the message will be reached by people in the living area. The customer does not always have access to a mobile phone. The customer pays the village reporter in order for the messages to be broadcasted on the radio.

The village reporter is a person living in the same rural community as the customer and owns a mobile phone. By making the phone calls or by allowing the customer to do the announcement by him or herself to the radio station, the village reporter serves as a mediator between the customer and the radio station.

The radio station ensures that the announcement is broadcasted on the radio. For the announcement the customer pays a fee of 1000 fCFA per minute to the village reporter. The Basic Customer Model shows an AND-fork, which represents that the village reporter transfers economic value with two other actors, namely the radio station and the phone company. For every announcement made, the village reporter pays 750 fCFA per minute to the radio station.

The phone company provides the phone connection to the village reporter. The village reporter pays 85 fCFA per minute to the phone company for this service.

In The Basic Customer Model scenario a telephone connection is used but no internet access. The announcement that is made is communicated via telephone and written down on paper by the radio staff. It is than read out loud on the radio. There is more than one customer that wants to broadcast a message on the radio, therefore there are many announcement transfers and payments.

Table 2 Prices of services for The Basic Customer Model

Value Object	Value (fCFA) per minute
Announcement service (customer)	1.000
Announcement service (reporter)	750
Phone connection	85

In The Basic Customer Model scenario, we assume that there are 80 customers per month who want to broadcast a message on the radio and that every customer makes one announcement per month. The duration of an announcement is one minute. For every announcement one telephone connection is needed. For simplicity reasons, there is one village reporter, one radio station and one phone company in this scenario.

We can say that from a structural point of view the radio station in The Basic Customer Model scenario is able to sustain on the longer run. All three actors (village reporter, radio station and phone company) receive money value when an announcement is broadcasted. We assessed also the economic sustainability from a quantitative point of view for The Basic Customer Model. Table 3 shows that the customer pays 1.000 fCFA for a broadcasted announcement. As previously indicated there are 80 announcements per month, the costs of 85 fCFA per phone connection for the phone company and 165 fCFA per announcement for the work of the village reporter. Generating a net income of $80.000 - 6.800 - 13.200 = 60.000$ fCFA per month for the radio station. In The Basic Customer Model scenario the radio station manages everything and does not deal with outsourcing. This analysis shows that from a quantitative point of view the service of broadcasting announcements from customers in a rural area, using only a telephone connection without internet can be sustained by the radio station

Table 3 Profit analysis and sentiment analysis for The Basic Customer Model

Actor	Occurrence	Valuation (fCFA)	Total (fCFA)
Customer	80	1.000	+ 80.000
Phone Company	80	85	-6.800
Village reporter	80	165	-13.200
Radio station	80	750	60.000

4.2 The Kasadaka Customer Model scenario

The second scenario represents the situation in which an innovative web service Foroba Blon has been introduced to facilitate the work of the radio, allowing him to process a larger number of incoming broadcast requests. This is done by deploying the so-called Kasadaka radio platform, which hosts the Foroba Blon service .

The business scenario below represents the so-called Kasadaka Customer Model in Figure 2. There are five actors in this model. The actors are: a customer in a rural community, village reporter, radio station, phone company and voice or web service provider. The later is the new one, with respect to the first model. Table 4 shows the optional goals of these actors.

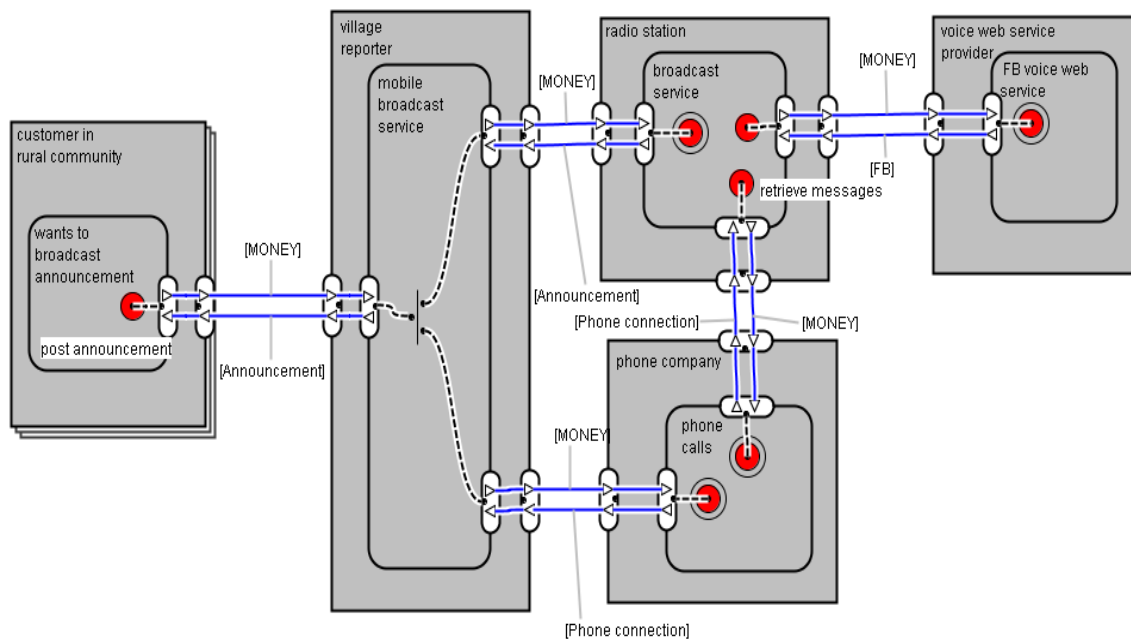


Figure 10: The Kasadaka Customer Model

Table 4 Actors and corresponding Optional Goals for The Kasadaka Customer Model

Actors	Optional Goals
Customer in rural community	Wants to broadcast an announcement
Village reporter	Provides phone access to customer as a business
Radio station	Informs the listners and broadcast announcements
Phone company	Provide phone connection to the village reporter and the radio station
Voice web service provider	Provide the radio station with the ability to retrieve messages from ForobaBlon

Just like in the The Basic Customer Model scenario, the customer in The Kasadaka Customer Model scenario, is a person living in a rural community in Mali and has the need to announce a message to other people in the area, but does not always have access to a mobile phone. The customer wants for example to broadcast a message on the radio because there is an upcoming wedding. By reporting this on the local community radio, the message will be reached by people in the living area. The customer pays the village reporter in order for the message to be broadcasted on the radio.

The village reporter is a person living in the same rural community as the customer and owns a mobile phone. By making the phone calls or by allowing the customer to do the announcement by him or herself to the radio station, the village reporter serves as a mediator between the customer and the radio station.

The radio station ensures that the announcement is broadcasted on the radio. For the announcement the customer pays a fee of 1000 fCFA per minute to the village reporter. The Kasadaka Customer Model shows an AND-fork, which represents that the village reporter transfers economic value with two other actors, namely the radio station and the phone company. For every announcement made, the village reporter pays 750 fCFA per minute to the radio station.

The phone company provides the phone connection to the village reporter and the radio station. The village reporter pays 85 fCFA per minute to the phone company for this service and the radio station pays 16.500 fCFA per month to the phone company.

The Voice web service provider provides the radio station with the ability to retrieve messages from ForobaBlon. A (voice web) ICT service provider, provides the radio station with a platform named Kasadaka. The Kasadaka can be bought and hosted by the radio station. A Kasadaka costs between 393.000 fCFA and 524.000 fCFA. In this case the radio station would have to depreciate these costs; this will not be visible in the E3value model as depreciation, but as an investment. If the radio station decides to buy a Kasadaka, the hosting needs to be done by the radio station. This requires management time and costs and at this moment it is unknown how long a Kasadaka lasts, therefore the choice is made to outsource the hosting of the Kasadaka to the voice web service provider Yelleman. The hosting of a Kasadaka by Yelleman will cost the radio station a monthly fee of 65.000 fCFA.

Contrary to The Basic Customer Model, The Kasadaka Customer Model in figure 2 is based on the fact that a phone and internet connection is used to broadcast a message. The announcement that is made is communicated via telephone and stored in a database. The radio staff can then retrieve the announcement and broadcast is on the radio.

Table 5 Prices of services for The Kasadaka Customer Model

Value Object	Value (fCFA) per minute	Value (fCFA) per month	Value (fCFA) investment
Announcement service (customer)	1.000		
Announcement service (reporter)	750		
Phone connection (radio station)		16.500	
Phone call (reporter)	85		
FB voice web service (hosted by Yelleman)		65.500	
FB voice web service (hosted by radio station)			393.000- 524.000

In The Kasadaka Customer Model Scenario we assume that there is one announcement per month per customer, that the duration of an announcement is one minute and that the village reporter needs one telephone connection for every announcement. We calculated that in order for the radio station in The Kasadaka Customer Model scenario to be profitable at least 110 customers per month are needed. The break-even point for this model is between the 109 and 110 customers per month. There is one village reporter, one Phone company, one radio station and one voice web service provider.

We can say that from a structural point of view the radio station in The Kasadaka Customer Model scenario is able to sustain on the longer run. All five actors receive money value when an announcement is broadcasted. We assessed also the economic sustainability from a quantitative point of view for The Kasadaka Customer Model. Table 6 shows that if 110 announcements are broadcasted, a net income of $82.500 - 65.500 - 16.500 = 500$ fCFA per month for the radio station will be generated.

Table 6 Profit analysis and sentiment analysis for The Kasadaka Customer Model from the perspective of the radio station

Actor	Occurrence	Valuation (fCFA)	Total (fCFA)
Customer	110	1.000	110.000
Phone Company (village reporter)	110	85	-9.350
Village reporter	110	165	-18.150

Phone Company (radio station)	1	65500	-65.500
Voice web service provider	1	16500	-16.500

A little more than half of the Malian population has to manage with less than \$ 1.25 a day (Unicef, 2013). In rural Mali the average salary is between 1 and 2 US dollars a day (Bon et al., 2016). This is between the 617 fCFA and 1234 fCFA per day. In The Kasadaka Customer Model scenario a broad estimation of 1.310 fCFA per day is used. A salary between 58.950 fCFA and 65.500 fCFA per month for the radio station would be good. Table 7 and 8 show that respectively between 188 and 197 announcements per month are needed for the radio station to make enough profit. A net income of $141.000 - 65.500 - 16.500 = 59.000$ fCFA per month is generated if 188 announcements are broadcasted and $147.750 - 65.500 - 16.500 = 65.750$ fCFA per month if 197 announcements are broadcasted by the radio station.

Table 7 Profit analysis and sentiment analysis for The Kasadaka Customer Model from the perspective of the radio station

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer	188	1.000	188.000
Phone Company (village reporter)	188	85	-15.980
Village reporter	188	165	-31.020
Phone Company (radio station)	1	65500	-65.500
Voice web service provider	1	16500	-16.500

Table 8 Profit analysis and sentiment analysis for The Kasadaka Customer Model from the perspective of the radio station

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer	197	1.000	197.000
Phone Company (village reporter)	197	85	-16.745
Village reporter	197	165	-32.505
Phone Company (radio station)	1	65500	-65.500

station)			
Voice web service provider	1	16500	-16.500

We know that a Kasadaka is able to process two incoming phone calls at the same time. We calculated that for the radio station to make enough profit an average of almost seven calls per day are needed. The Kasadaka is able to process this number of phone calls. It becomes a problem when the Kasadaka receives more than ten calls per minute. In this case the customer receives an engaged tone. One Kasadaka is not enough a second Kasadaka is then needed to process all the incoming calls. From a quantitative point of view the service of broadcasting announcements from customers in a rural area using a phone connection and internet via a Kasadaka, can be sustained by the radio station.

4.3 The Telephone Line Customer Model scenario

The third business scenario for Foroba Blon is represented in The Telephone Line Customer Model in figure 3. There are six actors, a customer in a rural community, village reporters, radio stations, phone company, voice web service provider and the hosting fixed phone provider. Table 9 shows the optional goals of these actors.

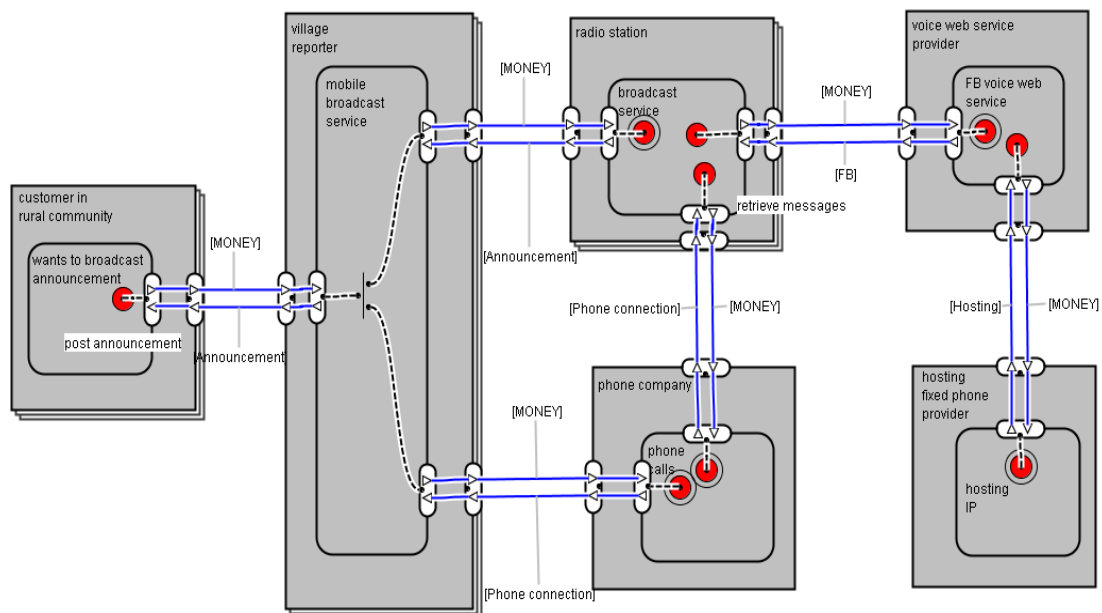


Figure 11: The Telephone Line Customer Model

Table 9 Actors and corresponding Optional Goals for The Telephone Line Customer Model

Actors	Optional Goals
Customer in rural community	Wants to broadcast an announcement
Village reporters	Provide phone access to customer as a business
Radio stations	Inform the listners and broadcast announcements
Phone company	Provide phone connection to the village reporters and the radio stations
Voice web service provider	Provide the radio station with the ability to retrieve messages from ForobaBlon
Hosting fixedphone provider	Hosting the ForobaBlon voice web service

The customer, just like in The Basic Customer Model scenario and in The Kasadaka Customer Model scenario, is a person living in a rural community in Mali and has the need to announce a message to other people in the area, but does not always have access to a mobile phone. The customer wantsfor example to broadcast a message on the radio because there is an upcoming wedding. By reporting this on the local community radio, the message will be reached by people in the living area. The customer pays the village reporter in order for the message to be broadcasted on the radio.

The village reporter is a person living in the same rural community as the customer and owns a mobile phone. By making the phone calls or by allowing the customer to do the announcement by him or herself to the radio station, the village reporter serves as a mediator between the customer and the radio station.

The radio station ensures that the announcement is broadcasted on the radio. For the announcement the customer pays a fee of 1000 fCFA per minute to the village reporter. The Telephone Line Customer Model shows an AND-fork, which represents that the village reporter transfers economic value with two other actors, namely the radio station and the phone company. For every announcement made, the village reporter pays 750 fCFA per minute to the radio station.

The phone company provides the phone connection to the village reporter and the radio station. The village reporter pays 85 fCFA per minute to the phone company for this service and the radio station pays 16.500 fCFA per month to the phone company.

The Voice web service provider provides the radio station with the ability to retrieve messages from ForobaBlon. The Telephone Line Customer Model is based on the fact that a telephone and internet connection is used to broadcast a message. Contrary toTheKasadaka Customer Model scenario, The Telephone Line Customer Model scenario make use of a standard telephone line existing of 32 lines instead of the Kasadaka. It is possible to process 32 incoming phone calls at the same time. Yelleman can provide this service to more than one

radio station, therefore the radio and the village reporter are both modelled as a segment existing of one or more radio stations and one or more village reporters. An investment between 1.170.000 fCFA and 1.755.000 fCFA is needed to build a 32 telephone line. In E3value these costs are seen as an investment. The radio station pays 10.000 fCFA per month for the use of ForobaBlon to the voice web service provider.

The Hosting fixed phone provider hosts the ForobaBlon voice web service and receives a monthly fee of 234.000 fCFA from the voice web service provider.

In The Telephone Line Customer Model scenario we assume that there is one announcement per month per customer, that the duration of an announcement is one minute and that the village reporter needs one telephone connection for every announcement. In this scenario one Phone company, one Voice web service provider and one Fixed Phone provider are involved. We calculated that for the ForobaBlon provider to be profitable at least 24 radio stations need to use the ForobaBlon voice web service. The break-even point here is between 23 and 24 radio stations. In order for the radio stations to be profitable at least 864 announcements in total per month are needed. This means 36 customers per radio station. The break-even point for this model is between 35 and 36 announcements per radio station. We assume that every radio station has at least one village reporter employed.

Table 10 Prices of services for The Telephone Line Customer Model

Value Object	Value (fCFA) per minute	Value (fCFA) per month	Value (fCFA) investment
Announcement service (customer)	1.000		
Announcement service (reporter)	750		
Phone connection (radio station)		16.500	
Phone call (reporter)	85		
FB voice web service (radio station)		10.000	
Hosting (fixed phone provider)		234.000	
32 telephone line (fixed phone provider)			1.170.000-1.755.000

From a structural point of view the radio station in The Telephone Line Customer Model scenario is able to sustain on the longer run. All six actors receive money value when an announcement is broadcasted. We also assessed the economic sustainability from a quantitative point of view for The Telephone Line Customer Model. Table 11 shows that when 36 announcements are broadcasted, the every radio station will generate a net income of

$27.000 - 16.500 - 10.000 = 500$ fCFA per month. An income for the radio station between 58.950 fCFA and 65.500 fCFA per month is a good income. Table 12 and 13 show that respectively between 114 and 123 announcements per month for every radio station are needed to make enough profit. When 114 announcements are broadcasted every radio station

will generate a net income of $85.500 - 16.500 - 10.000 = 59.000$ fCFA per month. When 123 announcements are broadcasted every radio station will generate a net income of $92.250 - 16.500 - 10.000 = 65.750$ fCFA per month.

Table 11 Profit analysis and sentiment analysis for The Telephone Line Customer Model from the perspective of the radio station

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer	36	1.000	36.000
Phone Company (village reporter)	36	85	-3.060
Village reporter	36	165	-5.940
Phone Company (radio station)	1	16.500	-16.500
Voice web service provider (radio station)	1	10.000	-10.000

Table 12 Profit analysis and sentiment analysis for The Telephone Line Customer Model from the perspective of the radio station

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer	114	1.000	114.000
Phone Company (village reporter)	114	85	-9.690
Village reporter	114	165	-18.810
Phone Company (radio station)	1	16.500	-16.500
Voice web service provider	1	10.000	-10.000

Table 13 Profit analysis and sentiment analysis for The Telephone Line Customer Model from the perspective of the radio station

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer	123	1.000	123.000
Phone Company (village reporter)	123	85	-10.455
Village reporter	123	165	-20.295
Phone Company (radio station)	1	16.500	-16.500
Voice web service provider	1	10.000	-10.000

Contrary to the The Basic Customer Model and The Kasadaka Customer Model in order for the radio stations to be sustainable not only the profitability of the radio stations need to be calculated, but also that of the voice and web service provider. Table 14 shows that if 24 radio stations use the service, the ForobaBlon voice and web service will generate a net income of $240.000 - 234.000 = 6.000$ fCFA.

For the ForobaBlon voice web service provider to be sustainable all the expenditure needs to be earned back plus an extra percentage of 10% to 20%. The ForobaBlon voice web service provider has to pay 234.000 fCFA per month to the hosting fixed phone provider and receives 10.000 fCFA per month per radio station. Between the 10% and 20%, means a profit between the 23.400 fCFA and 46.800 fCFA per month. This means that between the 26 and 29 radio stations need to use the ForobaBlon web voice service in order to achieve this profit.

Table 14 Profit analysis and sentiment analysis for The Telephone Line Customer Model from the perspective of the ForobaBlon voice web service provider

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Voice web service provider (radio station)	24	10.000	+240.000
Fixed phone provider (hosting)	1	234.000	-234.000

Between the 4 and 5 announcements per day are needed in order for the radio stations to make enough profit. This analysis shows that the service of broadcasting announcements from customers in a rural area using a phone connection and internet can be sustained by the radio stations.

4.4 Conclusion

These three different business models, built with e3value for the Foroba Blon voice based web service, show that it is possible to evaluate economic sustainability of an ICT service, before it is deployed.

It also allows to compare different scenarios for the same service. In this case three models were juxtaposed, based on a growth of the number of users, and the technology used. The three scenarios are: (i) paper based, no technology, a small number of users only, due to work load (ii) simple technology for a modest number of users or (iii) a more advanced system), allowing a larger number of users.

The e3value model also allows to calculate the breakeven point for the different models, and to assess the business profitability for each actor, given the parameters. The data (parameters) for these models have been provided by users in Mali.

5. Evaluating two different ICT services for one voice based system

In this chapter we evaluate if the Foroba Blon service, described in chapter 3, can be made profitable for other types business models, in this case these are two radio services for larger, commercial purposes, in which an outside agent — either an information provider or a media concern — wants to disseminate certain information (e.g. advertisements) or obtain local field data, such as village news. One businesses model uses an information push and the other uses an information pull. This chapter also shows that e3value is useful to visualize different cash flows in the network, which demonstrate who are the large and small beneficiaries in the network.

5.1 The Advertisers Model scenario

The fourth scenario for ForobaBlon is represented in The Advertisers Model in figure 3. There are five actors, a customer (NGO, local advertiser etc.), voice web service provider, the radio station, phone company and the hosting provider. Table 15 shows the optional goals of these actors.

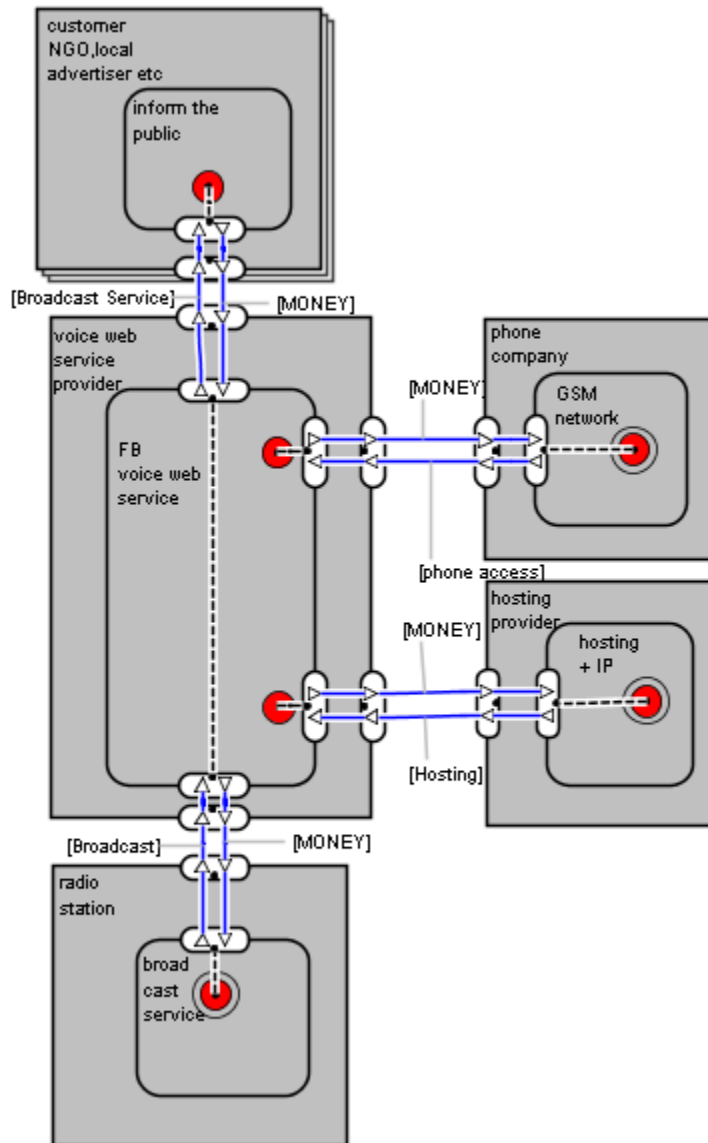


Figure 12: The Advertisers Model

Table 15 Actors and corresponding Optional Goals for The Advertisers Model

Actors	Optional Goals
Customer (NGO, local advertiser etc)	Want to broadcast a message multiple times on the radio to inform the public
Voice web service provider	Provide the customer with the opportunity to leave written or spoken messages online
Radio station	Broadcast announcements
Phone company	Provide phone access and airtime to access the ForobaBlon platform
Hosting provider	Hosting the ForobaBlon platform

The customer in the Advertisers Model scenario is e.g. an NGO, a governmental health service or a large advertiser. The customer has access to the internet and is willing to broadcast a message multiple times on the radio to inform the public about e.g. agriculture, health issues or advertising. To be able to do this the customer uses the Foroba Blon web voice service and pays 1.500 fCFA per minute for the broadcasts to the voice web service provider.

The voice web service provider provides the customer with the opportunity to leave written or spoken messages online. The provider sends a sms or an e-mail to the radio station to inform the radio about the broadcast requests.

The radio station broadcasts the announcements and receives a payment of 1.125 fCFA per minute from the voice web service provider.

The phone company provide phone access and airtime to be able to access the Foroba Blon platform and receives 2000 fCFA per month from the voice web service provider.

The hosting provider hosts the Foroba Blon platform physically and connects to the phone network of Orange, the voice web service provider pays 16.500 fCFA per month to the hosting provider for the hosting. for the phone connection to the phone company.

Table 16 Prices of products and services for The Advertisers Model

Value Object	Value (fCFA) per minute	Value (fCFA) per month
Announcement service (customer)	1.500	
Announcement service (reporter)	1.125	
Phone connection		2.000
Hosting		16.500

In The Advertisers Model scenario we assume that there are 30 announcements per month per customer NGO, the duration of an announcement is one minute and there are five customers (NGO's, Local advertisers) per month. There is one voice web service provider, one radio station, one phone company and one hosting provider involved in this scenario.

From a structural point of view the radio station in The Advertisers Model scenario is able to sustain on the longer run. All five actors receive money value when an announcement is broadcasted. We assessed the economic sustainability from a quantitative point of view for The Advertisers Model. The customer is willing to broadcast a message multiple times on the radio to inform the public about e.g. agriculture, health issues or advertising. Table 17 shows that when there are five customer NGO's and every customer does 30 announcements per month the Foroba Blon web service provider generates a net income of $225.000 - 2.000 - 16.500 - 168.750 = 37.750$ fCFA per month and the radio station 168.750 fCFA per month.

Table 17 Profit analysis and sentiment analysis for The Advertisers Model from the perspective of the Foroba Blon voice web service provider

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer (message)	150	1.500	225.000
Phone Company (Voice web service provider)	1	2.000	-2.000
Hosting provider (Voice web service provider)	1	16.500	-16.500
Radio station (Voice web service provider)	150	1.125	-168.750

In the Advertisers Model the radio station is the one who has to do all the work that involves the editing of the messages. This is the reason why the radio station receives the biggest part of the money that is paid for the messages. The Foroba Blon voice web service provider needs to pay the costs that involve software maintenance. It is unknown how much work needs to be done in order for the service to run stable, but it is certain that it is not much work. For the Foroba Blon voice web service provider a profit above the 0 fCFA per month is enough. We calculated that the break-even point for the Foroba Blon voice web service provider lies between the 45 and 50 messages per month for the 5 customers. Table 18 shows that with 50 messages per month per 5 customers the Foroba Blon voice web service provider will generate a net income of $75.000 - 2.000 - 16.500 - 56.250 = 250$ fCFA per month. As indicated earlier, this is enough profit for the Foroba Blon provider. On the other hand the radio station needs to generate an income between 58.950 fCFA and 65.500 fCFA per month. This means that the 5 customers should post a total of 53 to 60 messages per month.

Table 18 Profit analysis and sentiment analysis of The Advertisers Model from the perspective of the Foroba Blon voice web service provider

Actor	Occurrences	Valuation (fCFA)	Total (fCFA)
Customer (message)	50	1.500	75.000
Phone Company (Voice web service provider)	1	2.000	-2.000
Hosting provider (Voice web service provider)	1	16.500	-16.500
Radio station (Voice web service provider)	50	1.125	-56.250

We can say that from a quantitative point of view, the service of broadcasting messages from customers (NGO, local advertiser etc.) using a phone connection and internet can be sustained by the radio station as well as the Foroba Blon voice web service provider.

5.2 The Big Media Concern Model scenario

The fifth scenario for Foroba Blon is represented in The Big Media Concern Model in figure 5. There are six actors, a news provider (BBC, Al Jazeera, CNN, and other radio stations), the voice web service provider, the hosting provider, the radio station, village reporter and the phone company. Table 19 shows the optional goals of these actors.

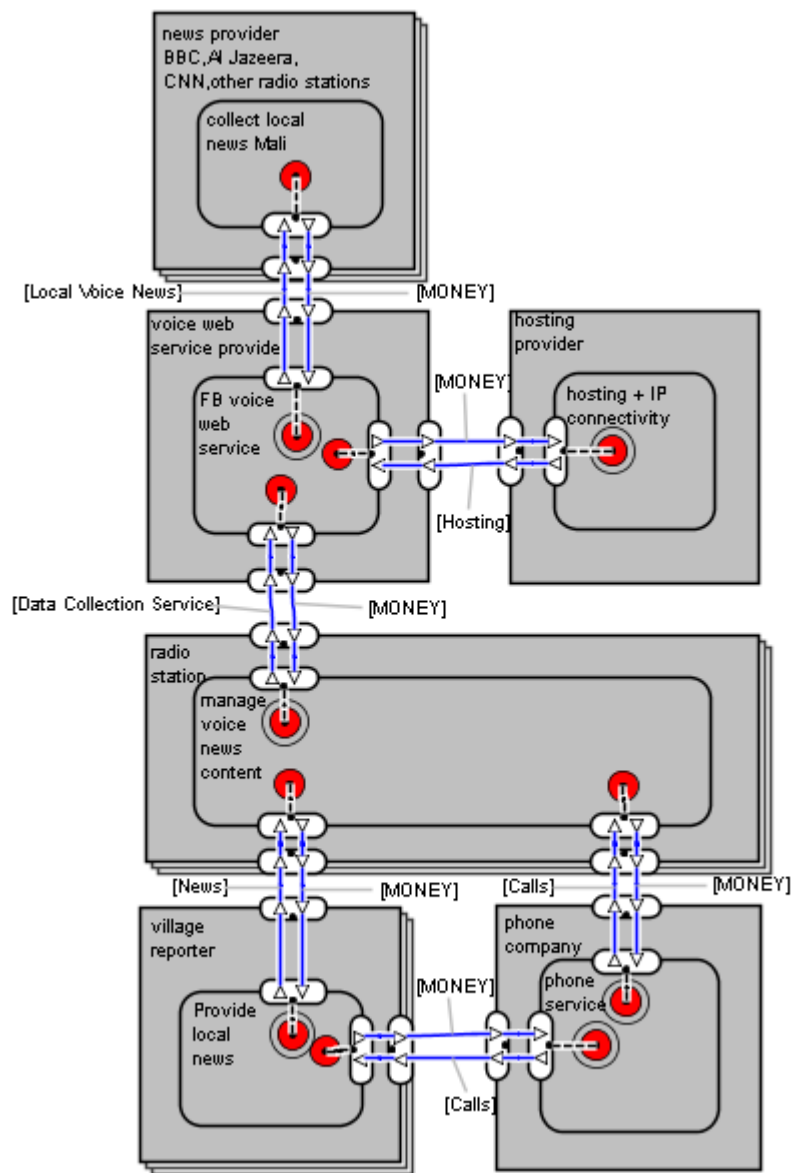


Figure 13: The Big Media Concern Model

Table 19 Actors and corresponding Optional Goals for The Big Media Concern Model

Actors	Optional Goals
News provider (BBC, Al Jazeera, CNN, and other radio stations)	Access the local news that is saved online
Voice web service provider	Provide Local Voice News
Hosting provider	Hosting the Foroba Blon platform physically
Radio station	Filter and enrich spoken news reports with metadata
Village reporter	Leave spoken news reports on the Foroba Blon platform
Phone company	Provide phone access

The customer in The Big Media Concern Model scenario is a large media concern such as BBC, Al Jazeera, CNN or other radio stations and has the need to access local news that is saved online. Contrary to the previous scenario's, this model shows an information pull. The customer can access local news online via a web interface on the Foroba Blon voice web service and pays 3.275.000 fCFA per month. This amount of money is reasonable because it involves large media concerns.

The voice web service provider offers the Foroba Blon voice web service, that contains local voice news. In the past, this service has been used by Al Jazeera in Ghana and Kenya to monitor the presidential elections. Foroba Blon becomes interesting due to the political situation in Mali. Village reporters are able to report on local news.

Hosting provider hosts the Foroba Blon platform physically and connects to the phone network of Orange. Because we are dealing with a big media concern, professional hosting is required. The voice web service provider pays 1.310.000 fCFA per month to the hosting provider.

Radio station uses the Foroba Blon voice web service to filter and to enrich these spoken news reports with metadata. For this data collection service the radio station receives 327.500 fCFA per month from the voice web service provider.

Village reporter is under contract of the radio station and can leave spoken news reports on the Foroba Blon voice web service and receives 1.125 fCFA for the news that he leaves on the Foroba Blon voice web service. The radio station have a couple of village reporters under contract.

Phone company provide the village reporters and the radio stations with phone access. The radio station needs unlimited internet access and pays the phone company 196.500 fCFA per month. The village reporter pays 85 fCFA per message.

Table 20 Prices of products and services for The Big Media Concern Model

Value Object	Value (fCFA) per minute	Value (fCFA) per month
Local voice news (customer)		3.275.000
Data collection service (voice web service provider)		327.500
News (radio station)	1.125	
Calls (village reporter)	85	
Calls (radio station)		196.500
Hosting (voice web service provider)		1.310.000

In The Big Media Concern Model scenario we assume that the Foroba Blon web service will be used by at least one large media concern, there are three radio stations who deliver the news and every radio station has three village reporters employed. There is one Voice web service provider, one hosting provider and one Phone company. The large media concern can retrieve local voice news, unlimited.

From a structural point of view The Big Media Concern Model show that the radio is able to sustain on the longer run. All six actors receive money value. We also assessed economic sustainability from a quantitative point of view for this scenario. We did the profit analysis and the sentiment analysis from the perspective of the web voice service provider, the radio station and the village reporter. Table 21 show that the customer requests local voice news via a web interface on the Foroba Blon voice web service and pays 3.275.000 fCFA per month for this service. The voice web service provider pays 1.310.000 fCFA for the hosting to the hosting provider and 1.304.760 fCFA per month to the radio stations for the data collection service. Generating a net income of $3.275.000 - 1.310.000 - 1.304.760 = 660.240$ fCFA per month for the voice web service provider.

Table 21 Profit analysis and sentiment analysis for The Big Media Concern Model from the perspective of the voice web service provider

Actor	Occurrences per month	Valuation (fCFA)	Total (fCFA)
Local voice news (customer)	1	3.275.000	+ 3.275.000
Hosting (voice web service provider)	1	1.310.000	-1.310.000
Data collection service (voice web service provider)	3	434.920	-1.304.760

Table 22 Profit analysis and sentiment analysis for The Big Media Concern Model from the perspective of the radio station

Actor	Occurrences per month	Valuation (fCFA)	Total (fCFA)
Data collection service (voice web service provider)	1	434.920	+ 434.920
Calls (phone company)	1	196.500	-196.500
News (village reporter)	90	1.125	-101.250

Table 22 shows that the radio station receives 434.920 fCFA for the data collection service from the voice web service provider and pays the village reporters 1.125 fCFA per news item. There are 90 news items per month; this makes a total of 101.250 fCFA per month. Also an amount of 196.500 fCFA per month is paid to the phone company by the radio station. Generating a net income of $434.920 - 101.250 - 196.500 = 137.170$ fCFA for the radio station.

Table 23 Profit analysis and sentiment analysis for The Big Media Concern from the perspective of the village reporter

Actor	Occurrences per month	Valuation (fCFA)	Total (fCFA)
-------	-----------------------	------------------	--------------

News (radio station)	30	1.125	+ 33.750
Calls (phone company)	30	85	-2.550

Table 23 shows that the village reporter receives 1.125 fCFA per news item from the radio station. There are 30 news items per month, making a total of 33.750 fCFA per month. For every call that is needed for a news item the village reporter pays an amount of 85 fCFA to the phone company. This makes a total of 2.550 fCFA per month. Generating a net income of $33.750 - 2.550 = 31.200$ fCFA per month for the village reporter.

From a quantitative point of view, this analysis shows that the service of retrieving voice news items by a large media concern via the Foroba Blon voice web service interface can be sustained by all three actors (the voice web service provider, the radio stations and the village reporters). However the question that needs to be asked is whether this model is ethical. A large amount of money is spent by a large media concern, but the radio stations and the village reporters will not experience a tremendous growth of their income. A large quantity will go to the biggest parties, namely the Foroba Blon voice web service provider, the phone company and the hosting provider. In addition to this, one can choose to do the hosting abroad, this will benefit the locals even less. Furthermore a lot of personal data is used in this model and the question is whether people that are involved are aware of this. Do they know which personal and non-personal data is transmitted, and what is further done with this data? Do these people not unnecessarily put themselves at risk for so little money because they transmit certain information?

6. Discussion and conclusion

6.1 Discussion

The cases presented in this thesis have shown that it is possible to make scenarios with e3value and evaluate sustainability and business profitability, even before deployment of an innovative ICT service.

However, some remarks should be made especially regarding The Big Media Concern business model. This model shows that all three actors (the voice web service provider, the radio stations and the village reporters) receive economic value, but the big question is whether this type of business is really providing economic opportunities for local partners. The large media concerns can invest heavily in gaining local news, but the radio stations and the village reporters will experience only a slight growth of their income.

Especially the biggest parties, i.e. the phone company and the hosting provider benefit from these services, much more than the local people.

In the case that the systems scale up rapidly, and professional web hosting is required to keep the service up and running, the financial benefit for the local actors is even less.

Other concerns that exist and questions that should be asked are whether people are aware of the use of their personal and non-personal data by large media concerns? What happens with their data? Don't these people put themselves unnecessary at risk for so little money because they pass certain information? In various African countries, legislation is still under-developed to protect the privacy and personal data rights of citizens. This is therefore a point of concern for further research.

6.2 Further Research

One of the observations made during this study, is that it would be useful to explore the possibilities of payment via a mobile money transfer service. This would further facilitate the deployment of commercial ICT services (such as Foroba Blon) in rural Africa.

With regards to local deployment, cost reduction and technical sustainability, research could be done regarding the possible use of a local voice platform, that does not need to be hosted in a data centre, but allow a larger number of users than the actual Kasadaka platform, since field pilots have shown that it becomes a problem when the Kasadaka receives more than 10 calls per minute.

Finally, research should be done to explore further possibilities of deploying ICT services in rural regions, since the first assessments give promising results.

6.3 Conclusion

This research, focused on the economic sustainability of web services for the rural poor in Africa, has shown that web services can be sustainable and that e3value has proven to be useful. The e3value methodology is validated for a low tech, low resource environment in rural Mali. Five presented business models show that a web services can become feasible and sustainable in rural areas in Africa, even given the special context of poor infrastructure, low literacy and low incomes. In addition, it has shown the usefulness and appropriateness of using the e3value methodology to evaluate sustainability of potential web services even before deployment.

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Appendix :

Questionnaires concerning a mobile money transfer service for ForobaBlon. This questionnaire will help gather information about the use of ForobaBlon. Your opinion is very important. Thanks for answering the questions.

DEMOGRAPHIC

1. What is your gender?

☐ Male

☐ Female

2. What is your age?

Age.....

3. What is your marital status?

☐ Single
Widow/Widower

☐ Married

☐ Divorced

☐

4. What is your highest education level?

☐ None

☐ Primary

☐ Secondary

☐ Tertiary

☐ Informal

5. What is your ethnicity?

Ethnicity.....
.....

6. Which language(s) do you speak?

Language(s)
spoken.....

CLIENTS

7. What percentage of your clients is male and what percentage is female?

.....% male

.....% female

8. Can you indicate what percentage of clients are in the different age categories?

younger than 20 years.....%

20-30 years.....%

31-40 years.....%

41-50 years.....%

51-60 years.....%

61-70 years.....%

71-80.....%

81-older.....%

9. Can you indicate per marital status what percentage of your clients belongs to each status?

Single.....%

Married.....%

Divorced.....%

Widow/Widower.....%

10. Can you indicate per education level what percentage of your clients belongs to each level?

None.....%

Primary.....%

Secondary.....%

Tertiary.....%

Informal.....%

11. What kind of ethnicity do your clients belong to? Can you give the percentage clients per ethnicity?

--

12. Which language(s) do your clients speak? Can you give the percentage clients per language?

--

13. What kind of jobs do your clients have? Can you give the percentage clients per job?

--

14. How many clients do you have on average per day/week/month?

Clients per day..... Clients per week..... Clients per month.....

15. Is the number of clients currently profitable for you? If no, what do you think can make it profitable?

☐ Yes ☐ No

16. How long does it take on average before you receive money from your clients?

☐ Immediately ☐ After.....days ☐ After.....months ☐ Else.....

17. Please categorize the type of messages that your clients want to be broadcasted via Radio Sikidolo? For example wedding announcements etcetera.

Category.....
Category.....
Category.....
Category.....
Category.....
Category.....
Category.....
Category.....
Category.....
Category.....

Category.....

18. Do you have regular clients? If so, what do they want to be broadcasted on the radio?

☐ Yes

☐ No

19. Do you encounter any problems getting clients? If so, what kind of problems do you encounter?

☐ Yes

☐ No

20. What do you think should happen to prevent or solve these kind of problems?

21. From which villages do your clients come? Can you give the percentage clients per village?

22. What percentage of your clients has a mobile phone?

.....%

23. What percentage of your clients uses his/her phone to make a call?

.....%

24. What percentage of clients uses his/her phone to send or receive a SMS?

.....%

25. How are payments done currently between the clients and you?

26. Which bottlenecks are there currently when it comes to receiving payments from your clients?

27. How many of your clients are familiar with any mobile money transfer service?

If so, which one do they use and for what purpose? Which bottlenecks do they experience by using this mobile money transfer service?

☐ Yes

☐ No

28. If it could be possible to use a mobile money transfer service to make payments to you, how many of your clients would use this service?

☐ Yes

☐ No

ICT AS A SOLUTION

29. Do you have a mobile phone?

☐ Yes

☐ No

30. What type of phone do you have?

Type of
phone.....

31. How often do you use your phone to make a call?

☐ Never

☐ Seldom

☐ Regularly

☐ Frequently

32. Do you use your phone to send a SMS?

☐ Never

☐ Seldom

☐ Regularly

☐ Frequently

**33. How are payments done currently between you and radio
Sikidolo?**

**34. Which bottlenecks are there currently when it comes to doing
payments to radio Sikidolo?**

35. Are you familiar with any mobile money transfer service? If so, which one do you use and for what purpose? Which bottlenecks do you experience by using this mobile money transfer service?

☐ Yes

☐ No

36. If it could be possible to use a mobile money transfer service to make payments to radio station Sikidolo, would you want to use it? Explain yourself.

☐ Yes

☐ No

Questionnaire

Ce questionnaire permettra de recueillir des informations sur l'utilisation de ForobaBlon. Votre opinion est très importante. Merci pour répondre aux questions.

DÉMOGRAPHIQUE

1. Quel est votre sexe ?

☐ Homme

☐ Femme

2. Quel est votre âge ?

Âge.....

3. Quel est votre état civil ?

☐ célibataire

☐ Marié

☐ Divorcé

☐ Veuve / Veuf

4. Quel est votre niveau de scolarité le plus élevé ?

☐ Aucune

☐ primaire

☐ secondaire

☐ tertiaire

☐ informel

5. Quelle est votre origine ethnique ?

Ethnicité.....

6. Quelle langue (s) parlez-vous?

Langue (s).....

CLIENTS

7. Quel pourcentage de vos clients est un homme et quel est le pourcentage des femmes?

.....% D'hommes

.....% de femmes

8. Pouvez-vous indiquer quel est le pourcentage de clients sont dans les différentes catégories d'âge?

moins de 20 ans%

20-30 ans%

31-40 ans%

41-50 ans%

51-60 ans %

61-70 ans%

71-80 ans%

81 ans plus%

9. Pouvez-vous indiquer par statut marital quel pourcentage de vos clients appartiennent à chaque statut?

Simple%

Marié.....%

Divorcé%

Veuve / Veuf%

10. Pouvez-vous indiquer par niveau d'enseignement quel pourcentage de vos clients appartiennent à chaque niveau?

Aucun% primaire.....% secondaire.....% Tertiaire% informel
.....%

11. Quel genre de l'ethnicité ne vos clients appartiennent? Pouvez-vous donner les clients de pourcentage par appartenance ethnique?

--

12. Quelle langue (s) ne vos clients parlent? Pouvez-vous donner les clients de pourcentage par langue?

--

13. Quel genre d'emplois que vos clients ont-ils? Pouvez-vous donner les clients de pourcentage par emploi?

--

14. Combien de clients avez-vous en moyenne par jour / semaine / mois ?

Clients par jour Clients par semaine Clients par mois

15. Est le nombre de clients actuellement rentable pour vous? Si non, qu'est-ce que vous pensez peut le rendre rentable?

☐ Oui

☐ Non

16. Combien de temps faut-il en moyenne avant de recevoir l'argent de vos clients ?

☐ Immédiatement ☐ après jours ☐ Aprèsmois ☐ Autres

17. S'il vous plaît catégoriser le type de messages que vos clients veulent être diffusé via Radio Sikidolo?Pour exemple les annonces de mariage etc.

Catégorie
Catégorie
Catégorie
Catégorie
Catégorie
Catégorie
Catégorie
Catégorie
Catégorie
Catégorie

18. Avez-vous des clients réguliers ? Si oui, qu'est-ce qu'ils veulent être diffusé à la radio?

☐ Oui

☐ Non

19. Avez-vous rencontré des problèmes pour les clients ? Si oui, quel genre de problèmes rencontrez-vous?

☐ Oui

☐ Non

20. Que pensez-vous devrait arriver à prévenir ou à résoudre ce genre de problèmes?

21. De quels villages vos clients viennent? Pouvez-vous donner les clients de pourcentage par village?

22. Quel pourcentage de vos clients a un téléphone mobile?

.....%

23. Quel pourcentage de vos clients utilise son / son téléphone pour faire un appel?

.....%

24. Quel est le pourcentage de clients utilise son / son téléphone pour envoyer ou recevoir un SMS?

.....%

25. Comment les paiements sont effectués actuellement entre les clients et vous?

26. Quels sont les goulots d'étranglement, il a quand il s'agit de recevoir des paiements de vos clients?

27. Combien de vos clients sont familiers avec les services de transfert d'argent mobile? Si oui, lequel utilisent-ils et dans quel but? Goulets d'étranglement qui ils l'expérience de l'aide de ce service de transfert d'argent mobile?

☐ Oui

☐ Non

28. Si il pourrait être possible d'utiliser un service de transfert d'argent mobile pour effectuer des paiements à vous, combien de vos clients utiliseraient ce service?

☐ Oui

☐ Non

TECHNOLOGIE DE L'INFORMATION COMME UN SOLUTION

29. Avez-vous un téléphone mobile?

☐ Oui

☐ Non

30. Quel type de téléphone que vous avez?

Type de téléphone.....

31. Combien de fois utilisez-vous votre téléphone pour faire un appel?

☐ Jamais

☐ Rarement

☐ régulièrement

☐ Souvent

32. Utilisez-vous votre téléphone pour envoyer un SMS?

☐ Jamais

☐ Rarement

☐ régulièrement

☐ Souvent

33. Comment les paiements sont effectués actuellement entre vous et la radio Sikidolo?

34. Quels sont les goulots d'étranglement, il a quand il s'agit de faire des paiements à la radio Sikidolo?

35. Connaissez-vous un service de transfert d'argent mobile? Si oui, lequel utilisez-vous et dans quel but? Goulets d'étranglement qui vous rencontrez en utilisant ce service de transfert d'argent mobile ne?

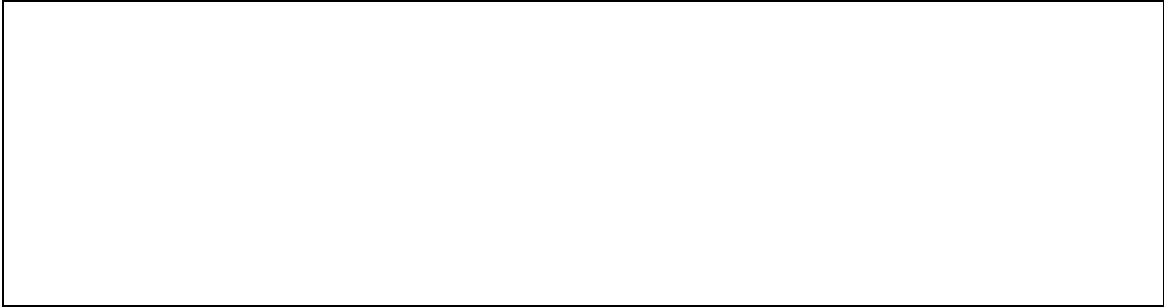
☐ Oui

☐ Non

36. Si il pourrait être possible d'utiliser un service de transfert d'argent mobile pour effectuer des paiements à la station de radio Sikidolo, voudriez-vous l'utiliser? Expliquez votre auto.

☐ Oui

☐ Non



Unstructured Questionnaire

The following questions came up when looking at the three existing business models.

Questions answered by AdamaTissougué Radio journalist Radio Sikido at Konobougou, 9 th of May 2016

Questions concerning the first business model for ForobaBlon. This is a networked business constellation of radio, village reporter, Phone Company (telco) and the ForobaBlon provider offering a messaging broadcast service to internet-less villagers.

1. Does one minute of broadcasting a message on the radio by the customer (in rural community) still cost 1000 fCFA? If this is not the case, how much does this cost now?

Oui 1000 fCFA

2. Does a phone call that enables a customer to have access to the ForobaBlon platform via mobile phone, still cost 100 fCFA per minute? If this is not the case, how much does this cost now?

85 fCFA per minute

3. How many village reporters are actually active for the radio station and how many customers does a village reporter serve on average on a monthly basis?

There are 85 village reporters working for Radio Sikidolo; one reporter per village.

4. Does a village reporter pay 800 fCFA per message to the radio station? If not, how much does he actually pay?

The village reporter earns 250 cfa and pays 750 to the radio per call/announcement.

5. Does a radio station pay 10.000 cFA per month for the use of the ForobaBlon web service? If not, how much does the radio station pay?

Nvt; this is not working currently.

6. How much is mobile internet per minute and how long/often do you browse with dongle/mobile?

16.500 CFA per month internet mobile total price.

7. Does an Orange Key of 13.500 CFA still buys you 2 GB/month download? If this is not the case, how much does 2 GB/month download cost?

8. How much does a hosting provider ask for hosting a web service in Mali?

nvt

Questions concerning the second business model for ForobaBlon. This is a networked business constellation of radio, village reporter, telco and ForobaBlon provider. A business company or an NGO want to pay for multiple broadcasts of one message.

9. How many customer NGO, local advertiser etc. are monthly expected to use the ForobaBlon web service and how many announcements are they on average expected to make?

1500 fCFA par minute pour une annoubecommerciale (50% plus)

10. Does it still cost a customer (NGO, local advertiser etc.) 60.000 fCFA per time to access the ForobaBlon website? If this is not the case, how much does this cost now?

Nvt internet costs fixed

Questions concerning the third business model for ForobaBlon. The customer here is a large media concern such as Al Jazeera.

11. Does a media company still has to pay a fee of 1000 fCFA per news message to the ForobaBlon provider? If this is not the case, how much does this cost now?

12. Does the ForobaBlon provider still has to pay toll fee of 100 fCFA per call to the phone company? If this is not the case, how much does this cost now?

Telephone 85 fcfapar minute

13. How much money per message does the village reporter receive from the radio station?

250 FCFA

14. How much money is being paid for the hosting of ForobaBlon in the case of a large media concern?

Nvt