

User Expectations for Simple Mobile Ubiquitous Computing Environments

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Abstract. In mobile ubiquitous computing environments users will be able to interact with different devices, providing them with many services. The technological heterogeneity of such an environment is expected to increase the overall system complexity. Flexibility and adaptability are thus key issues to cope with this complexity. The goal of the IST-Simplicity project is to design, develop and evaluate an architectural framework supporting easy customization of terminals, services and networks in a consistent manner. In this paper we present results from focus groups that have provided valuable user feedback on the concepts, user scenarios and business models developed during the project.

1 Introduction

In mobile ubiquitous computing environments users will be able to interact with different devices, providing them with many services. The technological heterogeneity of such an environment is expected to increase the overall system complexity. Flexibility and adaptability are thus key issues to cope with this complexity. The goal of the IST-Simplicity [1] project is to design, develop and evaluate an architectural framework supporting easy customization of terminals, services and networks in a consistent manner.

In this paper, we present results from focus groups, which have provided us with valuable users feedback on the concepts, user scenarios and business models developed during the project. The key concept of the IST-Simplicity project is based on a universal multi-application Simplicity Device (SD), providing a simple and uniform mechanism for customizing services and devices. By describing user scenarios, use cases and business models based on this concept, the project partners could define generic user, system requirements and identified major actors in the value chain. A user-centered approach was then initiated by setting up focus groups which aim was to understand how users deal with current Information and Communication Technologies and to discover how they perceive the SD, its services and functionalities.

In the opening section of this paper, we briefly present the related work before describing the methodology used to set up and run the focus groups. The third section describes the results of the focus groups. We conclude the paper with recommendations for the development of devices, services, functionalities and business models for mobile ubiquitous computing environments.

2 Related Work

The last decade has seen the emergence of a number of business models for mobile commerce related to web-based services, mobile office scenarios and electronic mobile payment. Most of them have been unsuccessful, particularly in Europe. In the consumer market only simple services have succeeded (e.g. ring tones and screensavers download). A commonly accepted explanation is the technical complexity and the lack of usability of the services offered to users.

Therefore a lot of research projects in industry as well as academia try to address these aspects by the development of context aware [2, 3, 4], personalized [5] or location based [6, 7] mobile services and interfaces [8]. Context information includes for instance user preferences, device capabilities, sensor data, service attributes and network parameters [9] which can be combined to high-level context information like "the user is attending a meeting". This context information is used by algorithms that mainly take rules or policies into account to decide which adaptation should be done under which circumstances [10, 11].

Through the rapid development of mobile storage technologies more and more people store a lot of personal data in their mobile phone, PDA, MP3 player and USB stick. The idea of a personal server where the user carries all his personal data and programs as well as a full PC in the size of a PDA with him or her is investigated by Intel's Ubiquity Personal Server [12, 13]. The Mobile Personal Server from Realm Systems [14] follows a similar approach.

3 Running the Focus Groups

3.1 Methodology

Qualitative research is the first step in an iterative and user-centered process. The focus groups methodology used within the Simplicity project aimed to support and improve the development and implementation of the Simplicity system as well as developing hypotheses for future research by analysing users needs and feedbacks on technologies, services and business models. We tried to better understand how target groups would react to Simplicity services. We also expected to obtain suggestions for service deployment (e.g. of distribution, promotion and pricing). To list of issues was set up to understand in depth user needs and to inform the development and implementation of the Simplicity system. Additional objectives included:

- Analyzing user feelings and responses when users came into contact with Simplicity services. The goal is to gain better understanding of responses from specific target groups than might have been possible using alternative qualitative tools (such as a questionnaire);
- Obtaining suggestions and ideas that for service deployment including issues of distribution, promotion and pricing. The focus groups were particularly useful in suggesting how to explain Simplicity to the end-user.

Based on these issues to lead focus group discussion we planned the following interview schedule aimed to:

- Analyse experiences and perceptions associated with different services, applications, equipments and wireless telecommunication technologies);
- Identify needs associated with different technologies (services, equipment, wireless telecommunication technologies);
- Gauge initial responses to the Simplicity concept and Simplicity services;
- Gauge initial reactions to 3 scenarios for using the Simplicity card proposed by the project;
- Identify other actors in the value chain and get suggestions for pricing strategy.

3.2 Profile of the Participants

We defined mobile workers as the target group of our study and used the following selection criteria

- Use mobile phones and computers daily as part of their normal working routine;
- Travel for work purposes (excluding short journeys e.g. for daily meetings) at least twice a month.

We then grouped candidates based on their age, profession and technical knowledge. Six focus groups were thus set up, as detailed in the table below:

Table 1. Profile of the participants

Mature adult groups (aged over 35 years old)					
Technology expertise					
FG No	Technology expertise	Work branch	Male	Female	Total
FG 1	Intermediate	Business	4	3	7
FG 2	Expert	Business	3	5	8
FG 3	Intermediate	Professional	4	3	7
FG 4	Expert	Professional	4	5	9
	Total		15	16	31
Young adult groups (aged between 25-35 years old)					
Technology expertise					
FG No	Technology expertise	Work branch	Male	Female	Total
FG 5	Expert	Mixed	4	4	8
FG 6	Intermediate	Mixed	3	4	7
	Total		7	8	15
	Total		22	24	46

We first conducted a pilot focus group session to assess the interview schedule planned. All focus groups sessions were filmed. In total, 46 people were interviewed. We recruited focus group participants by word of mouth to avoid the perception of the focus group as an event organized to promote a particular product

3.3 Material

Given that prototype development is still in progress it was not possible to test the way users would react to real devices. It was therefore decided to implement a “concept test”, capturing participants’ initial reactions to the Simplicity vision. Preparation of the concept test began by defining the “basic idea” underlying Simplicity: the “image”, characteristics and “personality” of the service we wanted to test. We went on to provide information about specific Simplicity services, identifying their main characteristics and components and their potential users. In short, we reconstructed the meaning and significance of Simplicity as seen by the people who had developed the system (i.e. the project consortium members). The aim was not only to create a concept test but also a structure for concept development. This would allow improving individual components and characteristics of the service and identifying those best adapted to the needs of specific target groups. A series of short films were com-

missioned to ensure that the “Simplicity concept” was easily understood. Each film was approximately 3 minutes long. The films served to clearly communicate service characteristics and components. Group discussion did not focus exclusively on the films.

The general structure was as follows:

- The first section of the discussion was approximately 40 minutes long. During this part of the discussion, participants spontaneously described their needs regarding wireless technologies, mobile working, mobile devices and so forth. Simplicity was not mentioned.
- The short films were shown during the second part of the discussion. Participants began by talking about their initial impressions of Simplicity, before going on to give their views on specific features. This part of the discussion lasted roughly 80 minutes.

The short films featured one of the more than 20 user scenarios produced by the project partners. The chosen scenario was the “mobile worker scenario”. This scenario explored all the components and characteristics intrinsic to Simplicity but featured only one user, a mobile worker. The idea was to focus on one clearly defined user, fully investigating the services this type of user might require. This meant that the films gave only a partial view of Simplicity’s potential, presenting services relevant to one class of user.

3.4 Concept Evaluation

As mentioned we used focus groups to investigate needs and interests of potential users on a number of different issues in the field of mobile computing. At the beginning of each session, participants were told how focus groups are run and how the results would be used. Afterwards we asked them about their experiences and general opinions on technologies (tools and equipments such like mobile phone, computer, PDA, etc.) as well as their needs to get an impression what the people think about these aspects. Then we introduced the core concept of our project which is to have a personal mobile device including personal data, profiles and preferences. Furthermore we explained our other concept to have services and applications proactively adapting to the user by considering the data stored on the personal device. It is often complicate to explain such sophisticated ideas to users and often it is also questionable how much they understood it.

Therefore we used films [15] presenting the concepts of the project through different scenarios. In the first scenario we showed how the personal device could be used in an office environment.

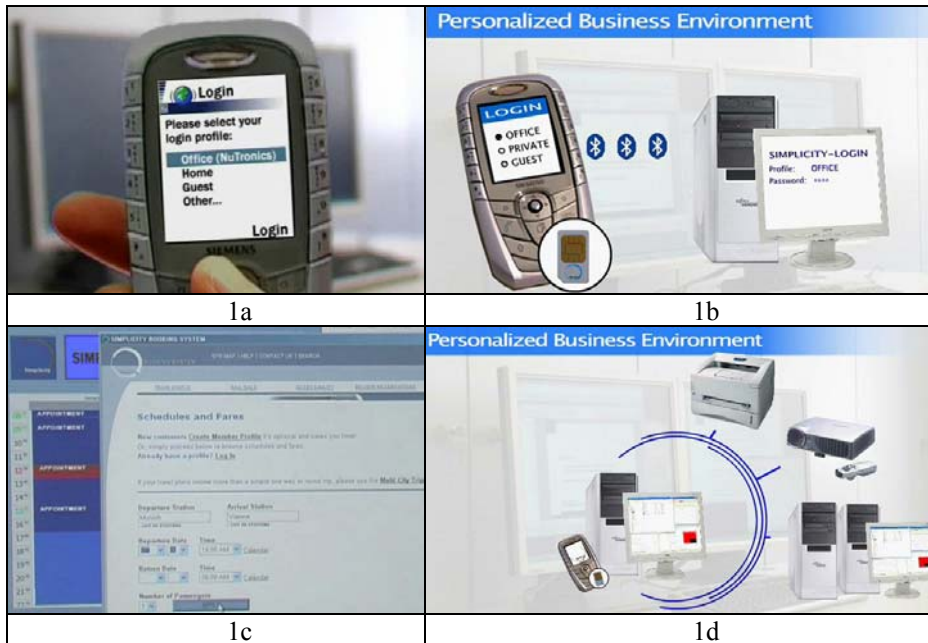


Fig. 1. Scenario “Office case”

An employee of a company finds a free workstation and logs in via his personal device. Once logging under a profile the user automatically accesses to the needed data and services in the office environment according to his specific profile (figure 1a). Then is the video presents how the personal device connects to the workstation (figure 1b) and how the services in the environment are used (figure 1c). We introduce also the idea of a personal assistant which helps the user in different situation and which does for instance automatic form filling (figure 1d). In the second scenario we showed how the personal device could be used for location-based services and mobile office environments.



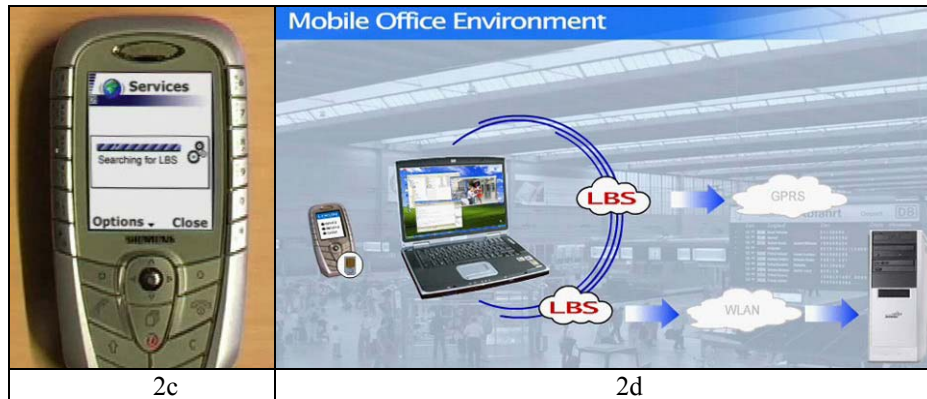


Fig. 2. Scenario “Train case”

At the railway station the user accesses mobile location-based services (figure 2a) which take user data on the personal device and local context-aware services (figure 2b) into account. During the train ride a mobile office environment is established whereby services that are provided by the train (e.g. WLAN) are used (figure 2c) and a personalized connection to the company’s network (figure 2d) are used. Having seen the scenario described, the group discussed different concepts and possible business models.

4 Results

4.1 Participants’ Key Demand on Technology: Integration and Interaction

The first part of the discussion focused on how participants used technology, and the feelings they associated with its use. At this point, no reference was made to the Simplicity project. In general, participants felt “involved” with technology but expressed a number of different feelings, ranging from positive or even enthusiastic opinions through to the idea of technology as something excessive, and sometimes useless and invasive. Although all participants had a general awareness and knowledge of new technologies, not everyone actually used them. Certain participants were adept at using most types of technology. Others were aware how useful technologies could be, but used them to perform quite basic tasks¹. The most common need expressed by participants was to be able to integrate and interact with different technologies: almost all participants expressed this need. The ability to integrate different technologies is one of the principal needs that Simplicity seeks to address. Almost all participants indicated that some of their needs were not met when using technology. In most cases, the priorities expressed by participants related to the need to connect

¹ This later group tended to rely on experts for technical or specialist operations. This was particularly the case for mature adults with non-technical backgrounds.

and interact. These were cross-cutting needs relevant to all tools in the new technological world (applications, connections, devices) regardless of context. Specifically, participants from all target groups identified the following priority areas:

- **Data:** participants were fascinated by the idea of having their own data available to them wherever they went. This was a priority even for participants in the intermediate groups and for people who do *not* travel for work so often.
- **Equipment and devices:** Many participants wanted to reduce the amount of hardware they carried. Some interviewees were put off by the idea of having to use such a complicated system. They displayed a conservative attitude and were less visionary than other participants; some even dreamed about technologies that did not require a device of any sort, which could be accessed by typing a code or swiping a card:
- **Networks:** Some interviewees felt that connecting to networks was too difficult. They found such difficulties stressful, particularly in new environments or when on the move.
- **Software systems:** Many interviewees considered software systems to be unstable and unreliable. These systems were felt to waste time and energy.

Table 2. Needs associated with technology

ISSUES*	QUOTE	FOCUS GROUP
Data integration need	“I’d love to have my hard disk with me wherever I go, like a sort of “mega USB” or to have all my files stored on a virtual hard disk that you an access regardless of the type of computer you’re using or any devices you might have attached.”	FG 3, Female
Network connection	“When I’m trying to connect to the network and I’m not in the office or at home, something always goes wrong. If I can’t connect first time, I just leave it, and sometimes even after several attempts I still get nothing.”	FG 4, Male
Interaction and compatibility	“Trying to synchronize my emails with my palmtop always makes me really angry.”	F5, Male
	“We’re always hearing about how cutting edge these systems are, and then you find that they aren’t compatible with each other even when it comes to the simplest things!”	F6, Female

*The identified key issues resulted from an analysis of the FG session protocols

The participants' desire for services that are easy to use is not met by current technology. Rather, it represents a problem. Many participants independently expressed the need for innovative services similar to those offered in the Simplicity scenarios. The majority felt that such services would be useful. But they also felt they would be "...too complicated to use". A number of participants equated technology with complexity. They were sceptical about the idea of integrating many different tools in a single package. Interviewees gave examples of ways they expected the technology to be unreliable, inadequate and hard to use. They were unconvinced that hardware and other tools could ever be intrinsically reliable. Even more tellingly, they expressed the belief that any growth in the system's complexity (considered as any increase in its power or capabilities) would increase the unreliability of the system as a whole. As a result, participants expected to experience more technical difficulties than before.

4.2 Simplicity Concept

General reaction

In general, most participants reacted positively to the Simplicity concept, especially the promise of easy accessibility and "comfort". The name encouraged these expectations. Almost all participants were enthusiastic about the possibility of accessing their own data, wherever they might be. Interviewees were impressed by the fact that Simplicity responded to the demand for centralized data. They were particularly keen to avoid sending, copying and duplicating documents and files, and to eliminate complex and boring procedures to save documents.

Simplicity device and Simplicity card

The most popular idea amongst participants was the possibility of using the "Simplicity Card" (containing the user profile and personal data) in conjunction with a mobile phone. This tallied with participants' needs: the mobile was seen as a simple and universal solution. Indeed, the first reaction to the Simplicity card was that it was the "obvious" solution and not particularly innovative. But precisely for this reason, participants perceived the card as something well tested and reliable. Most participants saw it as "Personal ID", a kind of appendix, an extension of themselves. In general, even though the card was considered as a personal ID, security issues were not of particular concern. Participants were not particularly afraid of losing the device or concerned about loss of privacy. Most participants placed a lot of trust in telephone operators and in "trust organizations" such as banks and credit card companies, who they viewed as fully capable of guaranteeing and managing user privacy. Participants were confident that security measures (such as blocking or reactivating the card) would be adequate to protect them in the event of loss or theft.

Location based services

In general, location based services were less popular than other Simplicity services. In particular they were much less popular than universal log-on and centralized data services. Many location based services struck participants as “excessive”. They were worried that they might contribute to what is already a “surplus of information”. Some saw such services as invasive or useless. In many cases, they were not interested enough to consider buying or using the services. Many were afraid that technological infrastructure, automatic updates and information verification options might be unreliable or insecure. Many did not see this kind of service as genuinely responding to their needs. Some (mostly women) found the service too “automatic and invasive” and complained it would prevent them from examining the full range of possible options and combinations. Participants found other types of location-based services to be more useful; especially those geared towards people who spend a lot of time waiting around, or who need information on specific products. Participants also suggested a number of new services related to traffic and parking information, public transportation, plane schedules, access to communities and P2P services.

User clusters

Using the data collected from the focus groups we were able to identify 3 principal “user clusters”:

- **“Trendsetters”** (approximately 35% of participants): This group contained the highest number of “innovators”. It was these users who had the most expertise in technology, who used it most extensively and who were most up to date with new products and services. Trendsetters were adept navigators of the Web. People in this group tended to be the first to introduce and promote innovative technologies to their friends, colleagues and family members. They owned and tried out new devices, tools, and applications. Often, they had experienced a sense of frustration in using technology and in making different technologies work together. In general, this group responded enthusiastically to Simplicity. Group members found that Simplicity provided a real solution to their need for integration and interaction.
- **“Posh”** (about 30% of participants): This group was the “smartest” group of participants. Mostly composed of women and young people, group members loved to play and experiment with technology. They frequently used mobile phones and were always quick to try out new services, such as MMS, surfing the Internet, etc. People in this group particularly liked technologies that combine usefulness with aesthetic appeal. This group had the highest percentage of ownership of I-Books, I-Pods and digital cameras. Outside their working environment, they were the most frequent users of mobile technologies. They perceived technology as something “clean, brilliant, radiant, clear, and simple”. These perceptions were even more marked in women.

Female participants particularly liked wireless technologies, partly for their convenience, but above all because “they get rid of that knot of dusty cables!” . The response of this group to Simplicity was positive. The device interested participants. They associated it with ease of use and as a support during their daily interactions with technology. But members of the group also suggested that a tangible, aesthetically pleasing device would have made Simplicity more appealing. For some the idea of Simplicity as something intangible evoked a sense of deprivation, and a loss of “ownership”. The fear that it would not be possible for users to have their data “physically” with them produced negative reactions. Interviewees in this group tended to “fetishize” not only their data but also the equipment they used, most notably their PC or laptop. Some people preferred to always use their own computer. Concerning location based services; some users (in particular women) considered that a user profile would never be enough to identify the services best suited to their needs. They also thought that to accurately define the profile, it would be necessary to continually update their personal data and that this could be an unmanageable task.

- “**Fussy**” (roughly 35% of participants): Members of this group were predominantly men. People in this group were the most selective and demanding of all participants. They perceived themselves to be “competent and knowledgeable” users of new technologies, about which they knew much, even if they did not consider themselves as fans of particular tools or services or as promoters of innovative devices. They appeared to be rational users: usefulness and capabilities were cited as the most important characteristics for any type of technology. But they were puzzled by technologies that did not seem to match their needs. They wanted to feel that they were familiar with the technology they were using and were extremely interested in usability, accessibility and the cost of various services. They indicated that these factors would be critical in making an eventual purchase. The reaction of this group to Simplicity was generally quite positive, though most participants considered that the service should be customized to include more interesting functions and services. They thought that some services (particularly location based services) could be improved and made more useful. In many cases, they questioned the true usefulness of the service, expressing doubt that it would be possible to provide adequate coverage. Within the “Fussy group” we identified a sub-group of uninterested, highly critical participants. We called this the **Droopy**” group. The most common sentiment in this group was total indifference to Simplicity, which was not perceived as an innovative service. Several participants believed the service was already available on the market.

Table 3. Reactions associated with Simplicity concept

ISSUES*	QUOTE	FOCUS GROUP
Simplicity initial impact	“I wouldn’t have to go through the usual ten million procedures like sending myself documents by e-mail, sending stuff to the office and then saving it onto the USB device.”	FG 1, Male
LBS, information overload	“Services like this should only be activated when you explicitly request them, otherwise you’re bombarded...”	FG2, Male
Intangibility	“I’d prefer to carry my data with me, to have it on me physically, I want to be able to see it.”	FG3, Female
	“It gives me the idea that in the end, I don’t really know where my data actually is. Is it virtual? Is it on my PC but also scattered about?”	FG6, Male
Profile	“If it was supposed to update itself automatically on the basis of choices I made, it would be constantly changing. For instance, I change the background image on my desktop every day.”	FG2, Female
Business models	“I don’t mind paying a supplement on the train ticket, or paying a bit more than I’d normally pay to include the card. The important thing is that I don’t have to make another additional payment, something that shows up on your bank statement and you’ve no idea what it is.”	FG5, Male

*The identified key issues resulted from an analysis of the FG session protocols

5 Recommendations for concept development

On the basis of the needs expressed and the feedback provided from the participants, we have defined a series of requirements and recommendations to improve the “Simplicity Concept” and customize it for various categories of users. Below, we identify three broad themes that emerged from the focus groups. These points represent not only an important input to the technical implementation process, but also ideas for the communication, dissemination and exploitation of Simplicity.

5.1 Sense of presence

Certain service characteristics evoke a sense of presence, the sensation of being in a familiar, tangible, comforting environment. For many users, this perception played a

key role in making the service appealing as well as adding to their sense that it was fully developed and dedicated to serving users. Sounds and images played a fundamental role in evoking a sense of presence. One service that users particularly appreciated was the possibility of accessing their own “desktop” every time they used the Simplicity device. Users appreciated the possibility of directly choosing their own icons, sounds and screen savers - rather than having them automatically generated from their user profile. This facility evoked a strong sense of presence and familiarity.

5.2 Collaboration, community and teamwork

A second theme that emerged from the focus groups was the need to improve the community dimension in Simplicity. In many instances, Simplicity was perceived as an individualized service, little suited to supporting teams and communities. A number of participants requested that Simplicity should explicitly provide a way for users to log into their own intranet, providing facilities for file sharing, chat and *peering*. Participants felt that desktops used by mobile workers (users moving from one location to the other, accessing their files via the Simplicity service) could act as a physical space, which the “Simplicity Community” could use. For example, users could share information with other users, by leaving files on the desktop that they had been using. Sharing could be extended and expanded, making the computer a *node* in a community of “Simplicity peers”. All this would help to make the service more tangible, reducing the sensation of intangibility, which some participants had complained of.

5.3 Business models

The final area covered in this study relates to business models and prospects. Most participants did not perceive the Simplicity service to be particularly expensive, expecting to pay a supplement of 7-10% on top of the monthly wireless connection fee. This would be equivalent to € 5 – 50 per month depending on the type of coverage selected. One point that emerged very clearly was the user requirement that billing, accounting and payment should be easy to use and understand. Independently of cost, participants indicated that they did not want to pay an additional bill to use the service. They wanted to pay a fee that would be included in their connection contract. In other words, the bill for Simplicity services would have to be included in their mobile phone bill or paid as part of their internet connection charge. Many participants seemed interested in some form of corporate registration: in this case, they would use the service mainly for work. Participants expected that corporate registration would allow users to obtain special discounted rates, as well as access to intranet services, websites, and user communities.

6 Conclusions

This paper presented focus groups ran to get users user feedback on the concepts, user scenarios and business models developed during the Simplicity project. This methodology also permitted to define 3 main user clusters (“trendsetters”, “posh” and “fussy”). Most participants reacted positively to the Simplicity concept, especially the promise of easy accessibility and “comfort”. However the participants expressed the need to interact with integrated technologies -as far as this integration does not lead complexity- and to have their personal data available anywhere, anytime. They were also concerned with the usefulness, usability and reliability of services, applications and networks. Moreover the participants of the focus groups clearly define the mobile phone as the appropriate Simplicity Device.

Surprisingly, security and privacy issues were not of particular concern for most of them since most participants placed a lot of trust in telephone operators and in “trust organizations” such as banks and credit card companies. However, they underlined that security should be transparent and not interfere with their tasks. Another interesting aspect if that location-based services were perceived as a potential information overload. We should also underline that user profiles were considered as unmanageable and inefficient in most case. Finally, we consider that the results obtained during these focus groups would apply to all kinds of “mobile users” and should therefore be considered for improving the work performed within the Simplicity project.

7 Future Work

Qualitative researches are often broaden with more extensive studies, identifying interesting issues for future research. In this study, the evaluation process began with research activities focused on specific target groups. Subsequent evaluation phases will use a mix of qualitative and quantitative methodology. The final phase will emphasize quantitative methodologies. Actually qualitative and quantitative studies are of course complementary; thus using both approaches at different stages in the evaluation process can provide more insight than either method can offer when used on its own.

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