A co-design innovation methodology: towards efficient delivery of mobile services in developing regions

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Abstract: The rapid growth of telecommunication infrastructures in Africa has created a favourable environment for mobiles services to emerge, especially the ones aiming at social impact. While a number of successful pilots have been reported, few of these services have achieved scale and significant impact. In this paper, we describe a co-design innovation methodology that takes into account the specificities of developing regions in Africa and the particularities of the mobile industry favouring successful mobile services development and deployment. The co-design innovation methodology has been validated partially in two case studies in Namibia and Uganda.

1. Introduction

Between 2003 and 2008, the number of mobile cellular subscriptions in Africa grew twice as fast as any other continent [1]. By 2008, Africa had nearly eight times as many Internet users as in 2000 especially via mobile broadband. This exponential growth of the mobile ICT sector in Africa is the beginning of a trend with significant room of development (e.g., the penetration of mobile subscribers is only 22% at this moment). This growing penetration provides opportunities for new mobile services and applications for commercial, social and development purposes.

For many people in this context, mobile phones are providing access to telecommunications for the very first time. In several sectors (e.g., agriculture, finance), mobile services can contribute to social development by alleviating poverty and capacitating people [2]. Numerous pilots on Mobile for Development have taken place in Africa [3] and a few of those initiatives have reached maturity or have shown strong potential for scaling: The most described is surely Mpesa [4] the financial service for the unbanked, proposed by Safaricom in Kenya. In this paper we focus on initiatives that have the ambition to scale up.

A number of factors can explain this phenomenon, for example the lack of proper regulatory framework, the difficulty for entrepreneurs to access financial instruments or the lack of appropriate technologies. In this paper, we focus especially on a methodology to develop M4D services in this context. In fact, while user needs analysis and case studies show the benefit mobile services can have, there is often a lack of proper documentation of the methodology in which those innovations have come into place. A methodology can help to make the development of services systematically successful and sustainable.

This paper gives a direction for all stakeholders in the M4D space seeking to create mobile services that have social impact and are economically, technically and socially sustainable. Assuming that current stakeholders in the M4D space are not part of the end-user

community, we foresee a potential for applying a "Co-design Innovation Methodology" for M4D service development. In section 3 we will present our proposed Co-design Innovation Methodology, a methodology that takes into account the constraints of innovation in developing regions (section 2) and includes the successful elements of existing methodologies. The Co-design Innovation Methodology will be illustrated in Section 4 with 2 cases in which we have applied the methodology in Namibia and Uganda. Based on these findings we will conclude with pinpointing the key success factors and preconditions for applying this methodology.

2. Innovation in developing regions

In this chapter we give an impression of the unique context for innovation in developing regions and list a number of innovation methodologies already in place for a developed or developing context. We conclude by addressing the gap that evolves from this analysis, a gap that we foresee be filled with the Co-design Innovation Methodology.

2.1 – Context

As innovation often spurs out of constraints, emerging areas offer a fertile playing field for novel applications/services to be developed. Furthermore, there is enough potential for the industry to tap into new and developing markets with innovative services [5]. Challenges arise because of the unfamiliarity with the local context and the distinct infrastructure in emerging market [6]. Without being exhaustive developing regions have their own particularities that need to be taken into account when developing innovative mobile services.

(ICT) illiteracy: Both illiteracy and ICT illiteracy are common in emerging regions which restricts the potential numbers of customers for the mobile services that imposing reading and writing (e.g. SMS) and the knowledge of using a mobile phone. Workarounds include proximal literacy (whereby a literate third party is acting on behalf of the customer), using voice modality or graphical representation

Cultural Identity: Mobile services are impacted by cultural values, so particularities from developing regions need to be taken into account. For example, the context of mobile phone use in emerging regions means that mobile phones are sometimes shared. This leads to a number of shared identity and privacy issues.

Cultural Diversity: The number of local languages is also a key factor for the acceptance of a given mobile service. There are for instance 240 spoken languages in Democratic Republic of Congo.

Low-end technology: As high-end technology is not widespread and too expensive for most people in developing regions, it is necessary to focus on low-end technology. Developing services for low-end phones and low-bandwidth means that there are only a few degrees of freedom in designing the user interface. The goal of the designer is to do more with less as the customer still expects a satisfactory user experience.

Affordability: The financial burden of mobile phones on already stretched family budgets and the lack of saving capabilities imply to rethink business models and value chains. In that respect, pre-paid cards of low value have for example been a way to provide affordable mobile services.

Hence, incorporating specificities of the context of developing regions or allowing for flexibility or unforeseen barriers and situations is key to any successful Innovation Methodology. The methodology should therefore be focussed on local development and inclusion of end-users in the process.

2.2 – Innovation processes in developing regions

A number of methodologies have been designed to develop solutions for the Base of the Pyramid (BoP); the largest but poorest socio-economic group of the global population. However, none of these methodologies have been formulated with specific M4D service

development in mind. Nonetheless we will list a few of these BoP methodologies and select the aspects that are of added value for an M4D Innovation Methodology.

C.K. Prahalad [7] is in favour of co-creating experiences with the consumers/producers themselves. Co-creation allows for personalized interactions based on how each individual wants to interact with the company and has "interaction as the focus of value creation".

The BoP protocol [8] uses the theory of Participatory Action research, originated in the social sciences and shows in its operational form many similarities with the theory of co-creation stated by C.K Prahalad. The consumer (or end-user) becomes part of the development team along with relevant stakeholders and in a period of 3 years a new product (or innovation) is developed in a sustainable environment. End-user participation is also key in the design phase, especially in priority setting, rather than just product testing that is traditionally the approach taken by many firms.

The National institute of Design (NiD) [9] has created five sustainability posters addressing the important factors to take into account for sustainable design in India. They work on the challenge of co-creation in order to create value along the value chain for all stakeholders necessary to make the solution sustainable.

P. Kandachar of the Technical University (TU) of Delft in the Netherlands proposes a product design process applied in numerous projects at TU Delft for developing regions. Even though it is set up in an engineering environment, the activities describe an integrative approach from several sciences: technical, social, management sciences, and working together with entrepreneurs [10].

2.3 – Innovation processes in ICT and design

Successful innovation methodologies for BoP presented in the section above address co-creation and end-user involvement as important elements of the methodology. In the domains of ICT and service design similar elements can be found in innovation processes, as they address multi stakeholder participation and human centeredness. They furthermore present important elements of innovation methodologies for mobile (ICT) services in a business context, which should be incorporated in the methodology for developing regions in Africa.

An increasingly important aspect of the Innovation Methodology for ICT is the interaction design that creates the valuable user experience of the (mobile) service. Alan Cooper [12], an advocate of interaction design, proposes to use user centred design tools, such as persona's, scenarios and focus groups, in order to capture the user's goals and integrate them in the development process. Developments in product development are related to human and user centred design and participatory design, in which end-users are involved in the entire innovation process. Liz Sanders states that the role of a user in a product development process has changed from being an informer into a co-creator [13]. J. de Boer and L. Kuiper even argue that not just the role of end-users has changed, but by applying co-design the roles of all stakeholders, including the end-users, is changing throughout the development process [14]. Designers must become facilitators between consumers and producers or create new systems of (co-)production and (co-)design that fulfil needs and solve real problems with the maximum benefits for consumers, producers and the natural environment [17].

The Vision in Product (ViP) design process propagates that the design of a context should be the start of all design projects [15]. This context consists of a number of factors, e.g. social patterns, technological possibilities, and cultural expressions, that affect the way people perceive, use, experience, respond and relate to products, i.e. the nature of the human-product interaction [15].

One of the ICT innovation methodologies, Scrum [11] is an iterative, incremental framework for agile software development [16]. It has been used since the early 1990s to develop complex ICT products. A key element of scrum is the division of the development process into "sprints", short development cycles each providing a working partial product.

The whole development is done with a small multidisciplinary team together with the (most important) stakeholders.

2.4 – Conclusion

While contributing towards an M4D innovation methodology, the methodologies described provide only partial answers to deliver mobile services in Africa successfully.

Prahalad focuses mainly on Multi-National Companies (MNCs), whereas the playing field in developing regions in the ICT space is also locally driven. The BoP protocol requires an intensive time investment that may not be suited for the short time service development of the ICT sector.

For all of the methodologies in ICT and design there is need for adaptation to the specific context of developing countries. From the Scrum methodology we learn that working in short cycles is beneficial for the software development processes. Another reason for using Scrum is the suitability for coping with adaptations; as the local situations are often not very predictable, flexibility in the development process is much required. Scrum however has not been tested in the context of mobiles services in developing regions, and a full-fletched software development process might be too extensive for the initial development of M4D services. The ViP approach points out the importance of the context, and requires on-site presence in developing regions, but is not holistic in the sense that it focuses on the designer, and not on the other stakeholders.

Both co-creation and co-design methods have been applied for ICT and design in a developed context, but have also shown their success in the context of developing regions. The involvement of end-users and stakeholders in the innovation process seems to be crucial for creating a successful service. The point will be taken forward while developing a Co-design Innovation Methodology

3. Co-design Innovation Methodology

Based on the key elements pointed out in the state of the art (chapter 3) and specific challenges not yet met in the existing methodologies, we propose an innovation methodology optimally tailored to mobile service development in developing regions. The Co-design Innovation Methodology does not aim to cover the whole spectrum in developing M4D services, but gives guidance for those wanting to develop M4D services. It includes and combines five elements as also referred to in figure 1.

3.1 Theoretical elements of the Co-design Innovation Methodology

Use short timeframes and create momentum by using a condense one week format

The Co-design Innovation Methodology proposes a one week format in which momentum is created and a tangible result delivered at the end of the week. In the process of innovation, the week includes the following stages of service development: 1. Strategy and conceptualisation, 2. Design and implementation, 3. Impact and evaluation. They are carried out sequentially, with time in between depending on the complexity of the project, and any stage could be the starting point of the innovation process depending on the level of understanding of the stakeholders.

Involvement of end-users in the development process by using user centred design tools.

When end-users are involved from the beginning of the process, they make their needs more explicit and create a "part of the team" feeling. Furthermore it bridges the (cultural) gap between stakeholders and end-users who may be from culturally different places and can hence overcome challenges as mentioned in section 3.1.

The Co-design Innovation Methodology involves end-users by letting them be the starting point for the innovation, and they are the ones that can indicate to what extend they can adopt the innovation in order to have a sustainable solution.

Creation of partnerships in a multi-stakeholder approach

Public authorities, companies, Non Governmental Organizations (NGOs), research institutes are most likely all involved to reach social and economical impact with mobile services. For this network of organisations and individuals to be sustainable it is essential to strive for partnerships in which the value that is created and exchanged between the partners involved is made explicit.

The Co-design Innovation Methodology enables the creation of partnerships by having a multi-stakeholder approach. Co-design allows for all stakeholders to discuss together on the solution taking into account existing social structures.

Create the whole eco-system, instead of just the ICT component; focus on system design.

Rather than focussing on the service itself, it is important to keep in mind the whole ecosystem in which the service will be introduced. The introduction of (new) mobile services can create social impact. This will require some behavioural changes for the envisioned end-users and beneficiaries. In that respect there is a shift from product/service innovation towards system innovation.

The Co-design Innovation Methodology creates a new eco-system by focussing on system design. Rather than focussing on the technology alone, it is aimed at creating a plan with the end-users and stakeholders to see what is necessary and what will change when introducing the service.

Focus on incremental innovations by using existing ICT building blocks

Africa has pioneered the uptake of new services based on SMS [1], SMS is from a technological standpoint not a disruptive innovation and widely used in developing regions already. We have chosen to focus on incremental innovations rather than disruptive, not only because incremental innovations are said to be more likely to succeed than disruptive innovations [18]. Using proven technology to make a (small) difference in a short timeframe can make a difference already, while allowing for minimal investment and short timelines.

The Co-design Innovation Methodology focuses on incremental innovations by working with existing ICT building blocks, and working in a short timeframe. Existing technology and social structures should be used to come up with a solution to the problem within a week. Moreover by focussing on what is already developed in open source code allows for a fast delivery of new services and tangible results.
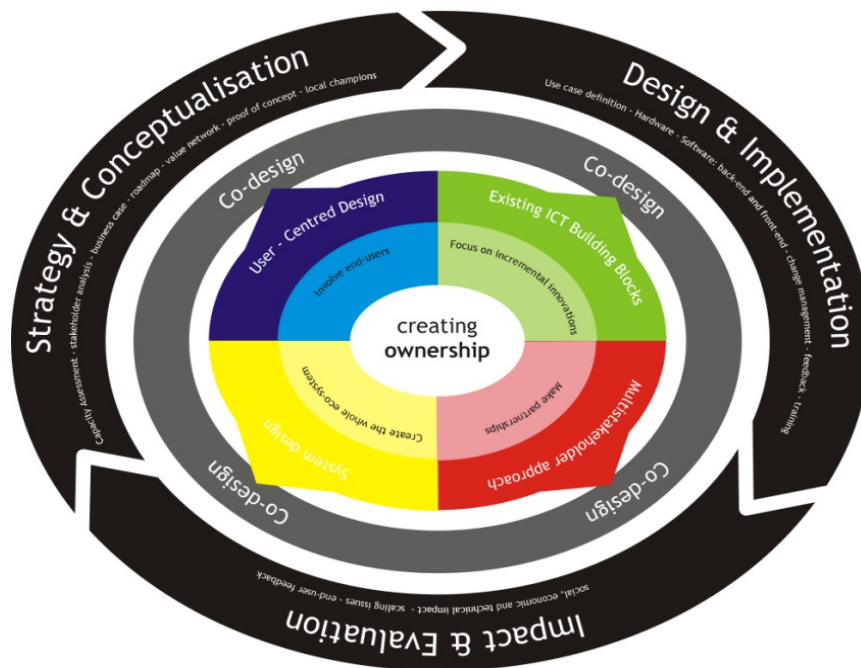

Figure 1: Co-design Innovation Methodology

3.2 – Implementation of the Co-design Innovation Methodology

In the Co-design Innovation Methodology, the weekly sprints are an essential element to ensure success of the innovation developed. A detail of a week is presented in Figure 2 (helicopter overview) and Figure 3 (detailed description).
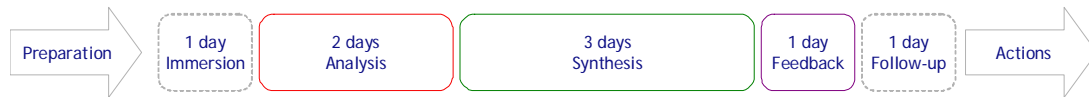

Figure 2: Co-design weeks

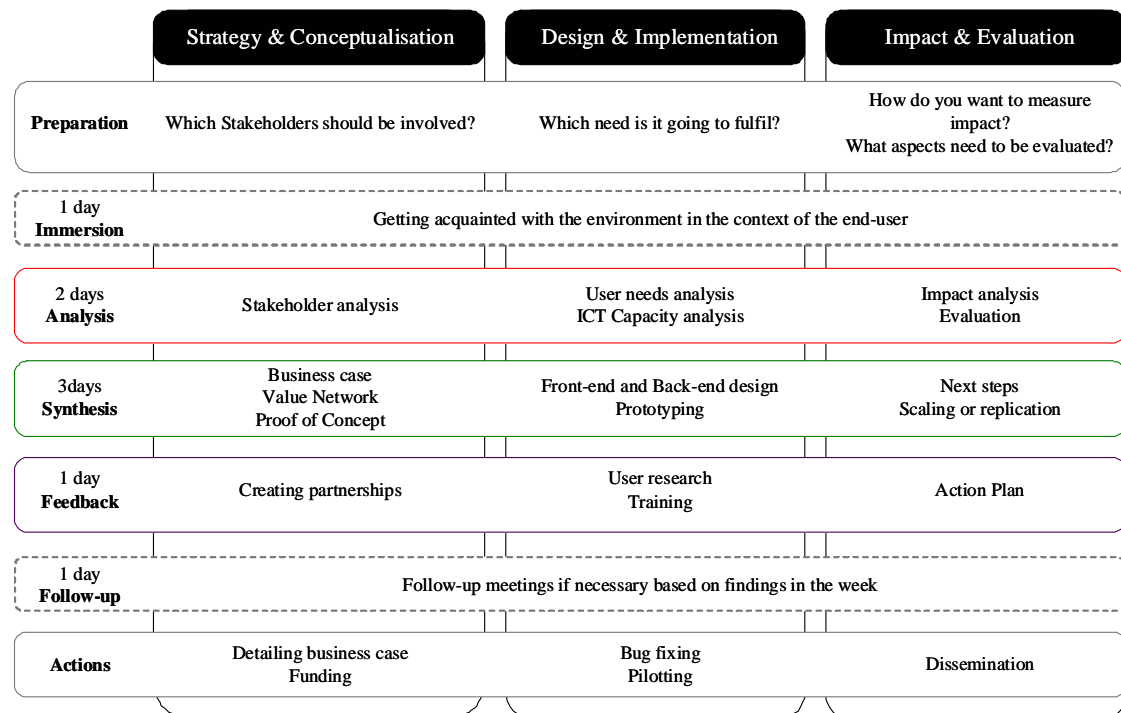|	Strategy & Conceptualisation	Design & Implementation	Impact & Evaluation
Preparation	Which Stakeholders should be involved?	Which need is it going to fulfil?	How do you want to measure impact? What aspects need to be evaluated?
1 day Immersion	Getting acquainted with the environment in the context of the end-user		
2 days Analysis	Stakeholder analysis	User needs analysis ICT Capacity analysis	Impact analysis Evaluation
3days Synthesis	Business case Value Network Proof of Concept	Front-end and Back-end design Prototyping	Next steps Scaling or replication
1 day Feedback	Creating partnerships	User research Training	Action Plan
1 day Follow-up	Follow-up meetings if necessary based on findings in the week		
Actions	Detailing business case Funding	Bug fixing Pilotting	Dissemination

Figure 3: Co-design weeks for different phases in Innovation Methodology

Because the Co-design Innovation Methodology relies on a multi-stakeholder approach, it is evident that stakeholders must be involved throughout the week. We have identified four different roles that need to be addressed during the weeks:

1. Facilitating stakeholder: the stakeholder that manages the project and the people involved. This stakeholder does not have a stake in the end-product from a user or financial perspective directly, but has a stake in the process to come to the solution.
2. Business or financing stakeholder: the stakeholder that has a stake in the outcome of the project from economic or social perspective. This does not necessarily mean that it should be a stakeholder from the industry; this role can also be an NGO that finances the end-users and beneficiaries for example.
3. End users and beneficiaries: the stakeholders that eventually have to benefit from the solution directly or indirectly.
4. ICT design and implementation stakeholders: The stakeholders that ensure technical sustainability, as they are the ones that have to implement the designed system.

In the following chapter, the Co-design Innovation Methodology is illustrated by a co-design week for "Design and Implementation" and a co-design week for "Strategy and Conceptualisation".

4. Two case studies

The two case studies describe two different instances of the co-design Innovation Methodology. The first case study was in the stage of "Design and Implementation", the second case study in the phase of "Strategy and Conceptualisation".

4.1 – Case study 1: Election Monitoring in Namibia

The first case was carried out in August 2009. The co-design week was applied in an innovation project that delivered an Election Monitoring toolkit for a human rights organization in Namibia [19]. The stakeholders involved were: (1) the innovation company (designing & facilitating party), (2) human rights organization (end-users), (3) the ICT partner (implementing party) and (4) the problem owner (financing party).

A day to day description of activities and developments during this co-design week is shown in Figure 4. Tangible results are illustrated in Figure 5.

Design & Implementation	
Preparation	After agreements with the problem owner on the scope of the project, TNO has been in touch with the Human Rights organization and the ICT partner. This made a first iteration on user needs and possible ICT building blocks to fulfill these needs. These building blocks made use of existing (proven) technology in an innovative way.
1 day **Immersion**	the Human rights Organization introduces TNO to the context of use and the problems they face in their work. This had a broader scope than just the problem to be solved with ICT; indications on the ICT literacy as well as relations in the institution and constraints by the local context are a few of the aspects that have been touched upon. Ideally this would have been done together with the ICT partner
2 days **Analysis**	User requirements analysis By means of previously prepared workshop TNO derived all necessary user requirements for functional and technical design from the Human Rights organization. Day 3: ICT requirements analysis The ICT partner demonstrates several possible solutions to fulfill the need to illustrate what is possible. The Human Rights organization could rank the possible solutions for TNO and the ICT partner to use as a starting point for designing and developing
3days **Synthesis**	The first iteration of the design was made. Part of the solution was fully implemented, that could be used by the Human Rights organization immediately after the co-design week. It was decided to use a combination of incident reporting (Ushahidi), SMS, MMS and Email service. By integrating these functionalities a new system was created that allowed for remote election monitors and regional offices to report on irregularities of the electoral process, without having to communicate everything to the main office. On the last day a roadmap was created on the follow-up of the implementation process to implement the complete solution
1 day **Feedback**	The design and prototype was shown to the Human Rights organization and feedback was gathered to improve it. The users received training on the part that was already implemented to enable them to use it immediately after the workshop and provide the team with feedback. The Problem owner was present to ensure the need to be done activities will be allocated with the right amount of money
1 day **Follow-up**	Training
Actions	Some final bug fixing and implementation was necessary to include all comments made by the end-user party. Eventually the end-user have been able to use the tools in the Electoral process in Namibia at the end of November 2009.

Figure 4: co-design week case study 1: Election Monitoring in Namibia
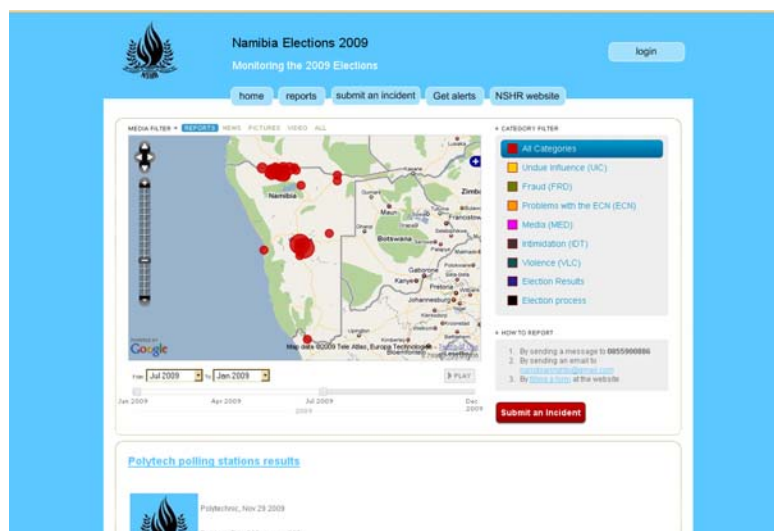
Figure 5: Tangible results case study 1: toolkit (top) and interface (bottom)

4.2 – Case Study 2: MobiScopy

The second case was carried out in January 2010. The co-design week was applied to deliver a business case description and roadmap for design and implementation of a system that takes pictures of microscopic images and share this with others in Uganda [20]. The stakeholders involved were: (1) the innovation company (designing & facilitating party), (2) health organisations (end-user representation), (3) the ICT partner (implementing party), (4) numerous other potential stakeholders that were involved during the week to create the business case.

A day to day description of activities and developments during this co-design week is shown in Figure 6. Tangible results are illustrated in Figure 7.

Strategy & Conceptualisation	
Preparation	Desk research on existing systems and business cases were investigated. The hypothesis for the potential value propositions and value network was created on the basis of which potential other stakeholders could be selected and invited
1 day **Immersion**	An informal gathering of all stakeholders with local representation was done to agree on the actions for the week and to make final preparations
2 days **Analysis**	Several laboratories were visited. 1 day was spend on visiting urban laboratories, 1 day on visiting rural laboratories. User requirements on potential and impact of the envisioned sytem was discussed with end-users.
3days **Synthesis**	Based on discussions with local laboratory experts and other potential stakeholders a preliminary value network and value proposition was made. Based on the local market a roadmap was defined that was divided in several phases. The technical feasibility was tested by creating a proof of concept of the ICT service
1 day **Feedback**	The preliminary value network was validated with major stakeholders that were envisioned to be involved in the first two phases of the roadmap.
1 day **Follow-up**	Based on the feedback of the major stakeholders some other parties were approached for open ends in the value network.
Actions	The value network was made final and a business case description was made, with which a good story could be told to potential investors for the implementation of the ICT service as described in the roadmap.

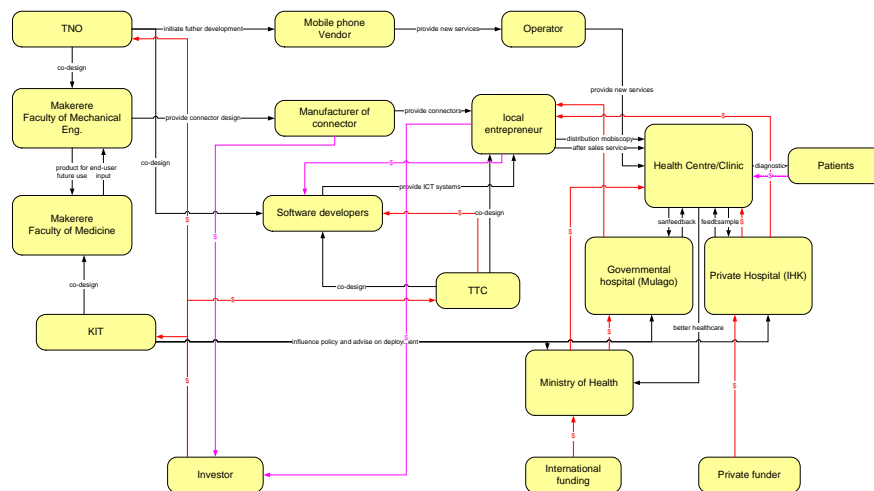*Figure 6: co-design week activities case study 2: MobiScopy*
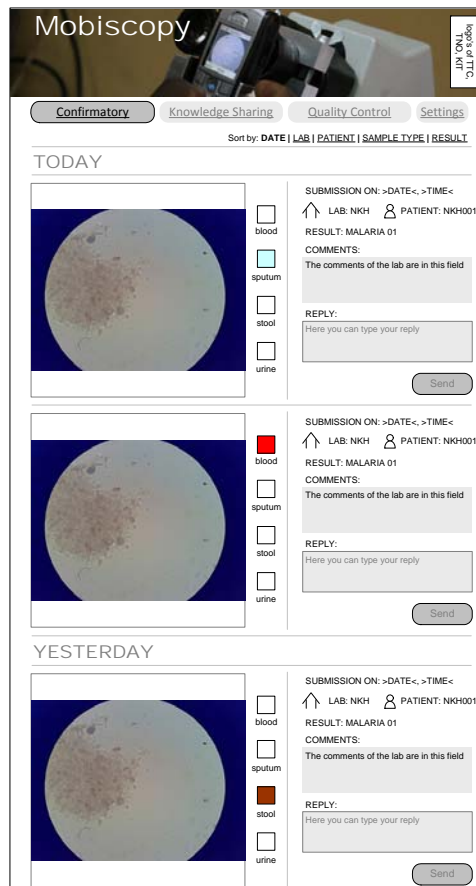
Figure 7: Tangible results case study 2: interface (previous page) and value network (above)

4.3 – Lessons learnt

In the two case studies presented above the Co-design Innovation Methodology has proven to be successful.

The potential is shown by the tangible result that is delivered at the end of the week; the results of the first case study have been used during the elections in Namibia in November 2009. Almost 60 field monitors have used the system and the main office processed the messages to reports and could publish them online immediately.

In the second case study, the outcome is a business plan used to approach venture firms and potential funders. The business plan has proven to be attractive for a number of different organizations.

Reflecting as the facilitating partner on the case studies, it can be seen that there is a need not only to look at the Innovation Methodology in terms of steps to take, but also to the attitude and state of mind with which to facilitate a co-design week. For instance, flexibility is a must in the programme that has been set up in the preparation. When organizing a co-design week from a distance, there is a great amount of uncertainty on how planned activities will unfold.

One of the limitations of the framework is that it does not yet supply a structured methodology in between the weeks. In each case the stakeholders involved had to come from different geographic locations, and after the week had to split up again. Though the week was effective, quality of the work that can be done during the week will most likely be better when there is a local representative (champion) involved that also has a stake in the result. In the first case study there was no local representative, which resulted in delayed communication, and guessing about the local situation. In the second case study there was a local representative that knew the context and could inform on local situations. By having a local representative the momentum of the week can be taken forward and the impact of the results can be higher.

In terms of roles, a local IT champion seems to be beneficial for the process. For an ICT solution to be sustainable it is crucial to take into account the maintenance issues that will evidently come when using new software or hardware. This should well be taken care of in the process, as was learnt from the first case study, in which the IT champion was involved for the last few days of the week. Role definition is also essential for a smooth co-design week. If roles are not defined and accepted by all stakeholders, confusion emerges creating non-optimal performances and lack of ownership surface quickly. In the first case study this was not made explicit strong enough at the start of the week, resulting in unrealistic expectations that had to be managed during the week, distracting from delivering the result.

5. Conclusion

In this paper, we have described a Co-design Innovation Methodology which aims at successfully introducing (i.e., creating a sustainable solution) mobile services in the context of developing countries (Africa). This methodology includes the following elements:

- Focus on incremental innovations by using existing ICT building blocks
- Involvement of end-users in the development process by using user centred design tools
- Creation of partnerships in a multi-stakeholder approach
- Create the whole eco-system, instead of just the ICT component, by focussing on system design
- Use short timeframes and create momentum by using a condense one week format

Two co-design weeks were carried out in Namibia and Uganda and validated part of the methodology. Both case studies include NGOs as prime stakeholders. The same principles could apply for the development of mass-market consumer services (via MNCs). In that case, involving envisioned end-users heavily in the development process allows to identify a group of early adopters and to create a thorough understanding of the customer base and the most appropriate strategy to enter a given market.

Future work includes the validation the methodology in other sectors (education, agriculture) and the investigation of the influence of the technology in this Innovation Methodology. So far only mobile and web technologies were used and it remains to be seen whether the use of other ICT innovations (e.g., voice services) impact the suitability of the process. Finally, only part of the methodology was validated, and from "strategy" to "evaluation", the whole cycle should be validated.

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