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DESIGN FRAMEWORK FOR SUSTAINABLE MOBILE SERVICES IN DEVELOPING COUNTRIES

Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Technology

Espoo, January 4, 2010

Abstract of the Master's Thesis

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Name of the Thesis: Design Framework for Sustainable Mobile Services in Developing Countries
Date: 04.01.2010   **Number of Pages:** 10 + 91

Department: Department of Communications and Networking
Professorship: S-38 Networking Technology

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Mobile phones are reaching also the poor in the developing countries. This provides opportunities to improve their lives trough better communication in situations where rapid action and citizen participation are essential, such as in health and crisis management. This thesis concentrates on mobile services that can be used to address these needs. The main attention is on the fundamental requirements needed for services to be sustainable over time. A new design framework is constructed for helping both local and international communities' to address these issues.

The design framework is based on a literature review and case studies. The literature review includes analyses of the recent modeling and framework activities in the area. Moreover, other relevant topics in mobile services, such as diffusion, usage, and finance are covered. The analysis uses a qualitative approach. The thesis includes two projects as case studies. In these mobile services are being developed for rural areas of Kenya and Liberia. The projects are currently in their initial testing phases aiming at starting pilots during the first half of the year 2010. The case study data has been gathered by using semi-structured theme interviews and grounded theory approach has been used to analyze the data.

The design framework is built on four key findings. First, it is important to get users involved into the service creation processes, because of the knowledge they possess about themselves and their living environments. Second, a trusted third party is needed to share the resources between the users and the professionals. This is important, as the lack of resources or knowledge can hinder the service development for the both parties. Third, local involvement from the start is important in service creation processes for services to reach sustainability. This could help the knowledge base to grow in the locals regions and eventually give more opportunities for the poor. Finally, a flexible service platform instead of specific service would make the service development faster and more efficient, providing more opportunities for the local actors to develop services for their real needs.

Keywords: Mobile services, Developing countries, Emerging markets, Mobile technology, mHealth, M4D, ICT4D, Base of the Pyramid (BoP)

Diplomityön tiivistelmä

Tekijä: Tuulia Virhiä
Työn nimi: Suunnittelukehys kestäville mobiilipalveluille kehittyvissä maissa
Päivämäärä: 04.01.2010   **Sivumäärä:** 10 + 91

Laitos: Tietoliikenne- ja tietoverkkotekniikan laitos
Professuuri: S-38 Tietoverkkotekniikka

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Matkapuhelimet ovat saavuttamassa kehittyvissä maissa elävät ihmiset. Tämä tarjoaa parantuneen kommunikaation avulla mahdollisuuksia parantaa köyhien elintasoa tilanteissa, jotka vaativat nopeaa toimintaa ja eri osapuolien osallistumista. Esimerkkejä ovat esimerkiksi terveyden editäminen ja kriisien hallinta. Tämä työ painottuu nk. hyötypalveluihin, joista edellä luvatut ovat esimerkkejä. Erityisesti tarkastellaan sitä, kuinka voidaan luoda palveluita, jotka ovat elinkelpoisia. Työssä luodaan suunnittelukehys, jonka tarkoituksena on auttaa sekä paikallisia että kansainvälisiä yhteisöjä tämänkaltaisten palveluiden toteuttamisessa.

Suunnitelukehys perustuu kirjallisuuskatsaukseen ja tapaustutkimuksiin. Kirjallisuuskatsauksessa tarkastellaan aiempaa tutkimusta kehittyvien maiden palvelujen mallinnuksesta ja vastaavista suunnitelukehyksistä. Lisäksi tarkastellaan muita olennaisia tekijöitä kuten mobiiliteknologian ja palvelujen levinneisyys, käyttö ja rahoitus. Analyysit toteutetaan laadullisilla menetelmillä. Tapaustutkimukset sisältävät kaksi mobiilipalveluprojektia, jotka toteutetaan Kenian ja Liberian maaseuduilla. Projektien pilotointi alkaa vuoden 2010 aikana. Tapaustutkimusdata kerätään puoli-strukturoiduissa teemahaastatteluissa ja käsitellään nk. grounded systems teorian mukaisesti.

Suunnitelukehys rakentuu neljän avainasian ympärille. Ensimmäinen on loppukäyttäjien osallistaminen palveluiden toteuttamisessa. Tällä tavoin on mahdollista saada käyttöön palvelujen kannalta tärkeää henkilökohtaista ja elinympäristöjä koskevaa tietoa. Toinen on luotetun kolmannen osapuolen asema käyttäjien ja ammattilaisten välissä. Luotettu kolmas osapuoli pyrkii mahdollistamaan tiedon jakamisen ja ammattilaisten resurssien käytön. Kolmas on paikallisten toimijoiden aktiivinen osallistaminen, jotta tieto ja osaaminen pysyvät paikallisilla alueilla. Neljäs on notkea palvelujen alusta-ajattelu yksittäisten palvelujen sijaan. Tämä voisi mahdollistaa palvelujen nopean ja tehokkaan toteutuksen oikeille tarpeille paikallisten toimijoiden toimesta.

Avainsanat: Mobiilipalvelu, Kehittyvät maat, Kehittyvät markkinat, Mobiiliteknologia

Preface

I would like to express my gratitude for the people who have supported me during this thesis. First, thank you Professor Matti Hämäläinen and Professor Heikki Hämmäinen for the opportunity to write this thesis and for the extremely important conversations during the project. I would also like to thank all of my colleagues and fellow workers for the helpful conversations, tips, and comments along the way. In particular, Timo Itälä and Gama Roberts have provided many insights in the development of the framework and for the Liberia case specifically. Pertti Lounamaa and Mika Välitalo have provided relevant information and advice for the Kenya case and for mobile services in developing regions.

For the rest of my studies, my friends and fellow students have made it much more encouraging and inspiring to learn and successfully accomplish all the courses along the way. Thank you for that. Special thanks to Liinu for my Tampere years and Anna and Henna for all the rest.

My family has earned their part of the thanks too. Special thanks to my parents Riitta and Jouni for encouraging me in everything I do in my life. Thank you also for my siblings and their families.

Last but not least, thank you Elisa and our two beautiful children, Stella and Daniel, for your support, help, and understanding during this journey of my studies. You are the inspiration of my life!

Espoo, January 4, 2010

Tuulia K. Virhiä

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Abbreviations

ADM	Architecture Development Method
AIDS	Acquired Immune Deficiency Syndrome
BoP	Base (Bottom) of the Pyramid
CCA	Citizen Centric Architecture
CMI	Crisis Management Initiative
EA	Enterprise Architecture
FEA	the Federal Enterprise Architecture
GIS	Geographic Information System
GNI	Gross National Income
GOe	Global Observatory for eHealth
GooB$^{©}$	Governance out of a Box$^{©}$
GPS	Global Positioning System
GSM	Groupe Spécial Mobile/Global System for Mobile Communications
HIV	the Human Immunodeficiency Virus
ICT	Information and Communications Technology
ICT4D	Information and Communications Technology for Development
ITU	International Telecommunication Union
M4D	Mobile for Development
mGesa	Mobile Geoservices in Africa
mHealth	Mobile Health
MMS	Multimedia Messaging Service
NGO	Nongovernmental Organization

POI	Point of Interest
SMS	Short Message Service
SSA	Sub-Saharan Africa
TOGAF	the Open Group Architecture Framework
USB	Universal Serial Bus
USSD	Unstructured Supplementary Services Data
WAP	Wireless Application Protocol
WHO	World Health Organization

1 Introduction

1.1 Motivation

Use of mobile phones in the developing world has grown fast during the ongoing decade (ITU, 2009). As penetration per cents are growing, mobile users have better access to communication services and information. This has produced opportunities to create new mobile services that can have great impact on people living in the developing areas. The services include such as health, education, human rights, crisis management, disaster monitoring, and trading services. This thesis is concentrating on health and crisis management services, but the results aim at benefiting other service areas as well. Health and crisis management have been selected as the example areas as they are particularly good candidates to demonstrate the potential of mobile technologies and services. Managing a health issue or a disaster situation requires rapid action, fast communication, and citizen participation that can be supported by mobile services.

Generally, research around mobile service field in the developing countries is growing but studies tend to appear in isolation from each other, in the means of region or discipline (Donner, 2008). The same phenomena can be seen in the service development field. Many new mobile services are developed by the international communities' for the specific service field or region and characteristics are different in various service implementations. This can affect services' ability to be developed further resulting to lack of sustainability. In addition, many services are developed without user contribution leaving end users out of the service creation processes. One challenge is in integrating those resources that professionals are offering with the information and other resources the users can provide. Integration could intensify the use of resources, as professionals could receive information about the real needs and the users' the ability to contribute. This could speed up the service creation processes and make the services better fit the local situation.

Other important aspects in the sustainable mobile services are the involvement of stakeholders and funding. Stakeholders include companies; governments; nongovernmental organizations (NGOs); universities; research institutes; equipment vendors; network operators; and end users. To make the services sustainable, it is extremely important to

analyze these stakeholders, as they are the key for services to succeed and fulfill the expectations for the all parties.

These above mentioned issues form the basis for this thesis. The aim is to develop a new design framework that would include elements for stakeholder analyses, architecture of the service design, and ideas for service platforms. Platform based approach means that the platform provides the "logic" for service development. Thus, services can be built faster and easier using already developed service platforms and service instances. The sustainability is defined as "services ability to sustain and be developed over time", creating more opportunities for the local people and other stakeholders. Furthermore, the sustainability issue is considered trough the stakeholders in a way that service development could be performed in a specific location by local entrepreneurs and mobile users where the service needs are better known. This approach benefits the local stakeholders and citizens in the region examined, as the money flows and learning stays in the local area. The target groups for this thesis are local and international communities that are planning to create mobile services for the poor in the developing regions and academics who wish to continue studies in this interesting field of mobile services in the developing countries.

1.2   Research Questions and Objectives

In an article "Are Cell Phones Leading the mHealth Revolution?" by Nellie Bristol, mobile health issues are addressed in following way:

"While enthusiasm is high for the new devices, there are challenges. Among those are financing constraints, lack of connectivity among various systems and devices, and securing local buy-in. Another issue listed as a major barrier by WHO's Global Observatory for eHealth (GOe): lack of language variability. GOe's 2006 study found multi-lingualism and cultural diversity to be "the least developed area of any examined." It adds: "It appears that these issues which directly impact citizen access to information are not high on the current agenda of many governments."

Building scale also is a problem. Warren Kaplan of the Boston University Center for International Health & Development, in a review of mobile health technologies in 2007, found there are a number of pilot projects that involve less than 40 people. "There's a million of these," he said. "The question is can you create a business model and can you adequately scale this stuff up so that it works."" (Bristol, 2009)

The article identifies most of the issues this thesis is trying to answer. These are the financial issues, issues in integration of the services, the local involvement, the cultural challenges, and the scalability. In addition, the role of user involvement in the service creation is examined. This can be one approach to overcome the challenge of cultural diversity. These are all components of the sustainability that need to be considered in order to make the services to last over time and develop. To address these problems, a new design framework is proposed including analysis of stakeholders, user centric approach, and "platform thinking", which means that services could be built using existing services or service instances. The above mentioned issues lead to the following main question and three sub questions:

- What sort of design framework would be useful for sustainable mobile services in the developing countries?

   - Who are the stakeholders that are needed in the service creation to assure sustainable mobile service in the local regions?

   - How to integrate citizen centric view and enterprise view to produce sustainable mobile services in the developing countries?

   - What are the key requirements that need to be considered when modeling basic mobile services in the developing countries?

The justifications for choosing these study questions are described below. First, there is a need for a framework that tries to combine bottom-up and top-down service development views in sustainable manner in the developing countries. Allowing end users to participate in service creation can bring more opportunities for the poor and can provide value for the whole mobile industry in the developing countries. Second, stakeholders need to be examined, as it is important to identify the stakeholders that are in key roles to make services sustainable. Finally, requirements for sustainable mobile services need to be examined, as they constitute a basis for the overall service creation processes. For the implementation, a "platform thinking" approach is studied, where services can be developed easily using already developed solutions and adapting them to meet the needs.

The key objectives of this thesis are to propose a design framework to help in mobile service creation in the developing countries and to illustrate the most important components of the design framework in a clear and simple manner. Emphasis is on sustainable solutions that can be applied across the developing world, to each case separately and maintain

dynamic nature in the fast changing technological world. In addition, current status in this field is studied focusing on issues that can have an impact on development of mobile service business in the target regions.

1.3   Scope of the Study

The scope of the research is limited to mobile phone services in the developing countries where the primary or the only network connection is via mobile phone. Developing countries and regions are chosen among the so called Base of the Pyramid (BoP), the BRIC-countries, and the Sub-Saharan Africa (SSA). The BoP includes 4 billion poorest citizens of the world living with less than $ 1,500 per capita income (Simanis et al., 2008; Prahalad and Hart, 2002). The BRIC-countries include Brazil, Russia, India, and China. The Sub-Saharan Africa consists of countries solely or partly south of the Sahara. Countries that do not fall into these categories are left outside the modeling process. Mobile phones include all phones which utilize mobile networks and provide two-way communication possibility with basic bearer services. The issues are specifically studied in the context of mobile health and crisis management services, but can be utilized in other service areas as well. Some of the studies included in the literature review contain also studies beyond the above mentioned scope, as research in this area is still very limited. These studies are used to extend the viewpoints of the thesis still keeping in mind the issues that are common in the target countries and service fields.

1.4   Methodology of the Study

Methodology of the thesis is divided in two parts: Analysis of background information and case studies. Methodology for analysis of background information is mainly literature review. Case studies include two projects from the field of mobile services in the developing countries. Case study data is gathered via semi-structured interviews and in meetings. The Data is analyzed following the grounded systems theory approach. The analysis is done in a qualitative manner. The methodology is explained in chapter 2 in more detail.

1.5   Structure of the Report

The thesis is divided into five parts. First part includes introduction and methodology chapters. Methodologies for analyses of background information and case study related parts are presented separately. Second part analyzes the background that is relevant for the goals this thesis tries to achieve. It includes chapters three and four. Chapter three introduces some of the existing modeling and frameworks. This chapter is divided into analysis and summary sections. Chapter four introduces the elements of sustainable mobile services. These elements include architectures, features affecting mobile phone use, and service categories sections. It is not enough just to analyze the existing modeling and framework studies or the elements of sustainable mobile services but we need both when developing the new framework.

Part three and chapter five introduces case studies. Case studies are based on materials, interviews, and meeting. Each case study is analyzed separately. Fourth part focuses on modeling and validating the framework. Part includes chapters six and seven. Chapter six is concentrating on modeling the new design framework for mobile services to reach sustainability in the developing countries. Chapter includes sections stakeholder analyses, architecture of service design, and platform approach. Chapter seven validates the thesis. Validation includes framework validation as well as validation on the background material. Part five and chapter eight concludes the thesis. Structure of the thesis is presented in Figure 1.
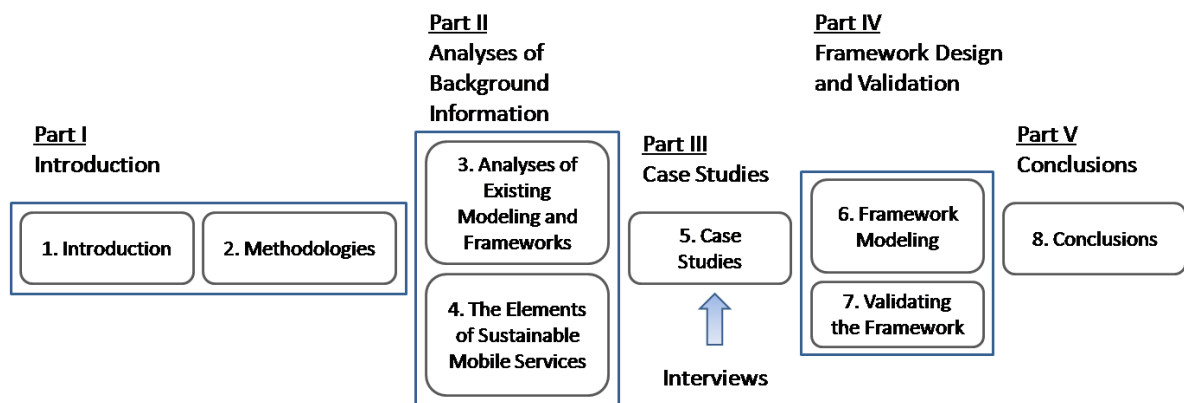

Figure 1: Structure of the thesis

1.6   Key Concepts

Base (Bottom) of the Pyramid (BoP) refers to the people whose per capita income is less than 1500$ per year. BoP includes approximately four billion of the poorest people in the world, living mostly in rural villages and urban slums. (Prahalad and Hart, 2002)

BRIC-Countries include Brazil, Russia, India, and China. These countries are the fastest growing economies in the developing world, which are predicted to reach the developed world first (Wilson and Purushothaman, 2003). It is also indicated that BRIC-countries are narrowing the digital divide between developed and developing worlds in means of diffusion of mobile phones and services (Chircu and Mahajan, 2009). Term was first introduced by O'Neill (2001).

Digital divide is a term traditionally meaning a gap between those who have access to internet and those who have not. Today, the term is used to include latest information technology. In addition, it is used to implicate the gap between those who have social or technical skills to access information via technology and those who have not. This gap is large especially between developing and developed worlds. (Norris, 2001; Compaine, 2001)

ICT4D - the Information and Communications Technology for Development is a field that concentrates to reduce poverty and increase wellbeing in developing countries via technology. ICT includes a range of devices that are able to process and transmit information in forms of sound, text, data, and picture. Traditionally devices such as radio, television, and telephones are used to receive this information. Today, the number of new technologies and devices is increasing such as mobile phones, computers, and Internet technologies. (Weigel and Waldburger, 2004)

M4D - Mobile for Development is a definition of the mobile phone services in the developing countries. This approach aims to implement and research solutions that help to decrease poverty and increase wellbeing in the developing countries via mobile phones. Development goals include improvements in social, human, and economic conditions. (Donner et al., 2008)

Mobile Services are classified in this paper as basic bearer services and value added services. Bearer services use mobile network infrastructure to process and transport information between devices forming a platform for information transfer. These services include speech, text, data, and picture services such as voice, SMS, USSD, MMS, and WAP services. Value added services make use of these bearer services and include such as

health, business, payment, entertainment, governmental, and information services. (Salkintzis, 2004; Schiller, 2003; Bouwman et al., 2008)

Stakeholder is a broad definition of any group or individual that is affected or is able to affect to the project or service creation. This can be done trough business process or strategy. (Eloranta, 2008)

Sub-Saharan Africa (SSA) consists of countries that are geographically located south or partly south of the Sahara desert. This region contains 781 million people fighting against poverty with Gross National Income (GNI) per capita approximately 862$. (WorldBank, 2006)

2   Methodologies

The design framework construction is done by applying qualitative methods. The framework is based on literature review, meetings, and case analyses. Finding of relevant literature is done by following the structured literature review approach by Webster and Watson (2002). Case data is gathered in semi-structured theme interviews and in a meeting. Data found from the cases is used in design framework construction following the grounded systems theory (Glaser and Strauss, 1977;). Each of the used methods is presented in chapter 2.1. Thereafter, the implementation of background and case study data gatherings are explained in chapters 2.2 and 2.3.

2.1   Used Methodologies

Search of relevant Literature

Search of relevant literary is following the structured approach by Webster and Watson (2002). Structured approach in this thesis includes the following steps:

1. First step is to search for relevant articles and publications. This is done by using the search engine of Google Scholar and manually searching any written documents from the web pages of institutions and organizations working in the field of mobile phones and developing countries.

2. Next step is to go backward and review the citations found in first step. In this step, the articles are ranked in order to limit the material to be considered.

3. Last step is to go forward and identify the articles that are citing to the key articles found in step two and draw these into the list of prior material considered relevant.

Google Scholar performs search from wide range of article databases, journals, thesis, books, and other publications. Moreover, it helps to locate complete papers and publications from the library data bases or from other sources available on internet. Examples of organizations that are working in the area of mobile phones and developing countries include Acumen Fund, International Telecommunication Union, Nokia Research, Plan International, United Nations Foundation, Vodafone Foundation, and World Bank.

There are good reasons for including organizations in the literature review sources. Currently there is a limited amount of academic publications from the field and such organizations provide valuable information as they actively participates the research and implementation of ICT-based solutions in the developing countries.

The above described systematic approach ensures that the search of literature is relatively complete leaving as little relevant material uncovered as possible. Search of material is an iterative process and is considered complete when relevant articles are not found anymore (Webster and Watson, 2002).

Semi-Structured Theme Interview

Semi-structured theme interview is an interview method that is executed around the themes including theme questions and focusing questions inside the themes. Semi-structured means that interview has structure that is looser than in structured interview, where questions are all determined before the interview, and more structured than open interview, where there is only topic but usually open conversation inside the topic area. In semi-structured interview, questions are made to guide the interview in the right direction, but still leaving room for discussion. Theme interviews are interview types where themes are predetermined to cover the areas that are important for the interviewer. (Hyysalo, 2006)

Grounded Systems Theory

Grounded systems theory refers to a method to discover new theory based on systematically obtained data. Theory indicates that gathered data that is apart from prior assumptions is necessary when discovering new theory that fits into the supposed uses. With this data, it is possible to discover new theory for the purpose, as prior assumptions and theories are excluded from the analysis. Advantage that this approach highlights is that it is difficult to completely refute theory by more data or replace it with new one, as it is linked tightly to the data. Theory could also last despite of the modification and reformulation. Grounded systems theory can be used for example to forestall the opportunistic use of theories that does not fit directly or have capacity limitations. (Glaser and Strauss, 1977) Grounded systems theory is used in the case studies to discover relevant concepts and patterns for the service design implications from concrete examples. These findings are used with the literature review findings to propose the new design framework this thesis is offering.

2.2   Analyses of Background Information Methodologies

Analysis of Existing Modeling and Framework Studies

Methodology used in the analysis of existing modeling and framework studies is following Webster and Watson (2002) recommendation of structured approach. First keyword used in Google Scholar is one of the following: "developing countr*", "Base of the Pyramid", "Bottom of the Pyramid" or "emerging market". These are combined with "mobile" or "ict4d" and one of the following key words: "model", "framework", or "checklist". "Ict4d" and "m4d" keyword are also used alone and with combination of last three mentioned. In addition, search of relevant literature is expanded to include important organization Acumen Fund, Plan, United Nations Foundation, and World Bank. Search is conducted trough search engines on web pages of these organizations combining key words "mobile", "ict", "framework", "model", and "checklist" or manually searching relevant publications.

The Elements of Scalable and Sustainable Mobile Services

The architectures subchapter is following the methodology of literature review and interviews. Enterprise architecture is well covered in the existing literature and relevant material is searched trough Google Scholar. The thesis builds also on the recent work on dual model and citizen centric architecture that are being developed by the Information Systems and Service Engineering Group at the Software Business and Engineering Institute, Helsinki University of Technology. The sources include discussions with the team members as well as workshop, presentation and submitted conference papers. Features affecting mobile phone use subchapter methodology is following the structured approach by Webster and Watson (2002) and searching information from organizations such as GSMA, ITU, MobileActive, Plan, and World Bank. Searches that reach relevant articles are performed with following key words: "mobile developing country", "mobile base of the pyramid", "mobile use sub-saharan africa", and "mobile impact developing country". Methodology for service categories is literary review, which includes two relevant reports that are outcomes of UN Foundation-Vodafone Foundation Partnership program.

2.2   Case Study Methodologies

Case studies include two cases that are entering pilot stage in the near future. Approach for the case studies is exploratory, as aim is to determine what is happening in the projects and to seek new insights and ideas for new design framework construction (Runeson and Höst,

2009). Case studies are carried out in semi-structured theme interviews and meeting, which are arranged for each case separately. Selecting the interviewees and meeting contacts is based on knowledge they possess about the cases. As both cases are in their initial phases, it is important to find contacts that are well aware of the first steps and are closely in touch with the cases. Both cases involve people that visit or live in the target regions and people who are working closely in the projects from the distance. Data is handled in qualitative manner following the grounded systems theory.

Table 1 presents the data gathering situations summary of the meeting and interviews. Each situation is briefly introduced after the table. Each of the interview situations includes two interviewers: Author of this thesis and Timo Itälä, senior researcher in Helsinki University of Technology in Software Business and Engineering Institute. Role for the author is to ask the questions and lead the interview, as Timo Itälä is observing and adding focusing questions.

Table 1: Summary of the data gathering situations

Date	Time	Case	Source of Data: Organization/ Location	Method
31.08.2009	15.00-16.00	mGesa	Pajat Management and TKK / Espoo, Finland	Meeting
03.09.2009	12.15-13.45	mGesa	Plan Finland / Helsinki, Finland	Theme Interview
08.09.2009	13.10-14.20	Birth Register in Liberia	Crisis Management Initiative / Liberia-Finland	Theme Interview
17.09.2009	13.40-14.10	Birth Register in Liberia	Crisis Management Initiative / Helsinki, Finland	Theme Interview

31.08.2009 mGesa Meeting

Table 2 presents the background of the meeting. Additional information is presented after the table.

Table 2: Background of the mGesa meeting

Names of the Attendees:	Pertti Lounamaa, Matti Hämäläinen, Timo Itälä
Roles and Backgrounds in the Project:	Pertti Lounamaa is the manager of the service provider company Pajat Management. He coordinates the technology side of the solution. He is visiting the target regions before the pilot is launched. Matti Hämäläinen is professor at the Helsinki University of Technology (TKK) in Software Business and Engineering Institute. He examines the involvement of TKK in the project and coordinates the open source possibility in technological solutions. He also offers his knowledge from the developing world and technology for other stakeholders involved. Timo Itälä is a senior researcher in the Helsinki University of Technology in Software Business and Engineering Institute. He is offering his knowledge for service provider from the fields of enterprise architectures and data management.
Date of the Meeting:	31.08.2009
Setting of the Meeting:	Meeting was held in the workroom of the author in the facilities of Software Business and engineering institute at Helsinki University of Technology (Innopoli II). Meeting was held in Finnish and was not recorded.

Meeting was held to clarify the rough stakeholder role map, the state of the project, and outline the future challenges the project is facing. In addition, meeting helped the preparation process of the interview questionnaire, as need for relevant information was discussed. Meeting was conducted as open as possible leaving room for wide range of themes to be discussed.

03.09.2009 mGesa Interview

Table 3 presents the background of the Interview.

Table 3: Background of the mGesa theme interview

Name of the Attendee:	Mika Välitalo
Role and Background in the Project:	Interviewee is the contact person for Plan International and the coordinator of the pilot solution. He is responsible for communication between Plan International, Plan Finland and Plan Kenya; aggregating the relevant information data from the field; management of need survey; and study on experiences of use of GIS based systems. In addition, interviewee coordinates the pilot phase including communication and budgeting.
Date of the Interview:	03.09.2009
Setting of the Interview:	The interview was held in Plan Finland office in a meeting room in Helsinki, Finland. Interview was held in Finnish and was recorded.

Outline of the questionnaire was sent to interviewee two days in advance by e-mail. Interview covered all the themes from the questionnaire outline in appendix A. Author received background material about the case by e-mail two days before the interview was held.

08.09.2009 Birth Register in Liberia Interview

Table 4 presents the background of the Interview. Additional information is presented after the table.

Table 4: Background of the birth register in Liberia first theme interview

Name of the Attendee:	Gama Roberts
Role and Background in the Project:	Interviewee is the coordinator of the project in Liberia and employee of the CMI. He has technical background in engineering in USA and public sector background in Liberia.
Date of the Interview:	08.09.2009
Setting of the Interview:	Interview was held trough mobile phone in a meeting room at Helsinki University of Technology, Software Business and Engineering Institute and in a work room of the interviewee at Liberia. Challenge of the interview was poor telephone connection. Interview was held in English and was recorded.

Outline of the interview was sent to the interviewee four days in advance by e-mail. At the interview situation, interviewer noticed a problem in the questionnaire that concerned roles, incentives, and future development plans of NGO. Because of this, themes were not covered at the interview situation. These themes were covered in second interview at 17.09.2009 along with other themes.

17.09.2009 Birth Register in Liberia Second Theme Interview

Table 5 presents the background of the additional interview. Additional information is presented after the table.

Table 5: Background of the birth register in Liberia second theme interview

Name of the Attendee:	Gama Roberts
Role and Background in the Project:	Interviewee is the coordinator in Liberia and employee of the CMI. He has technical background in engineering in USA and public sector background in Liberia.
Date of the Interview:	17.09.2009
Setting of the Interview:	Interview was held in a work room of the interviewee at the office of CMI in Helsinki, Finland. Interview was held in English and was not recorded.

Interview was held right after the meeting of larger project concerning the GooB[©]-concept. Interview covered the themes and areas of interest that were not covered completely in first meeting due to bad phone connection or problems in the questionnaire. Questions were not sent to interviewee in advance.

3   Analyses of Existing Modeling and Framework Studies

Analyses of the existing modeling and framework studies include two subsections. First, key findings of the existing modeling and framework studies are examined. Relevant articles are listed in Table 1 and analyzed separately. Second, analyzed articles are summarized and briefly described. Summary includes a table of important findings and factors that suggest the need for a new design framework.

3.1   Findings and Analysis

The findings of relevant articles are listed on Table 1. As findings reveal, modeling in the field of mobile phones and developing countries is very limited. Only the first study is assigned to mobile phones directly. Last four studies handle ICT related issues in generic manner including mobile technology.

Table 6: Existing Modeling and Framework Studies

Keywords	Source	Relevant articles
Mobile framework	Acumen Fund	Going Wireless: Dialing for Development, How Mobile Devices are Transforming Economic Development at the Base of the Pyramid (Lehr, 2007)
Ict4d	Google Scholar	Information and Communications Technology for Development (ICT4D) - A Design Challenge? (Tongia and Subrahmanian, 2006)
Ict4d checklist	Google Scholar	Information and Communications Technologies and Development: Help or Hindrance? (Curtain, 2003)
Ict4d checklist	Google Scholar	Best Practices of ICT for Development Projects (Vosloo, 2003)
Ict4d checklist	Bridges.org	Bridges Frameworks: 12 Habits & Real Access (Bridges.org, 2009c; Bridges.org, 2009b)

Past studies have at least partly different approaches and viewpoints in service creation processes in the developing countries. The first study by Lehr (2007) concentrates solely on mobile phone services and their implications and opportunities. The second study by Tongia and Subrahmanian (2006) tries to solve the design problem that ICT4D projects often face, bringing stakeholders and their metrics into the middle of the inspection. The third study by Curtain (2003) introduces key elements of good practices in ICT4D projects and how to integrate ICT4D projects into the main stream projects. The fourth study by Vosloo (2003) analyzes the case studies in pre-project, roll-out, and post-project phases and identifies best practices in project management. Framework that Vosloo (2003) is using is a previous version of the Bridges.org (2009a) habit studies, which is analyzed as the last study in this part of the existing framework studies. The reason for analyzing both studies separately is that Vosloo has a different approach, new findings outside the habits, and previous reduced version of the habits. The last study by Bridges.org (2009a); Bridges.org (2009b) includes two frameworks that are practice guidelines for project management to start new or evaluate the past ICT4D projects.

3.1.1 Going Wireless: Dialing for Development, How Mobile Devices are Transforming Economic Development at the Base of the Pyramid

Lehr (2007) study is divided into three sections that have impact on this thesis. First, key areas where mobile phones have been used are introduced. Second, important findings are examined based on the previous studies and current and emerging projects. These findings have been identified as the key factors that determine success or failure of mobile services in the developing world. Third, a checklist is presented, which can guide stakeholders to implement such services or evaluating impact of mobile service. Analysis starts with the key area studies and moves then to the key factor findings. Last, a checklist for mobile project implementation is presented.

Key areas include shared-access, improving market efficiency, delivering critical information, aggregating enterprise data, public reporting and data collection, and facilitating financial services. The business model for shared-access has shown to be a powerful way to reach the poor and make phone services available for them. The model allows entrepreneurs to purchase mobile phone and share airtime for free, earning a margin on the airtime units sold. Market efficiency and critical information delivery are the major areas that mobile phones have improved. This is because of fast and on-time communication that is able to perform continuously via mobile phone. Aggregating

enterprise data has made it possible to share critical information efficiently in real-time. It has been successful especially in the health sector where patients' information could be used remotely in rural locations. Public reporting and data collection allows journalists and citizens to send active or passive information from the current location. This has been important especially in conflict areas or areas where there are no other communication methods available. Mobile phones facilitate also financial services as they can be used to control bank accounts or function as e-wallets and micro-payment devices.

These key areas indicate that mobile phone is a powerful platform for services to reach the base of the pyramid. Lehr (2007) also points out that due to the digital nature of mobile services; they are scalable, replicable, and straightforward to reach a large installed base.

The key factors include observation of user preferences by listening to users, finance and business perspective, prototyping, market education, regulatory challenges, device and technology features and limitations, network effect considerations, and analyzing the past. Listening to users and market education are critical, as top-down approach often fails to notice issues that are important to users. These issues include language; cultural localization; usability; end user financing opportunities, such as pre-paid opportunity; and value of new service delivery method to new markets. Finance and business issues consist of metrics that are used to evaluate effects and cost structures of labor and technology. Regulatory challenges might be large inside a country as well as beyond borders. One challenge is the operators' monopoly position if services are dependent on operators' service platforms. This can be prevented by using bearer services as platforms, such as voice, SMS or USSD (Unstructured Supplementary Services Data). Regulatory challenge can be major problem also over borders where regulatory environments are different. Hardware and device limitations and features are a trade-off between cost and usability. It is important to consider technology and device functionality before implementing a service. Overall costs of service also need to be examined deeply, as labor; opportunities for platform providers; and price structures of voice, message and data services are different in different countries. Last factors are the importance of network effect and past studies. Many of the services lack a large user base and network externalities. This can hinder for example innovative price decrease solutions by end users. Services that leverage easily to a large user base often innovate in means of payment methods and service features. Last, the importance of past studies is worth mentioning. They can guide to implement successful services as some of the mistakes have already been made.

Checklist that Lehr (2007) introduces is aimed for mobile service stakeholders who wish to implement a service in a developing country. Nature of the checklist is general, as many of

the applications and environmental issues vary in different regions. Checklist is presented in Figure 2.

+ **Write It Up**—Prepare a 2–3 page Project Summary that identifies a need (quantify expected impact and measures of success wherever possible); describes past or existing attempts to meet that need (face the "competition"); proposes your remedy (keep the description simple); asserts the likely benefits of your approach (do your best to quantify potential outcomes); and identifies potential stakeholders (see steps 2 and 3).

+ **Focus on Outcomes**—Identify the explicit outcomes against which you will measure your success. Your performance metrics should be quantitative and concrete: be careful to measure outcomes rather than mere outputs.

+ **Assess the Stakeholder Landscape** — Identify any existing or potentially relevant programs, NGOs, partners, collaborators, or facilitators that share complementary goals or missions. Collect their contact information and prepare to selectively share parts of your Project Summary.

+ **Go Local** —Recruit and enlist individuals who can provide local perspective, insight and market intelligence. Don't forget to include potential customers in this mix. Return to them and solicit their views often as the project evolves.

+ **Identify Cultural and Linguistic Considerations**—Beyond whatever considerations you've highlighted in your Project Summary, make detailed observations – and review them often—regarding possible cultural or linguistic roadblocks. Visiting the markets you intend to serve is an absolute must!

+ **Try On Your Marketing Hat**—Equipped with local insights and an awareness of cultural conditions, prepare a 1-page bulleted "sales sheet" that addresses the needs, preferences and prejudices of your end users. You need to close the gap between what they need and what they'll buy. You've made some incorrect assumptions; fix them.

+ **Regulatory Assessment** — Identify, and factor in, the regulatory or enforcement drivers and barriers that may influence your project implementation.

+ **Borrow from Others**—Startup can be costly. As described in "Don't Reinvent the Wheel" on the next page, spend time and resources to uncover previous attempts to address similar or complementary problems in other settings. Can you succeed where they haven't? Contact those parties to hear their experience, lessons and recommendations.

+ **Seek Technical Validation**—Make sure a technical expert helps validate or inform your assumptions and expectations.

+ **Outline Tasks** — Establish a list of concrete and specific tasks and activities that will be necessary throughout implementation from startup to ongoing operations, maintenance and completion/dissolution (if relevant). Be sure to note the estimated timing and duration of all tasks. Take into account any emerging regulatory or technology factors.

+ **Identify Human Resource Needs**—Based on the task outline, identify the types of expertise you require and where you will go to get the talents you don't already have.

+ **Track the Money** — Develop a realistic, detailed and dynamic financial prospectus that estimates financial resource needs in the immediate (0-6 month), medium (6-18 month) and long terms (18+ months).

Figure 2: Mobile project implementation checklist (Lehr, 2007)

3.1.2   Information and Communications Technology for Development (ICT4D) - A Design Challenge?

Tongia and Subrahmanian (2006) addresses developing countries ICT design challenge as a whole. It does not restrict in to the mobile services but it can be seen as a value adding study for this thesis and can be applied in to the context of mobile services. The study

introduces three modeling components. First, design outline is given. Second, new model is presented which includes five basic elements. Third, new design process is demonstrated. These components are produced to help new service design as well as analyzing existing products.

The design outline is based on the authors' experiences and literature. It introduces characteristics for "good" design. The characteristics include stakeholders and their needs, technology performance, stakeholders' incentives, stakeholders' participation and feedback, and metrics for measuring success across stakeholders' studies. In addition, performance and metrics have additional characteristics such as solutions sustainability, scalability, and acceptance. Stakeholders and mapping their needs is the first step. It is important to find all possible stakeholders and metrics for baseline study. The outline continues with the technology performance part. It consists of issues such as cost/benefit, consequence, and price/performance analyses. These issues are often iterative or evolving. Next, stakeholders' incentives have to be examined. It is important to notice the different goals of different stakeholders, handle responsibility issues, and possible champion validation. In addition, the stakeholders' involvement is divided into three stages: designs, deployment, and diffusion stages. Metrics for measuring success across stakeholders have to include measuring parties' analysis, transparency of assumptions and methodologies, and evaluation of prior experiences.

As can be seen and is pointed out by authors, stakeholders are in the center of the project design. Thus, metric and performance are seen in context of stakeholders needs, including sustainability, scalability, and acceptance. Sustainability is seen as a result of supplier profitability and consumer affordability. Scalability is considered trough geographical, cultural, and economical sustainability. Acceptance hold issues, such as political economy, cultural acceptance, trust, free will of use, and empowerment.

A new model and process Tongia and Subrahmanian (2006) are presenting tries to overcome the limitations of technology-centric push approach. The starting point is to highlight the importance of formulating the right problem and to create alternative problem solutions. Basic elements of the model are stakeholders, goals, design variable and design space, tests and attendance metrics for goals, and starting points meaning historical solutions. These elements form a process that embodies participation of people with different backgrounds (functional, expertise and social) and problem solving approaches. Participation is executed by groups of people, with different backgrounds inside each group. As groups form different prototyping and solutions trough sharing and analyzing past failures and success, outcomes have to be debated among attendees and decision-

makers before deployment. This process model allows experimentation and improvements in process cycles. The process is presented in Figure 3.
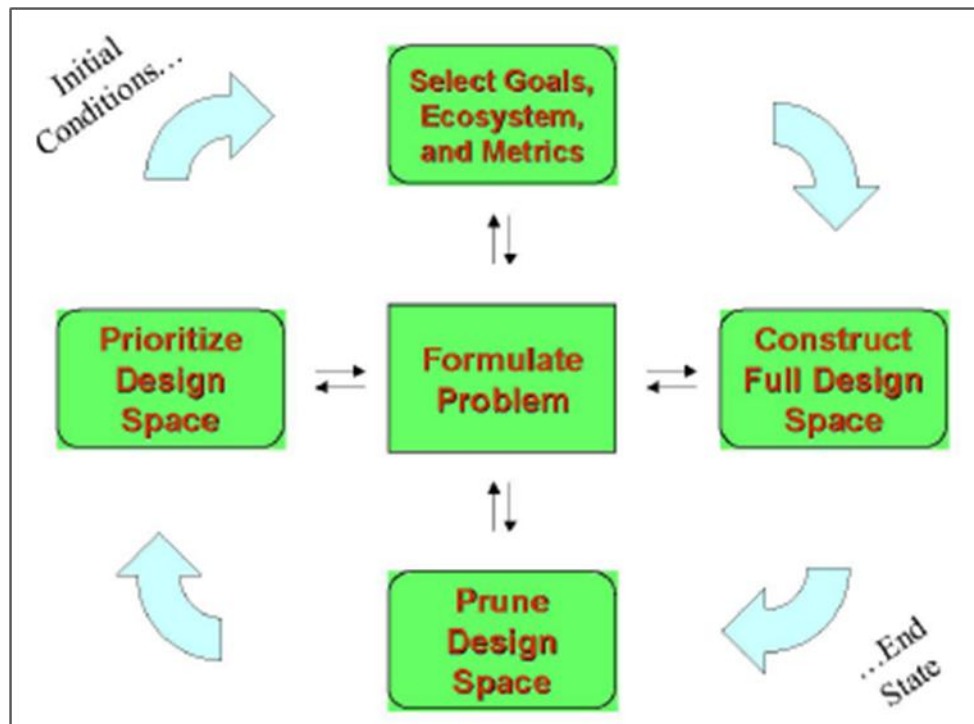
Figure 3: ICT for Development Design Process (Tongia and Subrahmanian, 2006)

3.1.3 Information and Communications Technologies and Development: Help or Hindrance?

Curtain (2003) study identifies key lessons learned from 100 ICT related projects from the developing countries. These lessons are drawn into two checklists. The checklists suggest an outline for good practice on execution of ICT related project. The first list presents a good practice guide to design ICT driven projects in the developing countries. The second list presents key steps for integrating ICT into the mainstream development projects. Each of the checklists are first introduced separately and then drawn together to highlight the similarities and the differences. Study covers ICT services in generic level including also mobile services.

The first checklist consists of ten points which are suggested to help address the design practice in the developing countries ICT related projects. Points are formulated as questions that need to be answered. The checklist point out issues such as goals, target group,

appropriateness of the solution, scalability, ability to replicate, stakeholders involvement, relevance and linguistic considerations for target group, self-sustainability, metrics and evaluation, and risk management. Checklist is presented in Figure 4.

Key components of a good practice guide to the design of ICT driven projects in developing countries		
1	Why?	Is the use of ICT-based project aimed clearly at achieving a specific poverty reduction goal?
2	Who?	Is there a clearly specified target group for poverty alleviation?
3	How?	Is the form of ICT to be deployed appropriate in terms of cost, support, maintenance and compatibility with existing information flows?
4	How?	Is the form of ICT to be deployed scalable to enable it to be replicated and expanded
5	How?	Are appropriate intermediaries being used?
6	How?	What scope is there for public private partnerships?
7	What?	Is the content transmitted by the ICT relevant to the audience and is it in a language easily understood by the target audience?
8	How long?	Is the project self-sustaining over what period?
9	How well?	What performance measurement, monitoring and evaluation processes are in place?
10	What risks?	Managing risk: 'What unexpected events or situations might arise?' and 'What should be done to manage these?'[2]

Figure 4: Checklist for the developing countries ICT design projects (Curtain, 2003)

The second checklist identifies the key steps for integrating ICT into the projects in the developing countries. It is aimed for projects that are driven by ICT and not as a supplementary for older technologies. The main findings in the key steps checklist that Curtain (2003) highlights are goals, target groups, causes, interventions effectiveness in breaking the causal linkages, ICT needs for target groups, role of ICT in two-way connections, appropriateness of the solution, environments enabling existence, measures

and methodologies of objectives achievements, and risk management. The checklist is presented in Figure 5.

	Key steps for integrating ICT into mains tream development projects
1	Define the project objective: In terms of poverty reduction, what aspect of poverty does the project address? For example, does the project address a specific indicator for a particular Millennium Development Goal?
2	Who are the poor to be targeted by this program? To what extent is it possible to identify the poor in terms of rural/urban location, region, gender, age, education attainment & health status?
3	What are the likely causes, as distinct from the effects, of the aspect of poverty the program is focusing on? Is it possible to rate the likely causes in order of importance? Is poor communication a cause of this aspect of poverty?
4	What types of interventions are most likely to be effective in breaking the causal linkages? Need to distinguish between direct, indirect and supporting interventions.
5	What are the information and communication needs of the targeted poor in relation to the project's objectives and how important are they to the success of the project?
6	What role can ICT and other media play in delivering the information and providing channels of two-way communication?
7	Is there an appropriate form of ICT which can be deployed in terms of cost, support, maintenance and compatibility with existing information flows?
8	Does an enabling environment exist for the ICT to provide the proposed support?
9	What measures can be devised to assess progress towards the poverty reduction objective?
10	Is there a methodology in place to assess how effective the proposed intervention is in achieving the operational objectives of the program
11	Managing risk 'What unexpected events or situations might arise?' and 'What should be done to manage these?'[4]

Figure 5: Key steps to integrate ICT project in the developing countries (Curtain, 2003)

Both of the checklists have similarities and differences. The lists keep goals; target groups; suitability in means of cost, support, maintenance, and support; measuring and evaluating the goals; and risk management as the important key findings. However, the first checklist for design practice concentrates more on stakeholders, scalability, self-sustainability, and

content issues, as second checklist concentrates on causes, need, effects, roles, and environment of technology and target groups.

3.1.4 Best Practices of ICT for Development Projects

Vosloo's (2003) approach in modeling the key lessons from ICT related projects starts with the examination of 12 case studies, in which one is related directly on mobile phones SMS service. Other studies include online, Personal Digital Assistants (PDAs), or computer based services. Study identifies a set of the best practices for successful projects. The findings are presented in three phases: Pre-project, rollout, and post-project phase. These are concluded in a general lessons part. Vosloo (2003) is using Bridges.org (2009a) seven step framework from the year 2002 to gauge the cases. Steps are as following:

1. Implement and disseminate best practice.
2. Ensure ownership, get local buy-in, and find a champion.
3. Do need assessment.
4. Set concrete goals and take small achievable steps.
5. Critically evaluate efforts, report back to clients and supporters, and adapt as needed.
6. Address key external challenges.
7. Make it sustainable.

Vosloo (2003) starts his best practices study by identifying pre-project phase practices. These are needs assessment; planning; goal setting; ensuring local ownership, buy-in, and champion; and identifying key external challenges. The needs assessment sets the problem definition, scope, and ensures suitability of the solution. The planning ensures that project has vision, defines roles and stakeholder responsibilities, and notices funding and technical and administrative means. The planning is also considering sustainability issue, which is critical for every solution. External challenges can be for example infrastructure features, such as power supplies or internet access, lack of ICT awareness, or political restrictions.

The rollout phase includes practices such as avoiding duplicate effort, reach towards small steps, pilot before actual solution, evaluation and adaption, and reporting to stakeholders. Duplicate effort can be reduced by searching the past works and utilizing this knowledge. The post-project phase includes final project evaluation, follow-up, and disseminate information broadly.

As a conclusion and in addition to phase analysis, Vosloo (2003) highlights some lessons learned and important findings that are relevant in the developing countries ICT projects. These are importance of partnership building; taking into account realities in ICT infrastructure and design according to these requirements; allow target groups to participate; be prepared for diversity among countries in means of geographical, political, economical, and professional situations; think beyond the project; focus on current project; provide training; offer incentives to speed up adoption; involve all stakeholders and their perceptions at all phases and keep them informed; and respect the local conditions.

3.1.5   Bridges Frameworks: 12 Habits and Real Access

Bridges frameworks include two different components: 12 Habits and the Real Access criteria. The 12 habits guide project managers to address the needs of the developing countries service design. They can be used for planning and evaluation (Bridges.org, 2009a). The Real Access criteria form a framework, which help to determine if there is real access to ICT. This means that access is not only devices and connections but also the impact on socio-economic development that technology can offer. It is a generic framework for all ICT solutions that try to improve services, such as healthcare, education, or government services. It includes criteria that are introduced to improve ICT-based initiatives and development policies planning, research, monitoring, and evaluation (Bridges.org, 2009b). Each of the frameworks is presented including brief introductions on each habit and criteria. Table 7 introduces the 12 Habits and Table 8 the Real Access criteria.

Table 7: 12 Habits (Bridges.org, 2009a)

Habit	Description
1. Learn from the past	It is important to know and study what has been done and what has not and to utilize past experiences.
2. Needs assessment	Need assessment is broad practice that includes environmental, user, technological, services preference, end user payment, and training issues.
3. Including locals	It is important to ensure local ownership, get local buy-in, find a local champion, and concentrate on specific context.
4. Local problem-solving and responsibilities	This approach can help local problem-solving situations to be managed locally in the future.
5. Partnership and collaboration	It is important to find trusted partners and workable collaboration as project usually involve many skills that are not able to possess by one organization.
6. Goal setting	Set concrete long and short term goals that are achievable.
7. Technology neutrality & adoption	Technologies change over time and it is vise to create solutions that are technology-neutral. Use open standards if possible.
8. Involving excluded groups	Excluded groups based on age, gender, race or religion is often excluded from decision making widening the digital divide between poor and higher income citizens. It is important to include these excluded groups into the project as poverty reduction usually concerns them.
9. External challenges	These are challenges that can not be directly controlled by implementers. It is still important to prepare for these as well as possible. External challenges are for example power outage, political landscape, and natural disasters.
10. Monitor, evaluate, report, and adapt	Monitoring and evaluation should continue trough out the project and beyond. It is important to measure outcomes besides direct income also from "social return of investment" point of view. Reporting should include funding parties, users, and all other stakeholders involved.
11. Sustainability	Project should be managed so that it is self-sustaining in means of incomes or effective social mission so that funding parties are involved continuously.
12. Disseminate information	Information about successful and failed projects should be distributed nationally and internationally as widely as possible. Thus, increasing the knowledge base of ICT related work in developing countries and improving the future work.

Table 8: Real Access criteria (Bridges.org, 2009b)

Criteria	Description
1. Physical access to technology	Examine if the technology is available in the project areas, among people, and organizations involved.
2. Appropriateness of technology	Appropriateness of technology need to be examined trough many perspectives, such as power requirements, security, environmental conditions, local situation, usability, and technical specifications.
3. Affordability of technology and technology use	Cost to use and implement technology and services must be considered well allowing also the poor to access.
4. Human capacity and training	Increasing awareness of benefits that the services can offer will accelerate the adoption of technology based services. In addition, professionals need to have training and locally maintained technical support.
5. Locally relevant content, applications, and services	Services need to be relevant for the people for services to be used in everyday life and work.
6. Integration into daily routines	Services should reduce the burden people are dealing with in their lives. This means that use of technology can not increase travel times or bring more work in order to be used.
7. Socio-cultural factors	Technology should help discriminated groups to be able to take part into the decision making processes and be able to use services. These groups are based on age, gender, race, religion, class, HIV status, geographical location, sexual preference and other socio-cultural factors.
8. Trust in technology	Trust in technology can be hindering or accelerating factor in the diffusion of technology and services in use.
9. Local economic environment	Economic state of target region must be considered when implementing a service. Solutions should improve economic situation and limit negative effect.
10. Macro-economic environment	Macroeconomic decisions are made by nation level authorities. These regulations and policies can affect services in limitative or accelerative manner.
11. Legal and regulatory framework	Legal and regulatory environment has effect on how technology is used and accessed. Decisions are made by international, national, and regional organizations.
12. Political will and public support	Governments can be in a key position for socio-economic development. Understanding the opportunities that ICT can offer and leading the development can increase the growth of the whole industry.

3.2   Summary

In spite of different approaches, existing modeling and framework studies introduce many of the same issues and characteristics. This summary tries to highlight these issues and analyze some similarities and differences. Another purpose is to dissect if there is a need for new design framework approach this thesis is offering. Issues from past studies are drawn into the Table 9 from each study separately. Table consists of characteristics that have commonalities in at least three of the studies, leaving less important findings outside the summary table. As a result, 12 issues are pointed out and briefly discussed after the table. Sustainability is introduced first, as analyses this thesis is offering are based on this requirement.

Table 9: Summary of the existing modeling and framework studies

Concept	Article by the Author(s)				
	Lehr (2007)	Tongia and Subrahmanian (2006)	Curtain (2003)	Vosloo (2003)	Bridges.org (2009c)
Stakeholder analysis	X	X	X	X	X
Need assessment	X	X	X	X	X
Goal/Outcome setting	X	X	X	X	X
Metrics, Evaluation, Monitoring		X	X	X	X
Sustainability		X	X	X	X
Local involvement	X	X		X	X
Cost structures	X	X	X		X
Learning from the Past	X	X		X	X
Technical assessment	X	X		X	X
Scalability	X	X	X		
Language/Cultural Issues	X	X	X		
Regulations, Policy	X	X			X

Sustainability issues consist of funding, ability to scale, and services continuity after actual project ends. Bridges.org (2009a) is handling sustainability trough self-sustaining income

or continuous funding from outside. Tongia and Subrahmanian (2006) see sustainability as a result of supplier profitability and consumer affordability, as Curtain (2003) asks how long is the service self-sustaining. In addition, local involvement is identified as one of the key factors to reach sustainable services (Bridges.org, 2009a; Vosloo, 2003).

Stakeholder analysis is playing important role in each study examined. Tongia and Subrahmanian (2006) are identifying stakeholders at the center of service design, as other are including stakeholder analysis into their frameworks. Following stakeholders are identified: Users as targeted or general group; NGOs; governments; funding entities; regulators; ICT developers and providers; public and private companies, service providers, and entrepreneurs; and academics and students.

Need assessment includes users' needs as well as stakeholders' needs. Each of the study notes that needs assessment is the basis of the service design startups. Need assessment examines what are the real needs the poor have and how these can be facilitate with technology. Another viewpoint that Tongia and Subrahmanian (2006) points out is that needs for each stakeholder have to be examined and fulfilled in order them to be committed into the service creation process.

Goal/Outcome setting should include concrete goals and timelines. Important is to scope the goal so clearly that it is achievable. Bridges.org (2009a) framework also points out those small achievable steps are important to motivate project parties.

Metrics, evaluation, and monitoring are treated differently in prior studies. Tongia and Subrahmanian (2006) introduce metrics in the means of stakeholder measurement. Curtain (2003) is noticing metrics in means of performance measuring of goals and objectives. Vosloo (2003); Bridges.org (2009a) handles metrics, evaluation, and monitoring in means of effect that project has achieved. In spite of different approaches, metrics, evaluation, and monitoring have been recognized as important part of service creation process.

Cost structures include comparisons in investments/benefits, cost/performance, and price structures of voice, data, and SMS services in different countries. Lehr (2007) also states that it is good to notice that labor and technology cost structures also vary in different regions.

Learning from the past issue indicates that every project or service implemented should be disseminated and studied before implementing a next one. In this way, failures can be avoided and industry can move forward faster.

Technical assessment is important to perform, as service creation need to consider ICT realities. These include network, hardware, and device limitations and opportunities.

Scalability issues found from studies concerns the services ability to scale geographically, culturally, economically, and among users. It is pointed out that services need to scale and be replicable in order to succeed. Lehr (2007) also notices the importance of reaching critical mass in order to find new innovative way to pay for service delivery.

Language/cultural issues that studies revealed are diversity of languages and cultures and the usability obstacles these can cause. Only way to really understand these is to visit the places and review often during the service creation process.

Regulations and policy are at the same time restrictive and liberating in means of services creation. It is critical to examine what can be done and what not in each region and country, as differences in the countries' political environments vary greatly.

Other issues that studies highlighted are preference of open source solutions; target group assessment; funding issues; collaboration between partners, public and private sectors; and including users into the service design.

Analysis of past studies uncover that there is still room for new design framework for sustainable mobile services in the developing countries. Research is still limited and approaches different. Aim for this thesis is to place users in the center of the service content creation and model collaboration between professional and end users in a sustainable manner. This approach means that new business models need to be developed to meet the expectations of the professionals' and the users'. This includes strong local involvement and revenue models that are pointed out also by the past studies. In addition, platform type of thinking is lacking from the past studies, leaving out one important issue of scalability that could lead services to sustain longer.

4   The Elements of Sustainable Mobile Services

In this chapter the elements for sustainable mobile services in the developing countries are presented. Chapter starts with brief introduction of current architecture theory. Main focus is on dual model where citizen and enterprise views are connecting. Other areas include citizen centric and enterprise architectures. The reason for presenting the architecture theory in the background part is to highlight the importance of the broad view of service creation process. It also outlines the frame for this thesis, as the angle of view is on dual model. In addition, architecture approach helps to address among other things the integration issues of data between different systems and to prevent creation of individual solutions that do not utilize resources effectively.

Last two subchapters concentrate to highlight current situation and issues that can have impact on mobile business in the developing countries. Features affecting mobile phone use include diffusion, usage, operator, and financial studies. Service categories demonstrate categories and services that are in the scope of this thesis. These include mHealth and crisis management services.

4.1   Architectures

4.1.1   Dual Model

Dual model is a new approach to strengthen the collaboration between professionals and citizens. It was first developed to meet the increasing demand of healthcare with constrained resources. Main idea is to bring citizen and enterprise views together and strengthens the collaboration and service creation trough iterative cycle of information sharing. Information sharing and allowing citizens to participate into the information sharing is critical, as this approach enables the use of complementary resources citizen are offering. To exploit this, critical mass is the crucial factor. Large enough user base is the key to launch and grow the service as well as to create incentives for all users. As this approach is involving users and professionals in a wide scope, it provides new opportunities for services and service providers to enable and accelerate the collaboration, binding citizen centric and enterprise architectures together. (Hämäläinen and Itälä, 2009)

Services that the dual model can strengthen are services that benefit from the information citizens offer or include places that are well occupied by the citizens. Information includes for example health, location, situation, and market information. Health information can be used for example disease recovery, to track infectious disease diffusion, and to track and react on deviation in newborn/maternal health issues. Location based services can help in disaster situation such as earthquakes and flooding where locations of possible victims are critical. In addition, citizens are usually well aware of their living surroundings and this information can be used to form maps from the places that are not yet captured. Situation and market information can include changes in living environment so that accidents, product price decrease, or other consequence can be prevented or foresee. These information sharing opportunities can be used to form services that can react or store information and is available to participants involved. Storing information and creating history information is also important, as governments and professional can make the service offering more efficient and be able to suggest services that are relevant for particular region or individual. Dual model is presented in Figure 6.
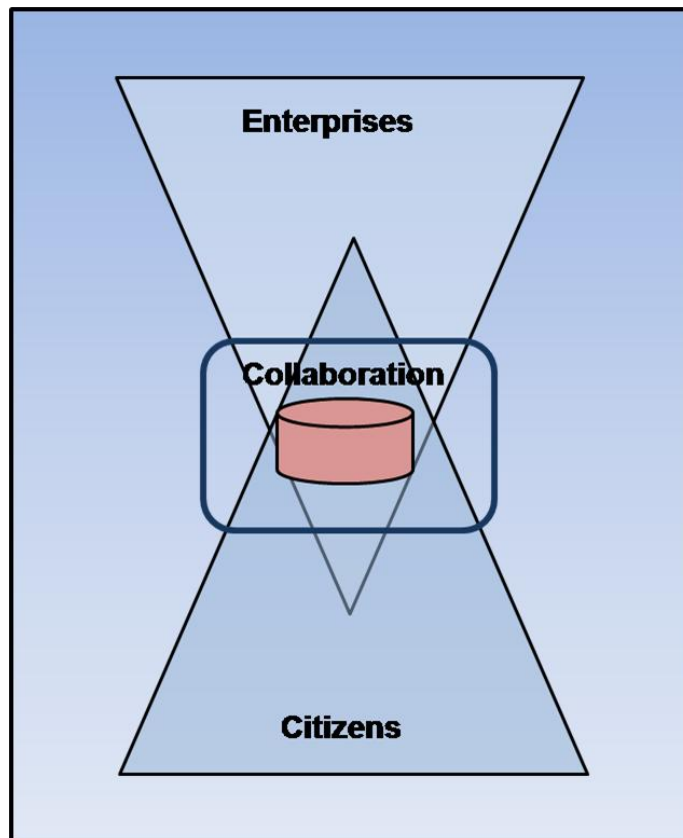

Figure 6: Dual model modified from (Hämäläinen and Itälä, 2009)

Lower pyramid

Lower pyramid from the dual model includes citizens, communities, and villages. This is where all the local and personal knowledge and complementary resources are located. Lower pyramid is also the place where most of the citizens events happen and where needs are best known. Features that can be used to describe lower pyramid's relationship toward technology are flexible, easy to use, good for purpose and "everyday IT". (Hämäläinen and Itälä, 2009)

Higher pyramid

Higher pyramid includes government, cities, community centers, enterprises, professionals, and special expertise and facilities. Traditionally, higher pyramid is the domain where services are designed and implemented and then offered to users. This can cause problems if user needs are not meeting the service offering. It is evident that enterprises and other higher pyramid stakeholders are aiming at reliable and "close to perfect" solutions to survive in competitiveness environment. This can lead to rigid and complex systems and services that adapt and extend slowly. (Hämäläinen and Itälä, 2009)

4.1.2   Citizen Centric Architecture

Traditionally, service creation in the ICT field has followed the enterprise approach, where services are created and implemented by professionals. Along with web 2.0 and related technologies also users have become service and especially content creators. Web 2.0 based services such as blogs, wikis, podcasts, mashups, social tagging, and social networking services are used daily by millions of people around the world. Thus, citizens possess the ability and desire to participate into the service creation and information sharing. (Sessions, 2007) Another observation that user driven services possess is "good enough" principle. This means that services need to be easy to use and they can be modified easily to meet the needs. In the fast changing technological world, speed of introducing services can be more valuable than developing "close to perfect" solutions that miss the target audience as the needs change.

Citizen Centric Architecture (CCA) is an approach that examines service creation processes from the citizen view and combines this view and resources to enterprise view and resources. This approach is binding together web 2.0 related and enterprise architecture principles to find effective means of service solutions to real needs. Service fields such as health and crisis management are in central position, as information from users is valuable

and at the same time enterprise resources essential to manage the services. CCA can be seen as a larger context than EA or as an expanded architecture (Han, 2009). Figure 7 presents the scope of the CCA.
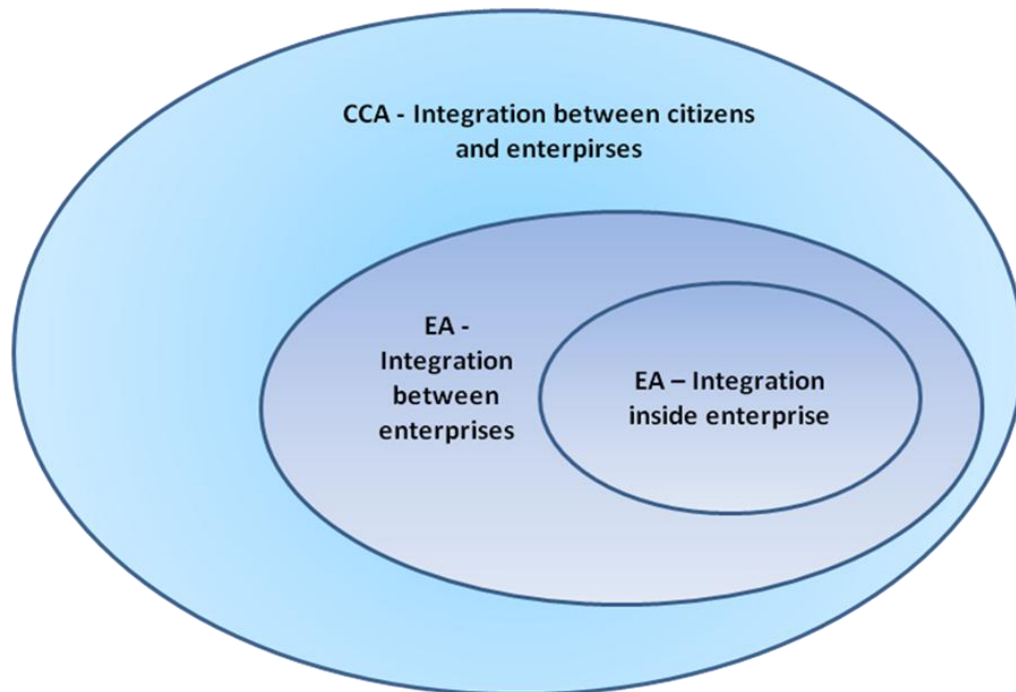

Figure 7: The scope of the CCA (Han, 2009)

Hämäläinen and Itälä (2009) identify also a number of challenges that CCA is facing. First challenge is to facilitate the "mental change" of both citizen and professionals. This is the starting point and actors involved need to realize the benefits of collaboration. Second challenge is managing multitude of different systems and interfaces by users. In the current situation, services are offered trough different service providers and interfaces causing confusion when entering into the services. Third challenge is to find the actor or stakeholder who takes responsibility to enforce CCA. This is important, as trust between stakeholders is crucial. Fourth challenge is finding the business models, which create incentives and benefits for all involved. Fifth challenge identified is the opportunity for new service providers. Challenge is how to create opportunities for new service providers to access in to the market and accelerate CCA. Finally, to earn benefits fast, nationwide

roll-out and large user base is important. Challenge is to leverage services in short time and nationwide.

4.1.3 Enterprise Architecture

Enterprise architecture (EA) was developed to meet the challenge of increasing complexity and the cost of information systems inside the organizations as well as between organizations. In addition, there was a need for better alignment of expensive and complex systems and business needs. (Sessions, 2007) In EA's 20-year history, many of different methodologies have been developed. In this part, two of the most widely used methodologies are introduced: The Zachman Framework and The Open Group Architectural Framework (TOGAF).

Before introducing the methodologies, definitions of architecture and EA are presented. IEEE (2000) defines architecture in the following way: "The fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution." This definition leads to EA definition By Sessions (2007): "An architecture in which the system in question is the whole enterprise, especially the business processes, technologies, and information systems of the enterprise."

The Zachman Framework

John Zachman's framework is providing a way to view systems from many different perspectives and to show how these are all related. It was the first framework to consider models for different roles and how these act in a complete system. Framework is a taxonomy which includes 36 cells organized into six columns and six rows. Six rows include descriptions of designing an information system. These are scope, enterprise or business model, system model, technology model, components, and operations. Each of the rows construct a different model structure as they present different role and different set of constrains. Rows are mapped into the columns in a grid. Columns include question words what, how, where, who, when, and why. These mean issues data, function, network, people, time, and motivation. Original framework was developed in 1987 and extended in 1992. (Sowa and Zachman, 1992) Today, the full grid is used with the latest addition of operations instance classes. Figure 8 illustrates the latest framework.

The challenge that framework highlights is that if one of the cells is modified this impacts other cell too. It is important to be aware of impacts as negative side effects need to be

eliminated in order to be successful in the future. Zachman is also noticing the challenge of describing the content of a cell in different languages. Framework is described with conceptual graphs to overcome representation problems. (Sowa and Zachman, 1992)
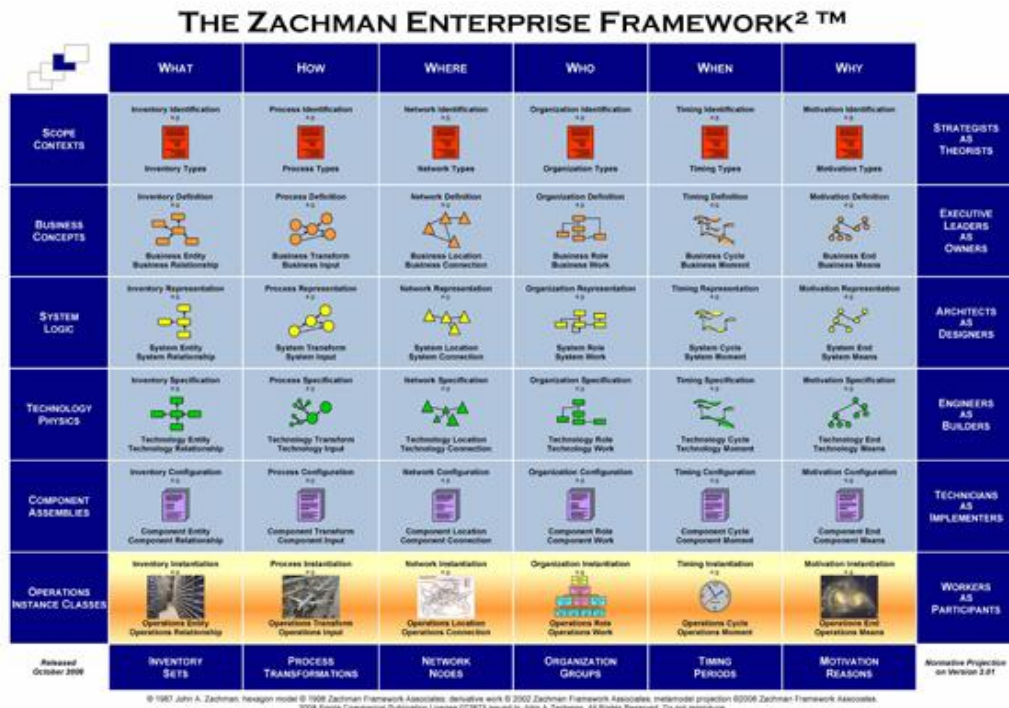
Figure 8: Zachman Enterprise Architecture Framework (Zachman, 2009)

The Open Group Architectural Framework (TOGAF)

TOGAF architecture has two meanings depending on the purpose it is used for. These are:

1. A formal description of a system, or a detailed plan of the system at component level to guide its implementation

2. The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time (TOGAF, 2009)

TOGAF approaches enterprise architecture in dividing it into four categories. These are business architecture, application architecture, data architecture, and technical architecture. Purpose is to identify artifacts that are important in enterprises success. In addition,

TOGAF treat enterprise architects in levels. Most generic level in enterprise continuum is foundation architectures. These are principles that are common in all IT organizations. Next level is common system architectures. These can be seen in many organizations but not all type of organizations. Industry architectures define principles that are common in organizations in specific domain. Most specific level is organizational architecture. It defines architecture principles that are specific for the given enterprise. (Sessions, 2007)

Organizational architectures are built on process which is called the Architecture Development Method (ADM). For this reason, TOGAF is often called in literature as architectural process more than a framework. ADM includes nine phases, first being preliminary phase and last eight forming a iterative cycle of architectural development. (Sessions, 2007) ADM is illustrated in Figure 8. As a result, ADM produces outputs that are outcomes of the effort such as process flows, project plans, or architectural requirements. These outcomes are defined, structured, and presented with the TOGAF Architecture Content Framework. It classifies outcomes in three categories a deliverable, an artifact, and a building block. (TOGAF, 2009)
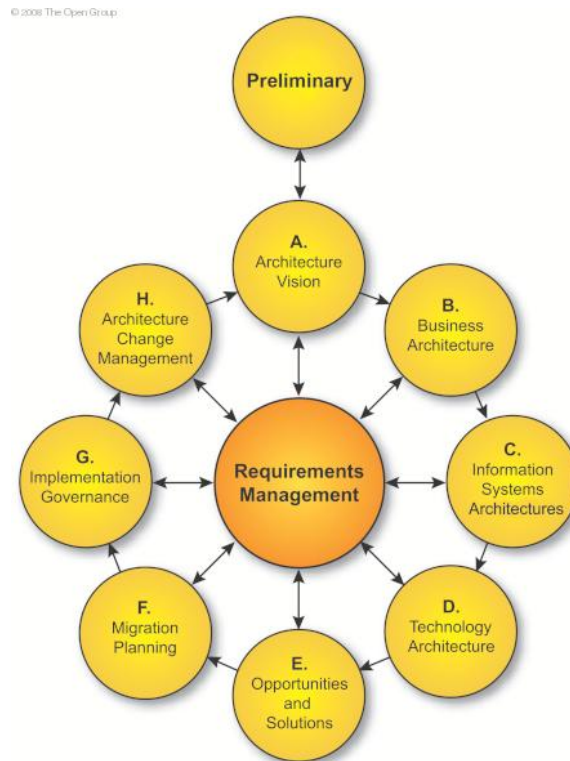

Figure 9: The TOGAF Architecture Development Method (TOGAF, 2009)

4.2   Features Affecting Mobile Phone Use

4.2.1   Diffusion and Usage Patterns

Mobile phones are reaching more people in developing countries than any other communication device or method before. This effect is seen especially in the poor rural areas where landline coverage has traditionally been low. Mobile connection is already covering 80 per cent of world's population bringing also poor into the reach of mobile services. Even that coverage is already in place in major part of the world, there is still large cap between coverage and mobile phone penetration. (GSMA, 2009) However, mobile phone usage growth has been significant in recent years and among others low income countries containing world's poorest 1,3 billion citizens identified by World Bank (2007) are participating into this growth. Same data statistics reveal that despite of the fast growth of mobile usage internet availability, enabled phones, and use is still considerably low especially in low income countries (WorldBank, 2007; Heeks, 2008). This causes restrictions when implementing services and services need to be implemented to meet these criteria if necessary (Heeks, 2008). It is also pointed out that as developing countries are late entrants in this field, they can benefit from the situation and access markets faster, as global critical mass, standards, and dominant designs have already been established in the developed markets (Rouvinen, 2006).

As the poor in the developing countries are prioritizing mobile phones into their everyday life, they are in most cases in touch with the communications technology for the first time of their life. Thus, making internet and other communication networks reality for them in the future (Beardon, 2009). This differs greatly from developed countries where mobile access and mobile internet is just a continuum of fixed telephone and computer access. Due to these facts, usage patterns and service creation is different in developing world (Beardon, 2009). This provides opportunities to introduce new methods to implement services and at the same time causes challenges especially in adoption of new services. One challenge is how to reach large installed base and to maximize network externalities, which is important especially in the developing countries (Rouvinen, 2006).

Users in the poor areas possess ideas to innovate in a service creation and new usage patterns suited for their needs. Evidence of this is the common use of shared phones and beeping. Developed world citizens are used to own personal mobile phone but this is not the case especially in Africa where shared public mobiles are common way to use mobile phones. Phones can be shared with family, friends, or neighborhood. Most succeeded business model for this is the Grameen Village Phone in Bangladesh, where local women

are offering mobile services in own villages as entrepreneurs. This approach have increased the income level of the entrepreneurs and made the services affordable for the users. However, shared use need to be considered when delivering personal information to a phone. Another mean of use that has been recognized also in the literature is beeping. Beeping means that caller is intentionally hanging up before called party answers the phone. This is one way to leave messages and to inform other party without needing to pay for the call. (Donner, 2005; Donner, 2007; Souter et al., 2005)

Other issues that past research and experiences has revealed are mobile phones efficient substitution for travelling, enabler to expand social networking, and voice services priority. In places where distances are long or travelling is slow, mobile phones are offering efficient way to communicate and share information, leaving time for households and businesses to carry out the daily activities. Another issue is strong social capital. Mobile phones have made it possible to communicate with family members, business partners and community members. This is extremely important especially in places where immigration is common and distances long. In addition, emergency situations have increased the value of mobile phones adding social capital for the poor. Beardon (2009) has also pointed out in her studies that in South Africa voice service outweigh messages approximately three times in urban and 13 times in rural areas. (Beardon, 2009; Donner, 2008; Kaplan, 2006; Waverman et al., 2005)

In spite of enormous growth of mobile penetration, there are still many issues to be considered in order to expand the actual use of mobile phones among the poor. These are for example political environment and pricing. Political situation in a country can be restricting and situation in spectrum, competition, tax, and pricing issues are important to notice when implementing services. Waverman et al. (2005) suggests the need for regulatory policies that favors competition to increase the diffusion of mobile phones. As an example, Kenyan government cut the taxes on mobile phones to accelerate the penetration of mobile phones. However, taxes in mobile services remains on the highest level world-wide in many African countries, increasing the price of the services. (Cellular-News, 2009)

4.2.2 Operator and Payment Method Issues

Mobile operators are the central stakeholders to impact the use of mobile services. In order to be able to use the phone, operators charge users for the services such as voice, SMS, and data. They are also in charge of the network coverage and investments of the network. In order to bear the prices and keeping the network usable, income is crucial. In regions where

household income is low, citizens can not afford to use much on communication services. This situation highlights the problems in many of the regions. As Pade et al. (2009) clarified in the report; most poor in rural South Africa can not access the mobile services, as prices are too high. In this subchapter, aim is to briefly scan the bearer services price situation in four countries: China, South Africa, Kenya, and Liberia.

Table 5 presents the monthly sub-price basket, mobile sub-basket per cent compared to GNI per capita, price for one minute call, price for one SMS, and price for one mega byte (Mb) of data. In addition to the service prices, it is important to notice that device and charging costs need to be added into the monthly price. Data is gathered from the database of MobileActive (MobileActive, 2009), internet pages of mobile operators in South Africa, and Kenya (Vodacom, 2009; Safaricom, 2009a), and contact in Liberia. Liberia statistics are based on local contact and are approximations. Data was received at the interview of the birth register case in Liberia. The interview was held 17.09.2009 in Helsinki, Finland.

Price basket for mobile telephone service per month is defined in the following way:

The mobile cellular sub-basket is based on the 2001 methodology of the OECD low user basket, which reflects the price of a standard basket of mobile monthly usage in US$ determined by the OECD for 25 outgoing calls per month (on-net, off-net and to a fixed line), in predetermined ratios, plus 30 Short Message Service (SMS) messages. (ITU, 2009)

Table 10: Mobile cellular prices in US$ 2008-2009

Country	Mobile sub-basket	Mobile sub-basket (% of GNI per capita)	Price of 1 min call (on/off-network)	Price of one SMS	Price for 1Mb of Data
China	2,8	0,2	0,09	0,01	Not available
South Africa	12,3	2,6	peak hour 0,33/0,38 non-peak hour 0,19/0,22	0,11	0,265
Kenya	13,4	23,7	0,21/0,38	0,05	0,109
Liberia	Not available	Not available	0,05-0,12	0,06	0,250

Statistics reveal that price for call and SMS varies greatly in different regions. As prices are low in China in both call and SMS service, South Africa and Kenya users are facing relative expensive service prices. Especially in Kenya, prices compared to income level are extremely high. In addition, price differences between voice and SMS in different countries are worth to notice. Mobile data statistics are gathered from prepaid non bundle rates. Data rates from China were not found that meet the same requirements. Many operators offer also more expensive data bundles and in Liberia also hour rate without restrictions on amount of data. These were left outside the scope, even that the unit price was lower in many cases. As it can be seen, data rates are relative cheap at the moment, but subscription rates are still low (MobileActive, 2009). There is still evidence that especially in Africa internet connection is made mostly trough mobile phone and investments in mobile internet are growing also in the other developing countries. This is important for the future service creation processes. (Beardon, 2009; Yan, 2003)

Statistics are gathered from the prepaid prices because that is the dominant payment method in majority of the countries. In Africa prepaid cards are used by more than 80 per cent of the users. Overall, future challenge is to enable free of use for end users or extremely low prices, as the communication technology is theoretically available for billions of user at the base of the pyramid who can not afford to pay much for the service. This can also boost the use of services, as the price structures enable more users. One current implication is beeping that was introduced in previous subchapter.

Other financial issue that past studies and experiences reveal is the use of voice as a valuable exchange currency. Operators for example in Kenya and South Africa offer transfer services, where prepaid customer can transfer voice time against a small fee to another user in the same network. This has led to the fact that voice time can be seen as a alternative currency, which can be used without bank accounts or incurring high bank charges. (Porteous, 2006) On used service in Kenya is M-PESA, in which user is able to send money using mobile phone number and service ID to send money or withdraw physical money from M-PESA agents. Service can be used also over different mobile operators' networks. (Safaricom, 2009b)

4.3   Service Categories

4.3.1 mHealth

Health issues in the developing countries have been one of the most challenging issues globally. Today, more and more people are in the reach of mobile phones and the potential of mobile phones in health issues have been recognized. Thus, opening new opportunities for poor to access health services and improve the quality of their lives. As the mHealth field is still in its infancy, research, standardization, and regulation is following behind the new service solutions. The future challenge is to standardize data in order to be able to transfer it between systems and countries. Report by VitalWaveConsulting (2009) introduces 51 mHealth projects which are categorized in six application areas: Education and Awareness, Remote Data Collection, Remote Monitoring, Communication and Training for Health Workers, Disease and Epidemic Outbreak Tracking, and Diagnostics and Treatment Support. Below, each of the areas is presented briefly trough example cases.

Education and Awareness

Project Masiluke was established in South Africa to fight against HIV/AIDS. Basis of the project is to send text message to users' mobile phones and encourage them to be tested and treated for HIV/AIDS. Text messages are used for directing users to call AIDS Helpline for further information about testing and treatment. Volume of the text messages is approximately million per day. Low income levels and lack of airtime was taken into account as people could "beep" to Helpline and staff could call back to the phone number. Goals for the project are to raise awareness, increase the treatment of those infected, and to decrease the spreading of the disease. In South Africa only, fraction of the infected people knows their status and testing is in important role to raise the awareness. The project has proved to have success already in the first three week pilot time and the challenge is to scale the service into different networks and also into other purposes such as tuberculosis treatment. Project members have also identified success factors for the project such as strong local partnership, enabling innovative usage patterns such as "missed calls/beeping", and measuring the data. In addition, text message are send in local languages to provide the service in different regions. (VitalWaveConsulting, 2009)

Remote Data Collection

EpiSurveyor is a data collection tool created by non-profit organization DataDyne Group. First pilot programs were launched in 2006 in Kenya and Zambia. EpiSurveyor is a free,

open source, easy to use application that enables health workers to create, share, and deploy health surveys on mobile phones. In the pilot projects, health officer used PDAs to gather administrative information such as medical supply levels and training status of the clinic staff. In Zambia EpiSurveyor was used also to conduct a vaccination survey. To provide more sustainable solution, aim is to assure local knowledge in programming, designing, and deploying health surveys. During the pilot cases, new needs arose in Kenya and application was easy to modify to meet the needs and scaled to Zambia due to the agreement to share the code for others interested. Based on the successful results of the pilot projects, EpiSurveyor is implemented in additional 20 sub-African countries in the near future. (Kinkade and Verclas, 2008; VitalWaveConsulting, 2009)

Remote Monitoring

The Cell-Life Project is addressing HIV/AIDS issues in South Africa with remote "Aftercare" program, which allows users to communicate with health workers at home. Health worker visits patients home to talk and to gather information such as medical status, adherence to medication, and other relevant factors. This information is then sent by SMS to central database for further investigation. The goals of the program are to reduce treatment errors, to increase data about the disease, and to increase comfort of the patients. However, scalability has been problem as language, network, and payment coverage is not reaching the masses. (Kinkade and Verclas, 2008; VitalWaveConsulting, 2009)

Communication and Training for Health Workers

The Uganda Health Information Network (UHIN) is focusing on information sharing between rural clinics and regional health centers. Clinic workers receive information such as treatment guidelines, education materials, newsletters, essential drug lists and databases, and international news articles via PDAs. In addition, clinic workers are required to send data back to regional health centers. Project has succeeded in efficient data collection and provided better health services to citizen, including healthcare planning, resource allocation, and delivery. In addition, project provides savings in money and offer better job satisfaction and retention for staff members. Because of the positive outcomes, project is expanded into two additional countries in the near future: Mozambique and South Africa. (Kinkade and Verclas, 2008; VitalWaveConsulting, 2009)

Disease and Epidemic Outbreak Tracking

FrontlineSMS is a worldwide bulk SMS message delivery program. It is PC-based software application running in GSM network, thereby working also without internet connectivity.

Software communicates with PC via mobile phone or modem attached to computer with USB cable. It is designed especially for NGOs to conduct surveys, to run awareness-raising campaigns and competitions, and to simply offer communication channel for fieldworkers and supporters. FrontlineSMS has been used in several countries and campaigns, including Africa-wide campaign about avian flu outbreaks. For further development, users are encouraged to share views and give feedback in an online forum. (VitalWaveConsulting, 2009)

Diagnostics and Treatment Support

Nacer is addressing the problem of maternal and child mortality, which is still one of the major problems in the developing countries. The goal of the project is to decrease by half the number of maternal and infant deaths in the rural Ucayali region in Peru. Project is based on Voxiva's solution, which allows field workers to share information with any telephone including mobile phone and internet technology. Information is gathered into the central database and is available for use in real-time. With the system, entire health ecosystem is able to send and receive information about patient health, provide referrals and follow-up care, and track supplies and disease outbreaks. With real-time data and access to patient health record of pregnant woman, regional health workers can send messages and other support to local actors to ensure that woman is receiving appropriate care. (VitalWaveConsulting, 2009)

4.3.2   Crisis Management

In catastrophe and disaster situation, mobile phones play important role in sharing information and connecting people and rescue resources. In addition, other types of crisis such as food shortage or dryness are potential areas to benefit services that can be implemented with mobile phones. Kinkade and Verclas (2008) introduce humanitarian assistance chapter in their study about mobile phones effectiveness in catastrophe situations. Three phases are presented: early warning systems, immediate disaster response, and long-term reconstruction. Research emphasize the importance and co-operation of governments, mobile operators, and relief organizations to ensure that communication networks are available and services can function in emergency and disaster situations.

Early warning systems are usually based on broadcasting and alerting information via text messages. Future challenges are to make solutions more effective, assure strategic investments, agree on standards, and coordinate relief organizations to exploit opportunities of mobile phones.(Kinkade and Verclas, 2008) Potential of early warning systems could be

realized for example in tsunami or storm type of situations where last minute warning is valuable to the citizens in disaster regions. Disaster response systems play crucial role after the accident as relief supply management and economical recovery are extremely important for the rescue operations and future development (Kinkade and Verclas, 2008).

Kinkade and Verclas (2008) present two case studies in the crisis management field: Food aid service for refugees in Iraq and facilitating communication services in earthquake situations in Peru and Indonesia. Food aid service is targeted for Iraqis refugees that are situated in Syria and are suffering from extreme poverty and lack of food. As distribution of food and informing the families about food delivery was inefficient, text messages solved some of the problems to reach families. Organizers of the program send text message to phone numbers in the refugee contact list with the information of distribution centers and locations of the food packets. Eligibility of the right to the food packet could be checked at the website of the program, limiting the misunderstandings of eligibility. The first pilot consisted of 6 600 refugees and successful implementation provided fast growth of the target families. In 2008, already 362 000 refugees are included into the service.

Mobile phones are valuable also in earthquake, flooding, and other crisis situations where organization of rescue parties is critical as well as connecting to people at the disaster region. Connection is important between all parties including family and friends that are separated because of the disaster. Telecoms Without Borders is a French NGO and an expert to reestablish mobile communication networks infrastructure. After an earthquake in Peru and Indonesia, organization was able to reestablish with local partners connections for mobile phone in 24 hours from the accident. With the mobile phones and communication, relief workers were able to coordinate the rescue operation and save lives. (Kinkade and Verclas, 2008) In addition to rescue management and connecting people together, mobile phones could be used to share important information from disaster regions by individual users. In flooding, important information could be water levels, locations of possible victims, and other issues related to survivor of people and nature. In earthquakes, rescue operation could be managed more efficient if individual users could take part into the rescue operations by sharing valuable information from the field. Challenge is to find the means to facilitate the cooperation between authorities, official rescue teams, and individual citizens to work together more efficient and save time for people in critical condition and rescue need.

5   Case Studies

Case studies include two cases: Mobile Geoservices in Africa (mGesa) and Birth Register in Liberia. Both cases are in their initial phases to be implemented in the near future and use mobile phone to share information between different stakeholders. Cases are analyzed from the NGO point of view, as both cases include NGO as a key stakeholder and information sources are mainly representatives of NGOs involved.

Analyses of the cases are based on meeting, interviews, and material distributed in the data gathering situations of the case. Meeting and interview settings are explained in chapter 2.

5.1   Mobile Geoservices in Africa (mGesa)

5.1.1 Background

Aim for this project is to gather information about point of interests, routes, and areas to form maps and to share information through internet and mobile phones. The first pilot of the project is located in Kenya, where lack of maps and location information is hindering the development of the regions. Information including picture is gathered with mobile phone with Global Positioning System (GPS) capability and stored on phone's memory. Along with location information and picture, important information about the target is added into the target file. Additional information could include for example condition and water level of wells; general condition, amount of drugs, and training needs of health clinic workers and facilities. This information could help in development of regions as the information about shortage of public services and capacity of local citizens are better known and seen.

Leading organization in this solution is Plan International, a children's development organization. Need for the Geographic Information System (GIS) based solutions and location information is recognized inside Plan's organization as well as in regions that lack this information. To bind these needs together Plan International started to seek collaboration partners in order to start the planning of the solution. At this moment, project is in its initial phase and prototype is planned to be tested in the year 2010.

Key goal for the solution is to gain positive benefit for the children and most vulnerable people in the target regions, as mission for development organization Plan is to achieve lasting improvements in quality of life for children in the developing countries. This could be realized with gathered information, which enables more efficient allocation of resources and ability to deliver relevant development aid to the target regions. In solutions viewpoint, goal is to develop multifunctional, scalable, and adaptive solution that could be used in different regions by all organizations and individual interested.

5.1.2 Usage

Use of mGesa is based on mobile phone, which possess the GPS capability, user who captures the data, central database where the data is stored and distributed, and device to analyze and utilize the information. In the initial phase of the solution, users are local Plan Kenya fieldworkers, who capture the data in their S40 software platform-based devices and store it in the mobile phones memory card. At the pilot phase, data is transferred to the computer via cable at the Plan program unit office and then send to the central database via internet. In the future, plan is to send data from the field directly to the central database using mobile networks, fastening the data transfer between the database and the users. Future plan is also to extend the user base to the citizen and local individuals in the rural villages, to allow locals capture information that is directly relevant for their needs.

Data, that is stored in initial phase of the solution, is divided into three categories. Each category includes detailed targets as presented below:

- Point of Interest (POI) - School, well, health center, religious institute, administrative office/center, ICT center, police station, building, electricity service point, telephone service point etc.

- Route - River, road

- Area - Program unit, community area, village, forest, district, hill, lake, land use, field

Each of the POI, Route, and Area information is finalized, approved, and published at the server end in the central database. In each target, additional information is attached for the

further analysis and use. Access to the maps and information is done via internet using web browser or mobile phone. Central database and internet connection provides accessibility to the map and information internationally. Information can be used for several different purposes. These are development program planning, influence authorities to establish or improve public services as information increases, to track and react on catastrophe regions before disaster such as flooding strikes, and disseminate more accurate information on sponsored children in the villages.

The pilot phase includes two to three program units of Plan Kenya and approximately 50 field workers. These field workers use 10 per cent of their work time in gathering the information on the target regions. Funding for the project is planned for the pilot phase first and after experiences on pilot for larger implementation. Outside funding is needed before the actual solution is running.

Benefits that are clear in this solution are the potential of maps and additional information in the work of Plan and other actors in the development work. Issues such as easiness of data gathering, sending, distributing, and central database solution are also enabling efficient use of information. Other benefits are the possibility to do influence work towards decision-makers of the local regions and increasing technology knowledge that is transferred into the local actors and users. In the pilot phase, server development is done in University of Nairobi to engage local people into the technology solution side.

5.1.3 Stakeholders

Stakeholder analysis starts by introducing the stakeholder role map. After that, focus is on NGO's roles, incentives, and thoughts about improving the service.

Stakeholders are divided into two main domains: NGO domain and technology domain. Between these two is service provider who is organizing the technology side to meet the NGO domain needs. Figure 10 presents the involved stakeholders at the initial phase of the service. Each stakeholder is briefly introduced after the figure.
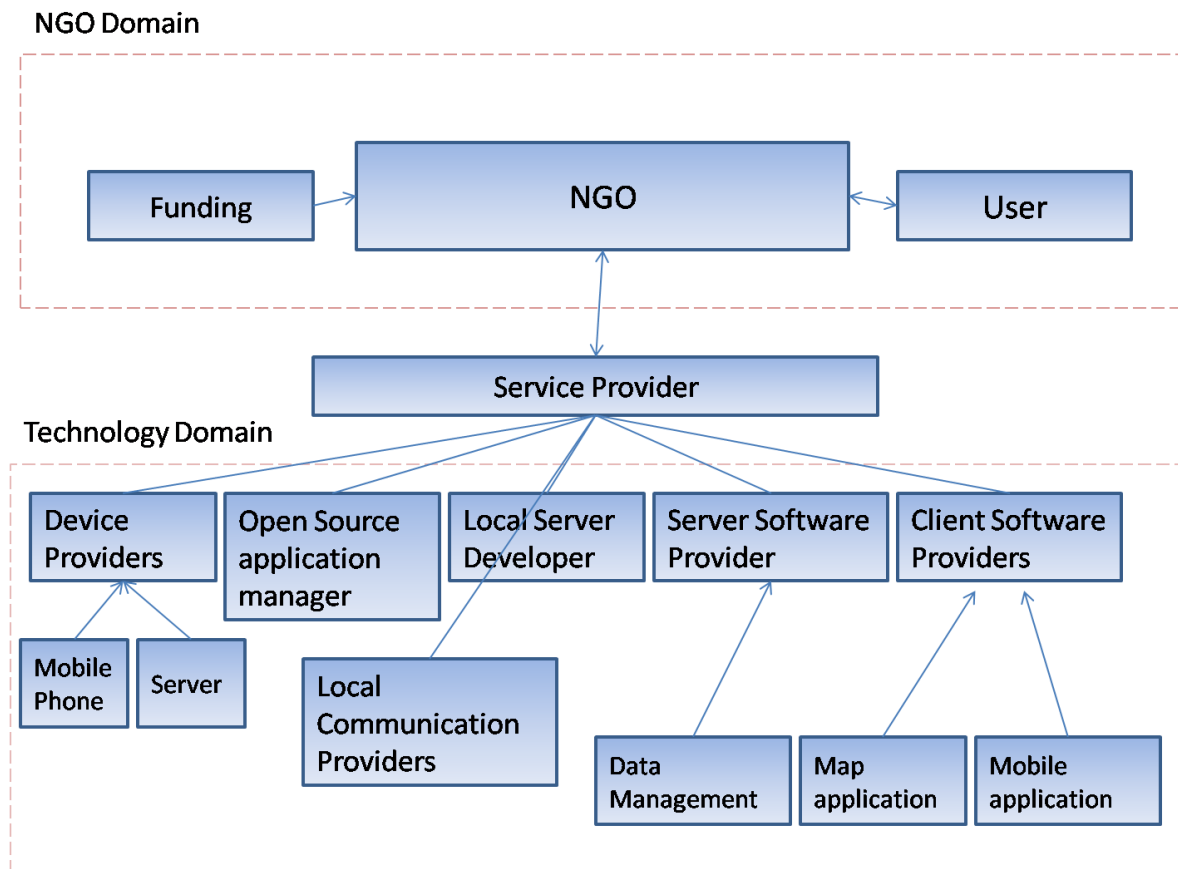
Figure 10: mGesa stakeholder role map

NGO is the client stakeholder whose interest and needs are implemented. In this case, client is Plan International including Plan Finland and Plan Kenya.

Users are local Plan Kenya fieldworkers and primary benefiters are local citizens.

Funding partners are providing the monetary resources to design, implement, and develop the service.

Service provider is managing actor between NGO and technology domains. As NGO does not possess sufficient knowledge about technology, need for service provider is recognized. Purpose for service provider is to map NGO domain needs and technology domain design into functional service. In NGO point of view, they only see service provider, not the technology providers.

Client Software Provider is responsible of client software development based on the requirements that follow the needs of NGO domain. Client software providers are divided into specialized map and mobile application providers.

Server Software Provider is responsible of server software development based on the requirements that follow the needs of NGO domain. At this point, server software developer is located in Finland.

Local Server Developer is managing the development of pilot phase server solution and is located in Kenya.

Open Source Application Manager is managing the possible open software application solutions to reduce the costs and increase the efficiency of the service. Open software applications are supporting the core applications. Open software stakeholder is academic institution in Helsinki University of Technology.

Device Providers are divided into two stakeholder groups: mobile phones and servers. These stakeholders are only providers of the specific devices. In the pilot phase, solution is build on top of Nokia mobile phones, which are S40 software platform-based devices.

Local Communication Provider is offering the internet connection and in the future mobile communication services to transfer the data between server and end user device.

It is important to notice that stakeholders, their roles, and relationships change during the time. Each stakeholder also possess own incentives and these guide the role and actions for each stakeholder. As the case is only in its initial phase, evidence about the future roles is impossible to analyze. It can be predicted that funding parties' roles change as service is shifted more towards local stakeholders as well as development of software and service as a whole.

Role of NGO is to bring end-user experiences, views, and needs available to all involved and to make sure these are the issues solution is solving. This includes conducting requirements and needs specification with local stakeholders and feedback trough pilots and testing in target regions. NGO does not take part in technological decisions unless they are in conflict with the local conditions. These conditions could be mobile phone base or availability of communication infrastructure. This means that solution need to meet the major mobile phone features, in this case S40 software platform-based phones, which are the most common mobile phones in the target region, and low connection availability for mobile data.

NGO identifies number of incentives towards the project. First is to help local children and vulnerable people to improve their standard of living. Second is to increase effectiveness of their work in the field and to develop systems to intensify work inside the organization. Third incentive is be part of interesting project where NGO, company network, and public sector is working together and to gain experience from such projects. Furthermore, NGO is taking the active role in the future in developing the solution, as it will intensify its resource sharing and allocation in the target regions and inside the organization. In the other hand, it is not Plan's incentive to spread and scale the service for other actors such as NGOs and companies. This action should could from technology providers or other stakeholders interested.

5.1.4 Characteristics

Characteristics are identified in the design phase of the service. They are the requirement and need specification characteristics that are set for the mobile phone project. Below, characteristics that were identified in the data are explained.

Easy to Use - Service needs to be usable in different countries, different continents by different users and backgrounds. Use of the service needs to be straight forward, intuitive, and simple enough so that need for training is limited.

Environmental Issues - Environmental issues include climate and cross-country features. In Kenya, for example heat, sand, and dry climate are taken into account when using devices.

Low connection - Service need to be designed to meet the connection features. These are for example low or limited connections in mobile data traffic.

Ability to Work in Unstable Networks - Service need to be designed in the way that it can recover from link failures or other unexpected situations in the network infrastructure.

Data in Analyzable Form - Data gathered from the field need to be in the form that is can be analyzed easily.

Cheap - Devices and all equipment involved in the service need to be cheap. This means that requirements for devices need be designed to meet the low cost device features.

Sustainable Technology - Technology used need to be sustainable as long as possible. Technology changes are kept as low as possible to make the solution more sustainable and cut the cost to develop new versions because of technology evolution.

Scalable, Ability to Modify - Service need to be modified into the local environment. This includes such as language variations and local data gathering categories to be used.

Cultural Issues - Cultural issues are can be different between countries as well as inside the country. It is important to examine what is the culture and attitude towards mobile phones. Mobile phones can cause for example problems in relationships and status of citizens inside the communities.

Prepare for Unexpected Situations - Regulations, policies, social, and psychological issues are examples of causes for unexpected situations. Best way to learn from the target region is to visit the place and do the everyday routines like locals do. This could reduce the amount of unexpected situations and problems service could face.

5.1.5 Scalability

Scalability issues this thesis is covering are geographical, user, and service field scalability. In the mGesa case these issues are covered only partly and superficially. In a pilot phase, service is implemented in at least two different regions and these use same centrally managed database for the information. This pilot reveals if the service could be scaled to cover larger area of a country. If service is implemented in different country, it can theoretically be replicated as each country possess own database of the country information. Moreover, aim is to implement the service so that information categories are scalable for different needs in the future.

Scalability among users is not considered deeply yet. Issues that can affect user scalability are price of the service, usability, and possible licensing decisions. Due to a central database, it is possible to scale larger amount of users into the service but this remains to be investigated in the future. Technical and cultural scalability issues are not yet considered. Potential for the service to be scalable and replicable are evident, but it remains to see how the pilot project is succeeding.

5.1.6 Sustainability

Sustainability issues are considered from the beginning of the service design. In a pilot phase, server side development is already conducted in Kenya by local stakeholders. Aim is to involve local stakeholders into the service early and increasingly. Financial sustainability issues are only superficially considered at this point of the solution but plan is to find sustainable business plan for the future development and use trough local stakeholders.

5.2   Birth Register in Liberia

5.2.1 Background

Liberia is in its post-war reconstruction phase after several years of civil war. The major challenge is to re-establish key functions of public administration and to offer citizen the basic services in order to re-build the state. Governance out of a Box$^{©}$ is a concept by NGO Crisis Management Initiative (CMI) that is addressing this issue in Liberia. One of the most important public functions identified in early phase of the GooB$^{©}$-concept, is the registering the births and eventually develop the population database. Due to a challenging environment and lack of sufficient means of transportation, birth register service is planned to be executed at least partly trough mobile phones to quicken the process and to offer better access to service for larger part of the population.

Need for the service is recognized by the government of Liberia and the stakeholders involved in the re-establishment processes. Main executive stakeholder that is part of the Government is the Ministry of Health, as it is coordinating the health information management in Liberia. Other key stakeholders include NGOs such as Crisis Management Initiatives, United Nations, UNICEF, and Plan International. To design technical solution, CMI and its partner with the close cooperation of Government of Liberia are addressing the challenging issue to design technical solution for birth registering service. Past experiences are limited into the technology side or other post-war reconstruction situations, but to implement mobile technology into the environment of post-war re-establishment phase is not done before by the stakeholders.

Key goal for the service is to register 90 per cent of the children under five by the year 2012. Incentives for parents to register their children are the birth certificate that is needed for applying to school and for travelling abroad. Other goals are to reach sustainable solution, which could integrate to other key functions of Government of Liberia. Aim is to

exploit the efforts made with this solution to integrate future and possible on-going projects with the system and infrastructure and to harness the knowledge and experiences this project is offering.

5.2.2 Usage

State of Liberia is divided into 15 counties that include different number of districts between one and eight. Each county has county officer and each district has district health officer. District health officers are in charge of the health information and data of citizens under that district. They are the end users of the mobile birth register solution. Pilot phase of the service includes one county and four district health officers.

Registering the births is done at the district health officers' facilities in the rural areas by the parent of the child or some trusted third person of the village and family. District health officer has the mobile phone, which includes application form for the registering information. District health officer fills the form and sends it trough mobile networks to the county office and central database, which is managed by the Ministry of Health. District health officers are certified government employees that are responsible for the accuracy of sent data. When Ministry of Health receives the birth registering data of the child, it is processed and birth certificate is send to the family via county health office. All the process is performed also with traditional paper forms and data is sent parallel via post delivery path to county office and Ministry of Health to backup the data. At the pilot phase, servers that gather data are acquired in two locations: county office and Ministry of Health facilities. These servers are used only for the birth registering purpose. In the future, plan is to use shared servers offered by Ministry of Health, which manage all health information management systems.

Funding of the service is based on Government of Liberia and Ministry of Health. District health officers are employees of the Government and get their income directly from there. Outside funding is needed in the initial phase when the service is planned, designed, and implemented. Most of the outside funding is coming from the NGOs and their sources.

Benefits that are achieved from the solutions are diverse. First, access for the citizen is better, as Government is coming closer to the citizens and offer organized birth registration opportunity at district level. This can increase the number of registered as traveling to government facilities is not needed anymore. Second, the speed for the registration process is improved substantially, as condition of road infrastructure is diverse and lack of postal services is slowing the process in the rural areas. Paper version of the registration form can

take several months to reach the Ministry of Health office and can be damaged on the road. Third, the use of new technology is stimulating for the users and citizens. To use and learn about new technology can fasten the rebuilding of services and help future projects at the district level. Last benefit identified is the information transfer opportunity for Government, counties, districts, and citizens. As information is moving faster and more data is available, it is easier to react in disease outbreaks or other issues related to birth data and in the future health data as a whole.

5.2.3 Stakeholders

Stakeholder analysis starts by introducing the stakeholder role map. After that, focus is on NGO's role and incentives.

Stakeholder network is based on Government and NGOs implementing the service. Users of the service are government employees at the district level. At the pilot phase, technology domain is quite limited, as aim is to use stand alone servers and data gathering application already available through mobile phone vendor. Figure 11 visualizes the role map of the stakeholder network. Each of the domain and stakeholders involved are briefly introduced after the Figure.
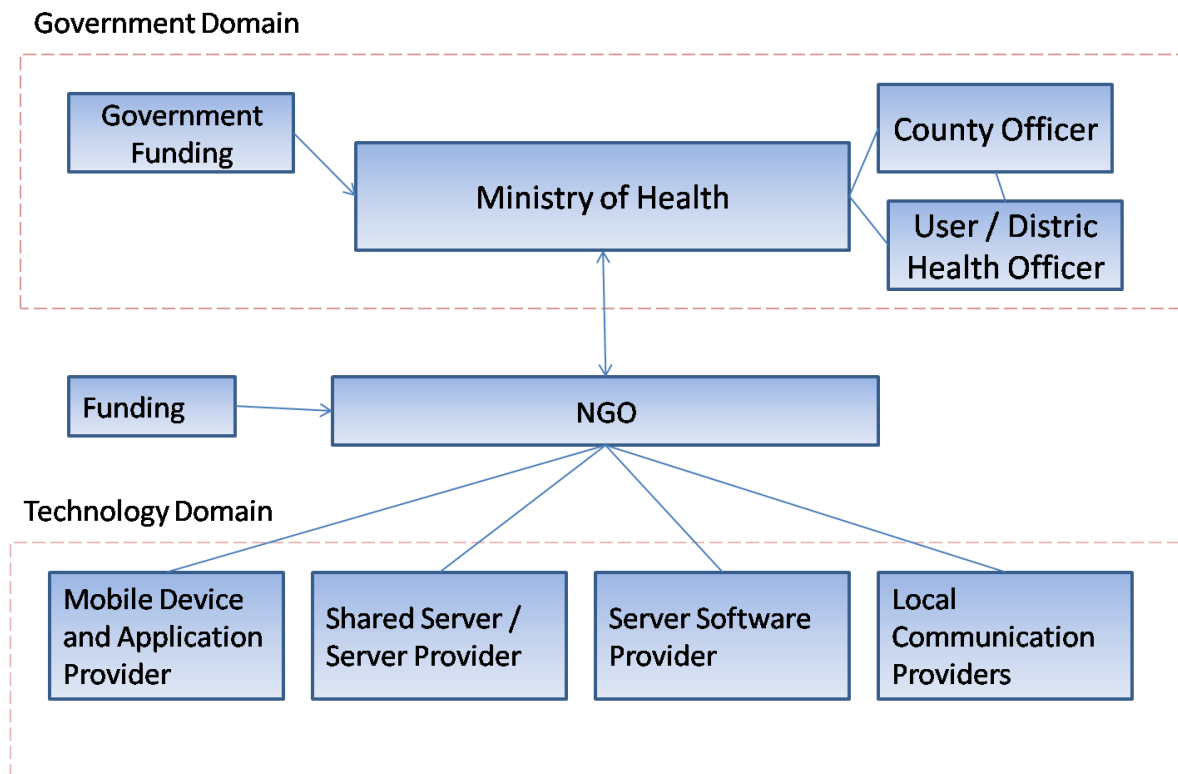
Government Domain

Figure 11: Birth register in Liberia stakeholder role map

Government domain includes Ministry of Health, county office, and district health officer who are the users of the service. As Ministry of Health is part of the government, funding is provided by the Government of Liberia. Ministry of Health is the key stakeholder and act as a client. In a pilot phase, stand alone servers are installed into the facilities of Ministry of Health and county office. Purpose is to integrate the data later on shared servers, which are managed by Ministry of Health and include all health information management systems.

*NGO*s are responsible of planning, designing, and implementing the pilot phase of the service. Acting NGO is Crisis Management Initiative, which is creating the technology side of the service with cooperation of its partners. Partners include technology and funding providers.

Technology domain in this case is quite limited. Crisis Management Initiative is purchasing devices from mobile phone vendor and server vendor. Mobile phone vendor is also providing the mobile application tool for making the mobile application form for birth

register end users. Tool is called Nokia Data Gathering solution. Server software needs to be acquired only for the pilot solution because the plan is to integrate the birth register data into shared servers managed by the Ministry of Health. Local communication provider includes mobile operator as data is sent trough mobile networks.

As project is trying to solve one of the key functions of the Government, change in government role is not obvious. Roles of the NGO and technology domains are more probable to change when post-war phase is over and technology knowledge is shifted more towards local stakeholders. There is also plan to increase user base by 300 field monitors that gather information from the field trough mobile phone and to include University of Liberia more into the service creation processes.

Role of CMI is to be the "state builder". It includes research on how to support post-war countries such as Liberia to re-establish key Government functions and to support and implement such services that improve and intensify the processes. In addition, developing the tools to strengthen the public governance is one of the areas CMI is involved. Birth register service is the first key function that CMI is implementing. Plan is to further develop the service and to seek if the service can be expanded to include other service areas that involve registers as well.

Incentives for CMI are to make impact and to see if the solutions can help to address issues that post-war rebuilding phase faces. Plan is also to increase knowledgebase trough experiences to help other countries in the future that face the same kind of situation and problems.

5.2.4 Characteristics

Based on the data in interviews and materials characteristics are quite limited before the solution is in its pilot phase. Need for the solution came from the government and CMI as partner of the government started to build collaboration network to help in state building phase. Trough conversations and meeting it came clear that services such as birth register are needed. Requirements specification and characteristics for the solution came into consideration as the project was proceeding.

Key characteristics that are identified in this solution are sustainability and ability to integrate with other services. Birth register is identified as one of the key functions of the government and to form complete population database birth registering solution is playing an important role. For making it sustainable, can have great impact on lives of citizen in the

future. It is also clear that integration of other registers and services is making the processes and information sharing more efficient fastening the re-establishment of the state of Liberia. In addition, it is evident that the environment is less than optimal. Service needs to be able to recover from poor connections and failures of mobile traffic. Moreover, service need to be able to handle large amount of data.

5.2.5 Scalability

Scalability issues that are handled in this case are users' scalability, geographical scalability, cultural scalability, and service category scalability. At the beginning of the service design, it was clear that the service could scale into all counties and district health officers. Other users that could use the mobile registering service could be field monitors, which are gathering the population and information from the villages. Plan is to use 300 field monitors and divided them between all districts. It remains to see if these field monitors could be using the mobile service part in their work instead of paper versions. Issues that could rise from the user scalability are the licensing of the software and mobile network connections. Licensing issue requires more investigation in the future. Mobile network connection is available in all districts but the places where it is limited field monitors need to do more effort to travel into the coverage area.

Geographical scalability and cultural scalability issues are quite straight forward in this solution. Goal is to reach entire country in geographical view. Language obstacles are small, as official language in Liberia is English. Each of the employees of the government and field monitors are literate English speaking citizen. Scalability of the solution into other service categories is potential. Integration issues are considered from the beginning and plan is to use as much as possible the same solution platform to other governmental services that require registering in the future. These are such as passport, driver's license, national ID card, health data, and inventory registers.

5.2.6 Sustainability

Sustainability issues this thesis is covering are funding and local involvement. Funding for running the solution is based on Government of Liberia. This fact is important as the money flow is already handled inside the country and local stakeholders. Planning, designing, and implementing the pilot solution are funded by NGOs and other stakeholders, but importance of outside funding is decreasing as the service is running. Involvement of local stakeholders is also considered from the beginning and users are only locals.

Involvement of locals in to the development process of the technology part is under investigation. Aim is to reach local private sector companies and members of university to shift knowledge to local stakeholders.

6   Design Framework

Design Framework chapter includes three subchapters that form a rough framework for addressing mobile service creation in the developing countries. Subchapters are stakeholder analyses, architecture for service design, and platform approach. Each of the subchapters is concentrating to highlight the issues that are relevant for sustainable mobile services and are integral part of the framework. Framework is based on background theory and case studies.

6.1   Stakeholder Analyses

Stakeholder analyses include three subchapters. These are identifying stakeholders, roles, and incentives of stakeholders. First subchapter aims to identify the most important stakeholders that are involved in the service creation and developing processes. Second subchapter analyzes the roles and third subchapter incentives of the stakeholders in a generic manner. Reason for the generic approach is that each project possesses different stakeholders and it is reasonable for this framework to highlight the common findings to be applied in different cases.

6.1.1   Identifying Stakeholders

Purpose for stakeholder identification is to examine stakeholders that are involved in service creation processes and to identify the most important stakeholders for services to reach sustainability. This is done keeping in mind that services should involve users as co-creators of the service and the content. User involvement has been recognized also in other studies as well as in the case studies. Simanis et al. (2008) for example examines second generation PoB strategies, which involve users as business partners and service creators. Case studies are examples of services that are implemented at the village or district level. However, the background and case studies of this thesis have revealed that it is not always possible just to combine citizen and enterprise levels together and share information. In many times, monetary resources, trust, or other major issue of the service is not meeting these two levels. For this reason, trusted third party could be the answer. Third party could balance the monetary need for the enterprise side and enable free of use for the poor citizen.

In addition, trust and data management are other reasons to use trusted third parties. Future challenge is to find business models for trusted third parties to help combine the resources available from both levels and at the same time avoid too powerful situation where trusted third party can hinder the development. Business models for trusted third parties could also involve network of third parties to avoid the power of one party, as pointed out by professor Chatterjee (2009). These approaches could also boost the use of services and help services to scale for large user base. Figure 12 presents the trusted third party idea in visualized manner.
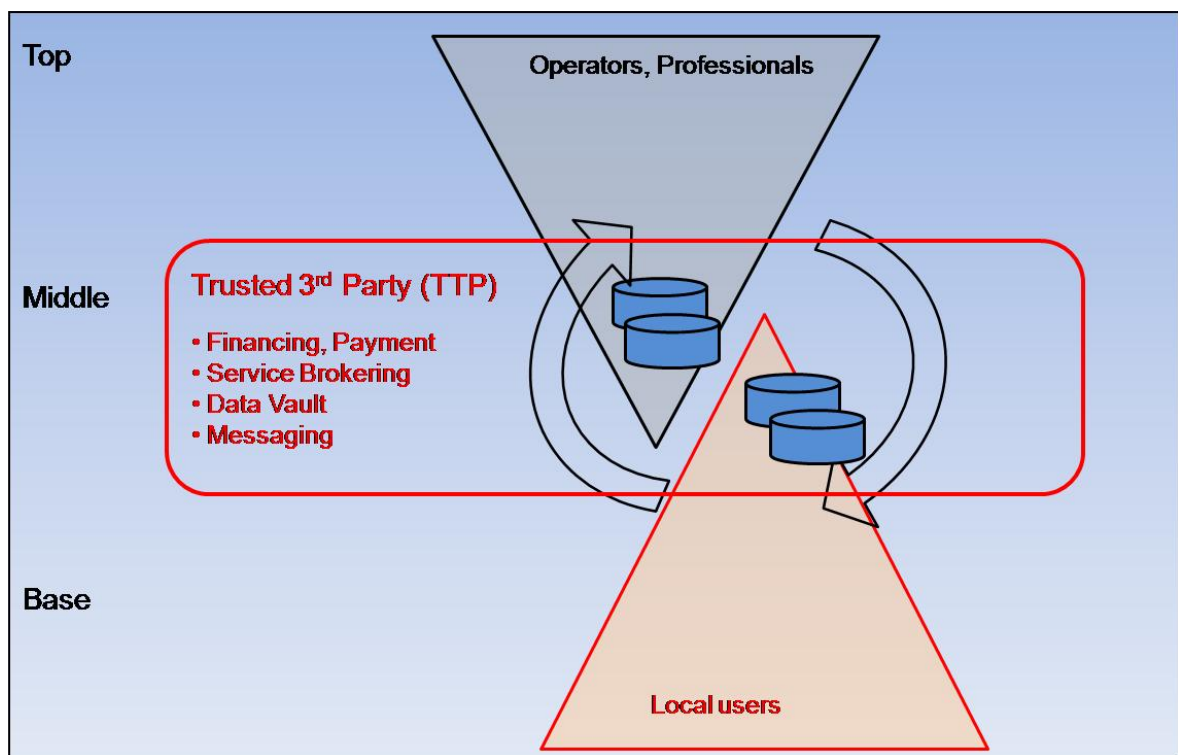

Figure 12: Trusted 3rd party

In addition to trusted third party idea, identification of stakeholders is important in each service creation situation. Case studies and existing literature highlight range of similar stakeholders (Bridges.org, 2009c; Curtain, 2003; Lehr, 2007; Tongia and Subrahmanian, 2006; VitalWaveConsulting, 2009; Vosloo, 2003), which can be divided into three domains: business, technology, and service provider domains. Business domain includes

such as client or owner of the service, funding parties, regulators, and users. Technology domain includes technology providers such as software and hardware vendors, mobile and other communication providers, mobile operators, application developers, and content developers and aggregators. Service provider domain includes actors that are taking care of the overall service creation process. Service provider(s) act usually between business and technology domains as a communication channel and agreement aggregator. This stakeholder role can sometimes be seen as a one type of trusted third party between other stakeholders. Overall, it is important to notice that stakeholder identification is dynamic and iterative during the project and these domains do not hold strict lines between each other.

This spacing into the domains is still not enough to identify stakeholders in order to reach sustainable mobile service. It also leaves out the important issues and stakeholders that are not falling directly into these domains. One of the most important stakeholder identified by the past studies and cases is the NGOs. NGOs can have basically any role and this depends on the project and NGO. Roles can be for example a client in the business domain, content developer and aggregator in the technology domain, or service provider between these two domains. They can also act for example as a funding party, a data aggregator, or trusted third party for data, money or other purpose. Role for NGOs is most likely to change during the project but in many cases NGO has central role in designing, developing and implementing the service. Another important issue is local involvement. As the goal is to reach sustainable service, it is important to engage local expertise and users early into the service design and creation. It is important to find local partners for technological solutions to start transferring the knowledge. To transfer knowledge in long term, involvement of local universities is also worth to examine. As Colle (2005) has pointed out, involvement of African universities in the ICT4D related projects is relevant in global creation and distribution of knowledge.

6.1.2 Roles

Role of each stakeholder can change during the project, as projects usually have different phases. In each phase, new stakeholders are needed and some stakeholders' roles decrease. Bouwman et al. (2008); Tongia and Subrahmanian (2006) introduces three phases that projects usually face. These are technology/design, implementation/deployment, and market/diffusion phases. Technology/design phase stakeholders are in central position to ensure that the service meets the needs of the users. For this reason, role of the local users is extremely important not only in the latter part of the project but also at the very initial

phase. It can be summarized so that users of the service need to be involved in the service creation process from the very beginning as active innovators and designers and place at the central position during the entire project. This could help project also to scale among users, as they are involved early enough. Other stakeholder that is important for services to reach sustainability is the organizer. Services need to have well organized managing practice for it to continue and progress. Overall, it is important to find the most important stakeholders by identifying the roles that are needed and to update this identification process continuously.

Other issue that is worth to notice is the preferred changes in the roles of outside funding parties, especially if they are acting as donators, NGOs, and foreign companies. They should decrease their role in a controlled way as project moves on and is reaching the market/diffusion phase. At this point local companies, government, universities, and all the local actors around the service should increase their role. This is extremely important for services to reach sustainability. It is also good to notice, that if the service is sustainable it can affect the whole industry around the service and region and bring other services and opportunities for the poor.

6.1.3   Incentives

It is clear that each stakeholder has own incentive to be part of the project. These can be for example need-based, mission filling for development organization or company, monetary, educational, or visibility of the organization. As an example, Kinkade and Verclas (2008) introduce service where women users of the devices receive unrelated news about celebrities and other areas of interest as incentive to use the device. This highlights the importance of the incentive analyses on key stakeholders in order to boost the use and development of the services as well as the wide range of the incentives to be considered. For sustainable services, it is important to engage the end users and key stakeholders by identifying the incentives and finding ways to fill these as good as possible. This can give better opportunity to scale the solution and reach sustainability.

6.2   Architecture of Service Design

Architecture of service design chapter introduces two approaches: the dual model and the layer model. The dual model presents citizen and enterprise views and the potential of collaboration of these two views, in order to include citizen into the service creation

processes. Layer model highlights the important issues of integration and architectural approach as a whole.

6.2.1 Dual Model

Dual model approach tries to highlight the importance of collaboration between citizens and enterprises in service creation processes. Knowledge sharing process is iterative and dynamic in nature. Goals that dual model is reaching are the effective use of knowledge citizen possess by involving local users into the service creation processes and to allocate resources more efficiently trough the growing amount of knowledge. It is evident, that mobile phones have made it possible to apply dual model also for the poor in the developing countries. The background theory and the case studies have also pointed out that local involvement, cultural and language issues are important to notice when implementing services in these regions. By involving users in the service creation process, could help to overcome also these cultural and language problems.

In many regions, lack of health care professionals, facilities, and equipment is hindering the development. Same can be said in crisis situations where fast rescue operations and past disaster development need effective co-operation with limited resources. It is impossible to cover all the regions by authorities or special expertise. Information and knowledge from target region can be more accurate, real-time, and easily updated, if done by the end users. With this information, professionals and authorities can be allocated to meet the needs of the poor. Figure 13 presents the dual model in the context of the developing countries. Each of the views is introduced after the Figure.
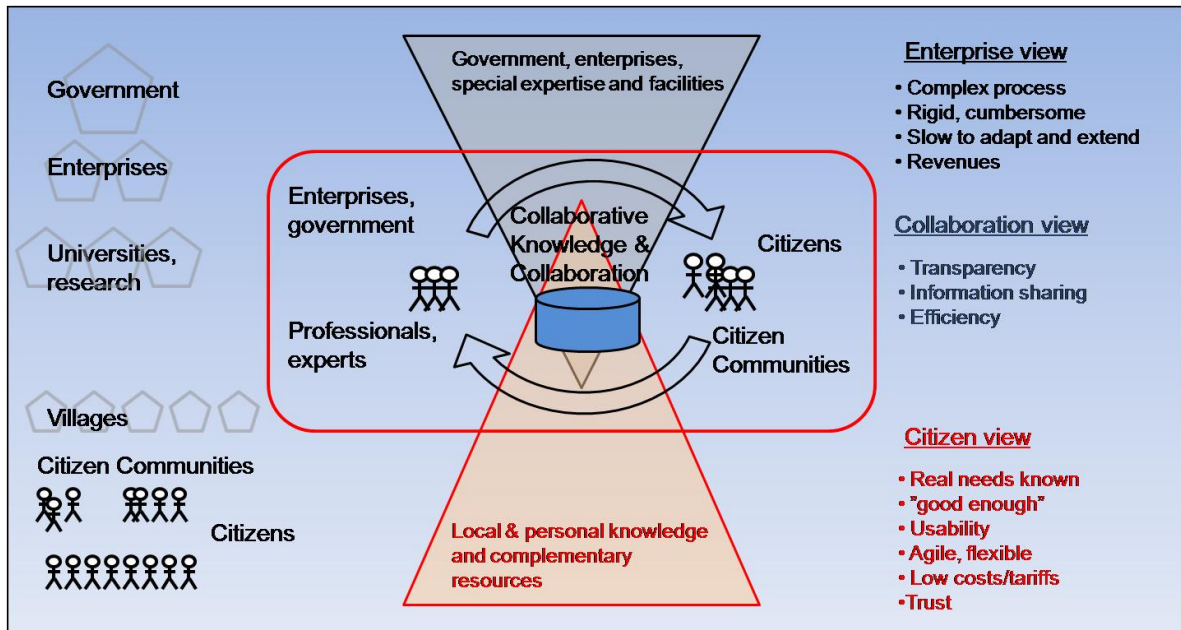
Figure 13: Dual model for the developing countries

Enterprise View

Enterprise view is based on professional skills, political decisions, and monetary resources. Created services are made to meet the needs of the users and to produce revenues for the enterprise. In government point of view, services are offered to the citizen based on the knowledge authorities possess using as less resources as required. These can lead to complex processes and services that are traditionally rigid and cumbersome. In addition, they can adapt and extend slowly to the changing needs of the users.

Issues that enterprise view is raising in addition to above-mentioned matters are limited revenue possibility from individual user, as users can not afford to pay for the service, and trust issues. It is studied that even a small price for health service in poor areas is preventing the use of the service, especially among children and women (Marriott et al., 2009). This issue is essential when designing mobile services in the developing countries and especially at the base of the pyramid. Trust is another issue that might hinder the use of the service. Trust can be formed trough relationship and elements such as confidentiality, privacy, and security. Enterprises and governments might have problems to establish trust relationship with users if users are not aware of the service creation, intention, and information processes that are affecting or contain user related information. Moreover, if there is long history of un-development, crisis, or other unstable situations, direct trust relationship might be hard to establish in the near future.

Citizen View

Citizen view is based on citizen, citizen communities, and village level users, knowledge, and resources. It is evident that citizen at the local regions and villages are most aware of their life and environment. Thus, basic needs are best known by the users. For this reason, citizen level information could be utilized more efficiently if the end users would have opportunities and capability to share this information in order to create services. Moreover, services that are "good enough" in means of easy to use and fast modification are more important than "close to perfect" solutions that take time and money to develop.

The studied material has revealed that mobile phones have strong social and emergency use in the developing countries. In addition, trust is playing major role especially in health, crisis, disaster, and public services in general. Letting users to involve and to see the process and outcome of the service could have impact on the use of the service and trust issues. In addition, knowledge that other village members are using the service could also help to overcome some of the trust issues. In health area, citizen should be able to see their own records and be able to modify them in trusted environment. This could increase the amount and accuracy of the information and help government to allocate resources to the regions where health information reveal needs. In disaster situations, "best enough" solution that allow people to involve in rescue operations by sharing, seeing, and modifying information could intensify the rescue operation, as needs are seen. "Best enough" solution is critical in these situations, because disaster is usually unpredicted and "close to perfect" solutions can take too much time and money to be developed or modified to the disaster at hand.

Two cases that this thesis is covering are taking steps closer to this approach. Both cases are including village level users into the service creation. The first case, mGesa, is including Plan field workers whose work is to gather information from the villages. The second case, Birth Register in Liberia, allow district health officers and in the future field monitors to gather information directly from the end user or village members. The cases are still in their initial phases to implement pilots in the near future.

Collaboration View

Collaboration of enterprises and citizen is the key to acquire accurate information fast from the local and rural areas. This offer also opportunities to reach large amount of valuable information as the number of potential users is high. Practical approach in collaboration could be to offer platforms for users to create the content and on the other hand allow users to access information that is relevant to them. Issues that can help fasten the collaboration

are transparency of the service process and information, efficiency especially in content development, and possibility on more personal information sharing.

Challenges that collaboration is facing are the changes in stakeholders mind and the will for enterprise side stakeholders to involve the local poor into the service creation. Challenge can be also to get local citizen involved at the initial phase when there is no evidence about the benefits of the service. In addition, new business models need to be developed for collaboration to work. Senge (2006) introduces reinforcing feedback loop where small changes can have major impact. This system thinking idea can be applied directly to service thinking in citizen centric approach. If users are getting benefit out of the service it can start snowball effect increasing the amount of users. In this way, amount of information grows constantly making the service even more appealing to users. Overall, reinforcing feedback loop that can spread the service trough positive word of mouth is good to keep in mind when trying to fulfill the needs of the users.

Integrating Dual Model and Trusted 3rd Party together

As it is pointed out, trust is playing major part in implementing CCA. One solution for trust management between citizens and enterprises can be trusted third party. Third party can act as an impartial stakeholder that mediate, redirect, or store information behalf of others involved. In addition, third party can be used to manage financial constraints that especially base of the pyramid is facing. It is evident that new business models are needed where citizens play major part and participation of masses is possible. One possible approach for this is to integrate dual model and trusted third party together. Challenge is to find the right partners and manage the business so that citizen can receive service for free or with minimum price and data is handled as trustfully as needed. In addition, enterprise side stakeholders and partners need to get revenue or other compensation that they are looking for. Figure 14 presents the integration in visualized manner.
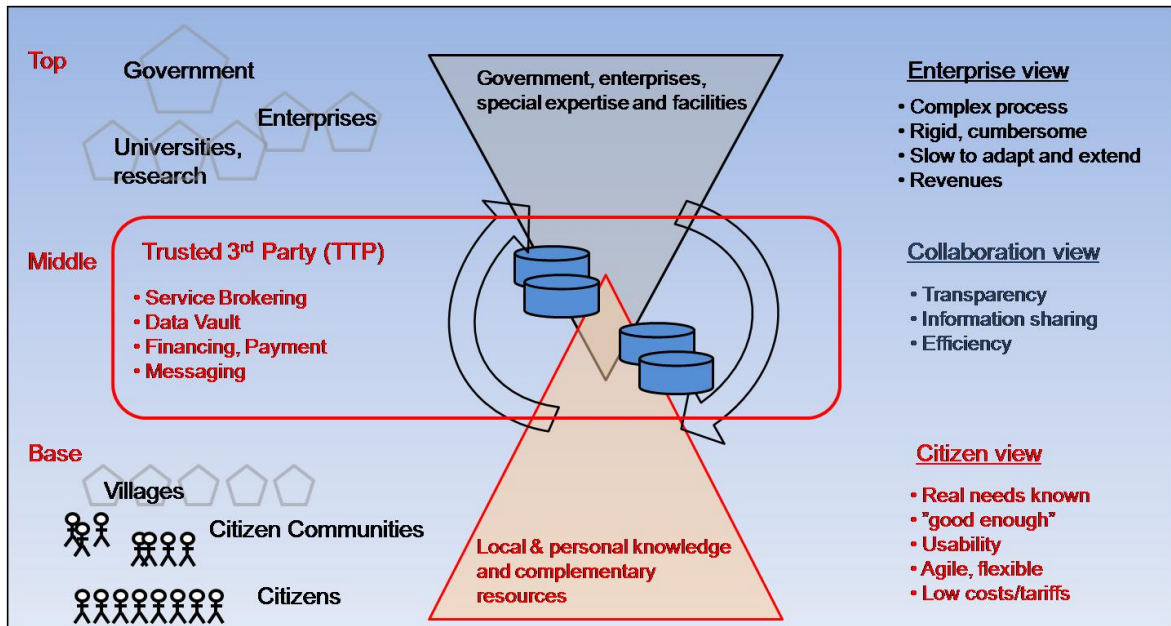
Figure 14: Extended dual model with trusted 3rd party

6.2.2 Integration Layer Model

The Integration Layer model tries to highlight the architectural and integration issues that are needed when designing mobile services in the developing countries. Aim is to explain matters that are important in overall service creation process in order for services to be able to use resources efficiently and to integrate different layers and stakeholder views together. Chapter 4.1 of this thesis introduces enterprise architecture models that try to reduce the complexity of the service and intensify the use of resources to reduce the costs of the information systems. These are good models to start with, but they do not suit directly into the scope of the developing countries mobile services. As chapter 4.2 explains, there are issues such as operator cost structures that need more consideration in the developing countries. For this reason, business and benefit model layer is needed into this layer model that lack from EA models presented in this thesis. Other layers are system and technology, information, architecture and business process, and organization layer. In addition, regulations and policies and additional user criteria and environment need to be considered throughout the service creation process. It is good to keep in mind that the development process that is following the integration layer model is iterative in nature and needs

updating continuously. Figure 15 presents the layer model in visualized manner. Each of the layers is briefly introduced after the Figure.
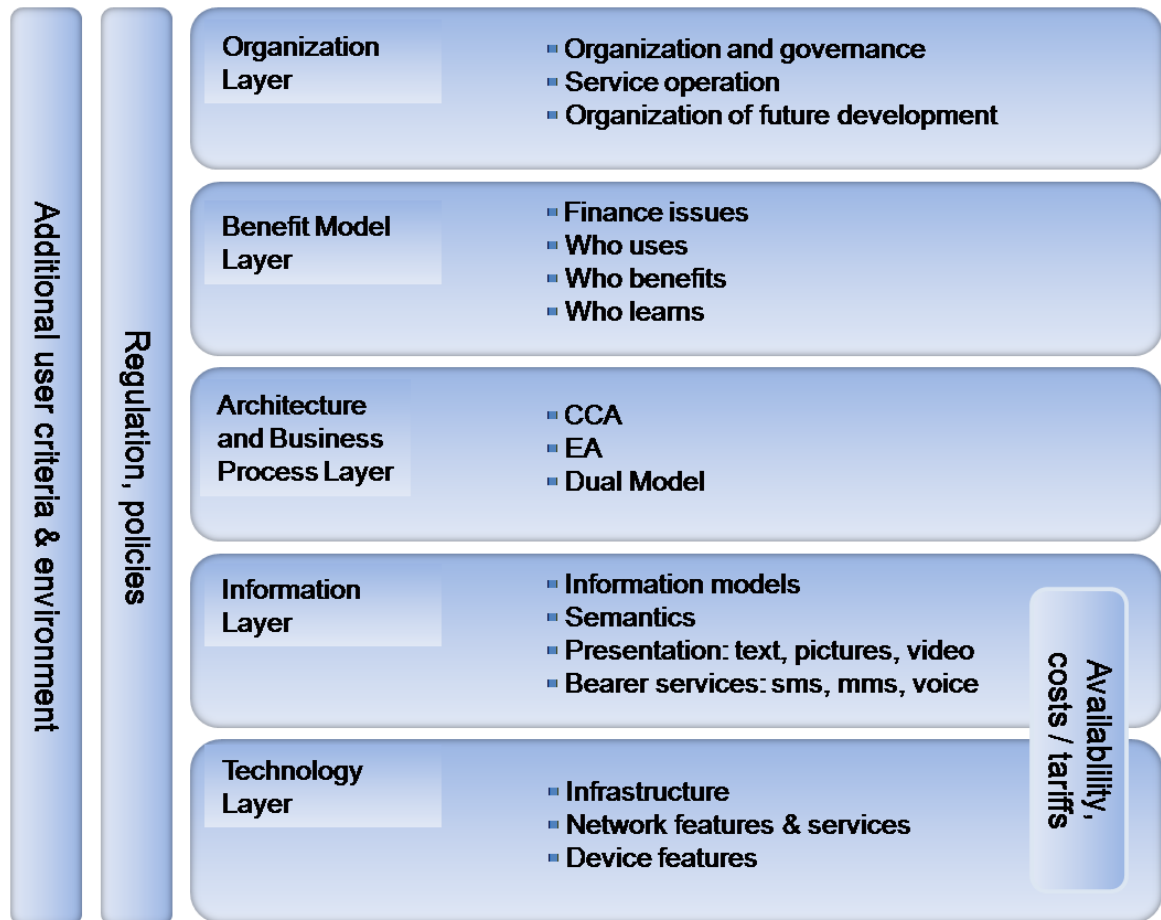

Figure 15: Integration layer model modified from (Hämäläinen and Itälä, 2009)

Technology Layer

Technology layer includes architecture for technology solutions of the service. Most important issues are network, device, and infrastructure features and interconnections. These guide the development of the service in technical level. Analyses on features need to

include overall availability and cost and tariffs of the service. Trust issues on technical level are also included into this category.

Information Layer

Information layer includes architecture for all information that is transferred inside the service. Information models and presentation need to be considered trough needs and technical features and planned so that information is usable and well functioning with underlying layer. For example, it is not reasonable to plan service to use video if the network or the mobile phone is not capable of processing it. Same can be said about the tariffs and costs. There is no reason to develop high cost services for people who can not pay for the service. Especially in the developing countries, challenge is to use the type of information in regions where citizen are both literate and illiterate users without decent income. Even more challenging can be the fact that data and internet possibilities can be unstable or lacking, making visual presentation impossible and forcing to use maybe more expensive text and voice services. In addition, semantics and ontology of the information need to be considered for sharing purposes and further processing of the information. It is also critical to seek standards or well known ontology, semantics and other presentation models for service to scale. However, lack of standards on information presentation models on mobile phone is still in progress and can cause scalability challenges in these early phases. Another issue is personal identification and the importance of information model to implement reliable identification process. This is essential when transferring sensitive personal data or trying to identify users in for example disaster situations.

Business Process Layer

Architecture and business process layer includes architecture for business process and overall architecture approach for service creation. This thesis is suggesting that CCA could be one opportunity to innovate and to scale services for larger user base. Thus, the business process need be build around the architectural approach that service is aiming for. This means in this case, opportunities for citizen to access and create services with the help of enterprise resources. Business model need to be reflected also into the underlying layers and planned so that it is possible to implement. As overall architecture and business process talks about the users and their involvement, it is also important to consider personal identification for users using the service. This is extremely important in health, crisis and governmental services that are processing private user data and the quality of the service depends on personal service. It is also good to notice that basis for identification need to be done also at the underlying information layer.

Benefit Model Layer

Business and benefit model layer includes architecture for overall financing, usage, benefit, and learning issues. Financing issues is one of the key components for service to be sustainable. It is critical to seek new business models to work with constrained resources of the citizen. Issues that need to notice besides service price is the price to acquire, charge, and maintain the mobile phone. Usage issues need to plan well to enable the use of the service. One key point here is the language and cultural diversity. Question is how to allow people to use the service with the language they know. Benefit models need to be taken care too. It is important to consider benefits for all to see that the service will last. Learning is also important and especially local users need to be educated trough usage or other ways, to engage them to the service and creation of new services. If developing the service outside the target region, technology transfer and capacity building to local regions is good to be included into the development plans.

Organization Layer

Organization layer includes organization and governance, service operation, and organization of further development. For services to reach the goals, scheduling, and financing plans it is important to have well organized management process. Management can be decentralized or centralized but the key is to have clear picture about the development process and roles. Management roles can change during the project and it possible for the service to reach the positive feedback loop and self organized management by the users. This is one possibility and should not be ignored as developing the service. Besides management, there is need for implementer and operator for the service at the user level. For this reason, service operator is needed. As managers of the service creators are usually responsible of overall management of goals, time, and money, service operators are responsible of successful implementation and running of the service at local regions. For this reason, service operators should involve local expertise on environmental and cultural characteristics. Another important activity is future development of the service. This is important to plan early, so that the service can reach sustainability. Again, local involvement is important, as the locals are most aware of the living conditions, service possibilities, and changes in mobile behavior in target regions.

Additional Layers

Additional layers include two layers: Regulations and policies and additional user criteria and environment layers. These two layers are placed into the model so that these issues are connected into all activities that are included into the layer model. Reason for this is that

these can guide the design of the service from the technology layer to the organization layer, minimizing the unexpected situation when developing and implementing the service. It is clear that regulations and policies are different in all countries. When designing a mobile service, it is important to notice the differences and to examine what is the situation in target region in access, use, and delivery of the service. In addition to differences, it is also worth to examine the common issues such as standards. If for example local health ministry is already using particular standard on digital health information and has regulated it, it is wise to develop service based on same standards if plan is to integrate information in the future.

In user criteria, it is important to consider the target users and their ability to use the service. Challenges can cause for example the combination of illiterate and literate users as well as mobile phone literacy. Other issues are such as possible preference of shared use and gender issues. It is not self-evident that all women have access to household mobile phone. These issues are important if for example designing service for children health information reporting, which is mostly done by women. Environmental issues include climate issues related such as heat, dust, and moisture. In addition, some regions can be exposed to flooding, storms or other natural weather phenomenon. These issues can force the service to recover from device damage and constant cut of the connection.

6.3   Platform Approach

Platform approach chapter is concluding the framework design. Reason for introducing platform approach in the framework design is that it is one of the key requirements for developing services fast and cost effectively for the real needs. Platform means in this case a method for implementing a service using the same generic solution for different services with at least modification as possible. Platform can include set of components that provide bundling of different functions into one solid service. Components could be for example data collection, data aggregation, reporting, and monitoring. Underlying idea is that if developing the service for one need such as the HIV treatment, the same service could be used to other disease treatment services as well. In addition, same function can also be needed in other service areas such as natural disaster situations like flooding and earthquakes and could benefit from the already made solution.

Other reasoning for the platform approach is that if the components or solution are easily available, accessible, and modifiable, it could offer potential for users and developers to develop new services at local regions for local needs. For this reason, open source is

preferred approach, as this can reduce costs to develop and solve some integration problems between components and services. Some of the organizations and services have taken steps closer to this approach. These are for example FrontlineSMS (2009), Nokia Data Gathering Solution (Nokia, 2009), and Ushahidi (2009). Figure 16 visualizes the platform modeling idea.
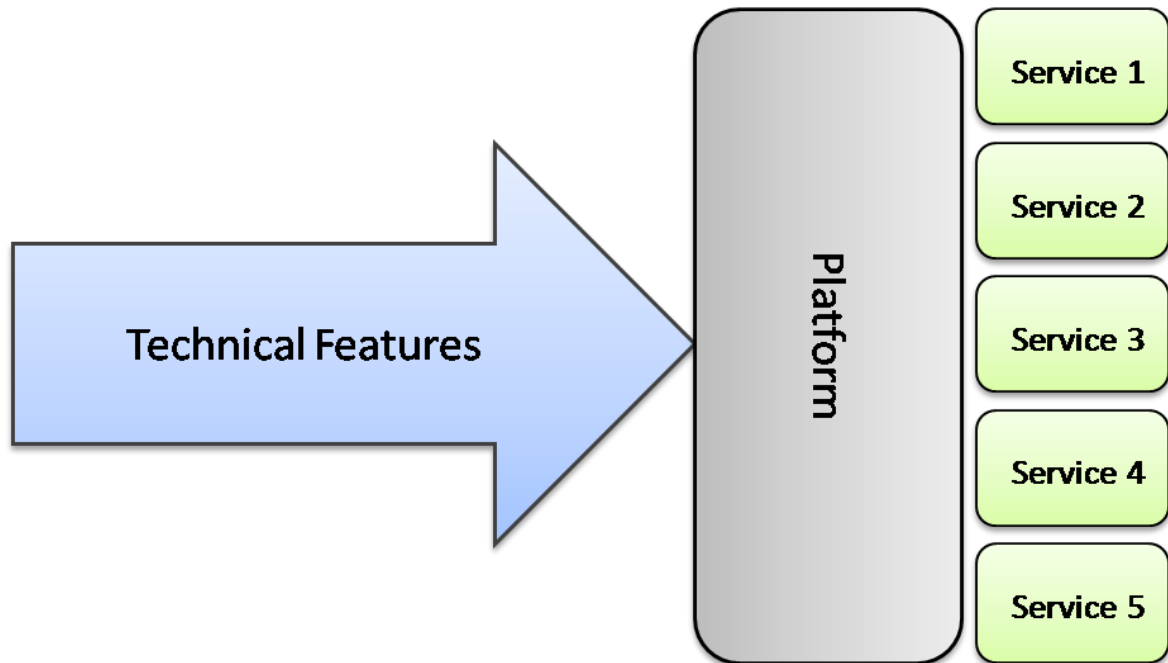

Figure 16: Platform Modeling

As the background studies and the cases have demonstrated, there are sometimes surprising features in the developing countries that can guide the development of the mobile services. Some of underlying technical features are presented in order to highlight the design challenge. These are the kind of features that developers especially in industrialized countries does not need to consider with the same focus when developing in robust networks than designing in the rural areas in the developing countries. Aim is not to explain technical specifications, but to identify issues that are based on underlying technology and need to be designed trough technical solutions.

Underlying features that are important to consider are for example unstable communication infrastructure, low power production in rural areas, and low data traffic connections. It is important to design the service keeping in mind that connectivity might be down several times a day. For this reason, recovering from the connection cut downs need special attention, especially in services that process important data such as personal health and disaster information data. Other feature that is common for all poor rural areas is the lack or limited amount of electricity production. To save power, services need to be designed so that the power consumption is as low as possible. Last, the speed for transferring the data might be fraction from the urban peak rates. This can cause problems if transferring chunks of data such as pictures or video, which in the other hand could expose valuable information from the rural areas.

In addition to above mentioned high level features, local regions all possess own features such as spectrums, availability of speed and data channels, and availability of bearer services and protocols such as SMS, MMS, WAP, and real-time protocols. Moreover, mobile phone market can differ greatly and use of more sophisticated models can be limited, bringing more challenges for the service creation.

7   Validation

7.1   Framework Validation

Framework validation starts by defining the used criteria suggested by Eisenhardt (1989). First, parsimonious means in this case that the framework is as simple as possible leaving all unrelated issues out the new framework. Second, testable means that the framework can be tested using some real life situation. Last, logically coherent means, that the framework is logically constructed without contradictory theory propositions and "logical gaps".

7.1.1   Evaluating Parsimony

Parsimony of the framework can be evaluated by testing how the framework would function if some of the parts would be left out. First hypothesis is to leave out stakeholder analyses. As goal was to find framework for sustainable mobile services in the developing countries, stakeholder analyses cannot be left outside the framework. For service to be sustainable, it needs stakeholders such as users, developers, and funders. Continuous analyses on key stakeholders can create better potential for the service to survive, as this gives more time to react on changes and future development.

Second hypothesis is to leave architecture of the service design out of the framework. Background material reveals issues such as language obstacles, cultural diversity, lack of monetary resources by end users, lack of trust, large amount of information by users, and wide use of mobile phones. These are some of the key point why services should include users and the at least the village level to the service creation process. Architecture that this thesis is suggesting is the user centric architecture, which challenges these issues mentioned above. In addition, integration layers are addressing the challenge of integrating services to work more efficient to save resources. For these reasons, architecture of the service design part is essential for the framework.

Third hypothesis is to leave the platform approach out of the framework. For service to be sustainable, it does not require platform kind of solution, as it does need stakeholders, users, and integration of the systems with underlying layers and services. For this reason, the platform approach part could be left outside the framework. However, some of the most successful internet-based services at the moment, such as Facebook have noticed this opportunity. Thus, even that the platform approach is maybe not the requirement for

sustainable mobile service in the developing country it can increase the potential of reaching sustainability as services increase in the markets.

7.1.2   Evaluating Logical Coherence

Logical coherence is evaluated by critically reviewing each of the components of the framework to see if some of the theories are conflicting or otherwise not logically suitable for the framework. Framework starts with generic business process type of analyses which includes stakeholder analyses and first part of the architecture of service design chapter. After that the focus moves on to more technical consideration, as second part of the architecture of service design chapter highlights also the technical aspect in integration of the services. Last component of the framework, platform approach, is most technical part introducing logic for developing the service by using the available technical possibilities.

First component of the framework is the stakeholder analyses. Stakeholder analyses are identifying the key stakeholders and their roles and incentives in a generic manner. Starting point is to enable user involvement in the service creation processes. Next component of the framework, architecture of service design, is addressing the issues of citizen centric architecture and integration. Citizen centric architecture analysis is natural follow-up for the stakeholder analyses, as it is highlighting the stakeholder view in more architecture point of view. It also combines stakeholder analyses key point into the architectural view. Integration layers in chapter 6.2.2 moves to overall design issues, including underlying technical requirements. Last component of the framework, platform approach, suggest model for developing the services with the available technical solutions. Logic that is binding all the components together is the view that users should be involved in the service creation processes. If looking from this point of view, logical coherence is well succeeded.

7.1.3   Evaluating Testability Trough Case Study

Testability evaluation of the framework is done by using one of the case studies as a reference case. Case study used is the Birth Register in Liberia, which is already introduced in the chapter 5.2. Each of the components in the framework is reflected to the case for searching some evidence that this framework is valid for service development in real life.

Stakeholder analyses component of the framework includes identifying the stakeholders, roles and incentives. First stakeholder that is important for the service to identify is the user and their involvement to the service creation. In the Birth Register case, end users of the

mobile device are the district health officers and the end users of the service are the parents of the child. It seems that involvement of the end users is extremely hard to realize in this case. Service design, development, and implementation are done excluding the end users from the process. This can be result from the wide number of the designer by the government and NGOs. Trusted third party is included into the first phase of the service creations process. Third parties are acting NGOs and outside funders, who have influence on the service creation process and are acting between the government and the end users. Local involvement is executed trough government involvement. It would be also important to include local companies and universities into the development of these kinds of technical solutions, which is note done at the moment.

Roles for each stakeholder are agreed superficially, but it remains unclear how these roles are fulfilled. This seems to be one of the problems in the implementation of the service. Incentive analysis for end users is also lacking from the data gathered. At the moment, parents of the child are not engaged to the service. It is also unclear, what is the incentive for the district health officer to use the service except the opportunity to use new technology. Incentive for the service provider, CMI, is to see if the solution is helping Liberia in this need and to learn from the experience for the future situations.

Second component of the framework, architecture of the service design, includes dual model and integration layer issues. The dual model addresses the issue of collaboration of the government and the citizen. In this case, data is gathered by the government from the village level, which is the basis for the model. This makes the service more efficient for both levels. However, it seems that transparency and information sharing in both ways is still not realized fully. Integration layer model implementation is still extremely lacking, as the service is still in its initial phase, and aim is to get the service running fast. Still it would be worth to consider the integration issues in also birth register service as the same data can be used for example in the population register, which is still not implemented.

Last component of the framework is the platform approach. Client side of the solution, mobile application, is planned to be used in different registering purposes and was chosen because of the easy modification opportunity. For this part, platform approach is considered. Only problems that the client side can cause, is the limitation of the suitable mobile phones. Application can only be used with high end Nokia mobile phones with the full keyboard, which can hinder the scalability of the current and future service users and solutions. Server side of the solution is still open, because applications are not running as planned at the start. This can be analyzed later when the service is running and integration to other services is topical. As a result, framework is a valid for testing the case. For more

accurate testing and to get more reliable results, further testing with already running services is recommended.

7.2   Background Methodologies Evaluation

7.2.1   Analyses of background information methodologies

Methodology used in background information studies is mainly literary review. Sources of information are Google Scholar search engine, web pages of related organizations, and conference papers. As methodology used is quite straightforward, it is analyzed only briefly. Only questions are if the search words were right and organizations choose correctly. Some of the studies were probably not found, but the material found is enough to draw some conclusions for the goals this thesis is aiming for.

7.2.2   Case study methodology

Case study methodologies include two methodologies. These are theme interviews for data gathering and grounded systems theory for data analyses. Theme interviews can be evaluated by asking following questions: Were the cases suitable for the framework? Were the interviewees right? Were the questions right? Were the interview situations right?

First case, mGesa, is focusing on forming informative map data in order to share information more efficient and to intensify the use of resources in the poor areas. Case fits into the scope of crisis management even that not all of the regions this service is used for are in dramatic crisis situation at the moment. The fact that this solution could make the prediction food, water, health care, or other services shortage more accurate is filling the crisis management scope. Contact persons and data sources of the project personnel are the key stakeholders this project is involving. One is representative of the users' side and one service provider and funder side. Questions asked in the theme interview could have been different, but for this thesis they gave valuable insight and data. Interviews were held at the interviewees' offices. Reason for this was to give the interviewee as comfortable situation as possible. Only disturbing factor could been the recording device at the theme interview, even that it didn't seem to have side-effects on either side.

Second case, birth register in Liberia, is trying to increase the number of registrations, fasten the process and reduce mistakes in registering the births in rural areas. Goal is to

deliver birth certificate for as many children as possible. Case fits in to the scope of the thesis in many ways. Mobile phones are used to establish a basic service for citizens in a country recovering from crisis. In addition, managing stakeholder in the project is Liberia Ministry of Health, which is in charge of all health data management in the country. Interviewees are involved in the project as technology facilitators and are also involved in the design groups of the government and outside supporters. Information sources could have included also other stakeholders, but for the thesis point of view, the most important person of the project was interviewed successfully. Question form that was sent to interviewee had some mistakes at first giving interviewee less time to think about the questions. Overall, answers to the questions gave valuable data for the design framework. First interview situation was held by mobile phones between Finland and Liberia and the quality of the connection was occasionally inferior making the interview more challenging. Phone interview was recorded but didn't help with the opening of the interview notable because of the connection problems. Second interview was held face to face leaving time to go through questions that were unable to resolve in the first session.

Data analyzes were done using grounded systems theory methodology. Reason for this was to utilize the information from the cases independently for getting impartial data for the framework. This goal worked great, as both cases highlighted partly the same and partly different insights for the framework. Other type of data analyzing could have been used but the challenge is how to keep the analysis neutral, highlighting the actual experience and implementation plan for each case.

8   Conclusions

Conclusions of the thesis are presented below. First, the key findings are presented and assessed. Thereafter the exploitation possibilities are discussed and suggestions for the further research made.

8.1   Findings

Mobile phones have reached also the poor in the rural areas of the developing countries. This holds enormous amount of possibilities for designing services for the basic needs by using technology to facilitate information exchange, collection, and sharing. It is also evident that the information and services that the professionals and officials can provide and manage is limited when compared to the information and local capabilities that citizen could provide. For this reason, it is important to include end users of the mobile services as co-creators from the start in order to utilize this great amount of information that is underutilized at the moment by many services. Involving end user and giving them opportunity to create content could solve some of the language and cultural issues. This would more actively engage them in using the services and more importantly would give the users opportunity to create the kind of service and content that is most relevant to them.

Users of the services still need some of the professional resources to create and use the services. The service developers on the other hand need the information that is available from the users. To help linking these two groups and their resources, a trusted third party is proposed for acting as an intermediary. Professionals and companies such as operators and other service and technology providers, need revenues to run the businesses. On the other hand, the poor do not have adequately money to pay for the services. Same issue is with the trust. In many situations, users do not trust professionals or government and are not willing to share the information if direct benefit is not seen. Trusted third party or network of trusted third parties could act as a financing provider, message broker, and a data vault between these two levels. This is important especially in services such as health and crisis management services where information transfer between the users and professionals is substantial. This approach could let users to exploit the resources the professionals offer and for the professionals to acquire information about the real needs.

For making the mobile services sustainable in local regions, it is important to involve local actors in the service creation processes. These include users, companies, government, academics, and the other relevant stakeholders that can provide capability or benefit from sharing information trough mobile phones. This could help the local regions to improve the whole industry around mobile services and mobile technology and offer more opportunities for the poor. It is also good to design the technology solution to work as a platform, so that it is generic, easy to modify, and provides simple user interface for the mobile part. This could also help local actors to create new services and to build business around the mobile services, as with such an approach it would be faster and more efficient to build services for real needs.

8.2   Assessment of the Findings

Involving the users in the service creation sounds like a self-evident idea. However, as background and case material reveals this is not considered in many situations. Recently, there is already evidence that this kind of thinking could work in the developing countries. For example, Ushahidi (2009) has introduced service where end users create the content. As mobile technologies and services become more familiar to users in the developing countries such approaches may become scalable provided that sustainable models are developed and easy creation of situational and niche applications supported.

Trusted third party approach in the developing countries still needs more investigation. This is one of the most important issues for enabling users to be involved and for making the service creation more efficient for all actors. While the ideas of value adding intermediary and third party are common in internet world the mobile industry has been rather operator centric and the service offerings have focused on operators subscribers. However, specifically in the developing countries where the mobile is the channel to all services there seems to be readiness to explore new business models to be developed for users and professionals providers. At the moment, the poor can not access the services because of the lack of money or trust and professionals hold only limited information on the local needs.

The importance of local involvement is one of the key findings of the thesis. This appears to be easiest to be realized at least partly when developing mobile services in the developing countries. It is important to start the capacity building in the means of technology transfer for services to be sustainable in the future. Keeping local users, professionals, and academics involved early enough will have greater impact on the knowledge base that enables further development in the various regions. Lastly, the idea of

generic service platforms is implemented already by some of the actors, but extensively exploitation of such platforms is still to be seen.

8.3   Exploitation

It is assumed that the key findings of this thesis are most valuable in new service creation processes where the service needs are identified by the end users and the service need of enterprise side resources is evident. Challenge is how to create the connection to the users from the enterprise side. One possibility is to work with NGOs that are already working on the field, as is the case in the first case study this thesis is introducing, mGesa. Another possibility is to be involved in the local universities, as they may have connections to wide range of areas and service needs. The service creation processes may also indicate the need for a trusted third party. The business model for such an actor depends on the case, on the application area, and the environment.

All in all, collaboration and networking with local users and professional is the key in utilizing the opportunities the developing countries hold. Possibilities are great for the developing countries to improve the information sharing and service creation, which could also give more opportunities for local people and the entire international community.

8.4   Further Research

The use of mobile phones is growing so fast in the developing countries that research around mobile services is not keeping up with the pace. For this reason, it would be possible to list wide range of topics to be studied. This thesis is concentrating on sustainable mobile services and future research suggestions are related to this topic.

New design framework reveals that users possess enormous amount of information that is not utilized at the moment efficiently. Mobile phones have made it possible to reach these users and involve them into the service creation processes. For this reason, further research should be concentrating on this issue. To be specific, further research should study the issue how users can be involved if they have the change to be involved and offer solutions for this.

Another major finding is the need for trusted third party in the information sharing. This could help services to develop, as users could have access to use them. This raises another key area for further research: Business models for trusted third parties. Trusted third parties

could be in an ideal situation facilitating the use of the resources both from users and enterprises sides. In addition, a trusted third party could make the service offerings and needs to better fulfill expectations from both sides.

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Appendix A - Outline of the Questionnaire

Outline of the Questionnaire – Half-structured theme interview

I Usage
1. What is the service?
2. For what is it used for?
3. How it is used?
4. Who uses it?
   a. Volume of users
   b. Volume of villages/target regions
5. Who pays for it?
   a. In initial phase
   b. In the future
6. What is the benefit?

II Background Information
7. Background of the Interviewee
   a. What is the role of the interviewee in the project?
8. Background of the Project
   a. Needs
   b. Past experiences
   c. Goals

III Stakeholders
9. Stakeholders and their roles
10. Your organization's role
11. Incentives for your organization
12. Service improving/developing plans for your organization

IV Lessons learned
13. What are the most important characteristic of the solution?
14. How to make the solution scalable?
    a. Number of users
    b. Geographically
    c. Culturally/Linguistically
    d. Other service categories
    e. Simple to complex / Complex to simple
15. How to make the solution sustainable?
    a. Funding
    b. Local involvement