MOBILEMAN

Socio-economic Research Methodology

Deliverable D7

Contractual Report Preparation Date: March 2004

Actual Date of Delivery: April, 7th 2004

Estimated Person Month: 9

Number of pages: 34

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Abstract: The aim of this deliverable is to review and critically evaluate the activities about the social assessment of MobileMAN carried out during the first 18 months of the project and to document the methodology of the coming activities taking into consideration the experience gathered during the first phase of the project.

CONTENT LIST

SUMMARY

The aim of this deliverable is to document the activities undertaken by the social unit of the MobileMAN project to evaluate the technology from the social standpoint. During the first year, it was considered to use the methodological approach of participatory design and therefore actively involve potential end-users in the definition of the technological system. We carried out a pilot test to verify the viability of this approach and concluded that other approaches to anticipate social responses to MobileMAN were more appropriate.

Therefore, we intend to carry on our task with a series of interlinked activities and case studies. Through a user-oriented website we plan to interact with a community of potential end-users and initiate a dialogue with them that will help us in designing new applications and scenarios of use for MobileMAN. A second activity is to study similar technologies and on the basis of the gathered data anticipate the social response toward MobileMAN. We aim at understanding how users experience new information and communication technologies such as the mobile phone and wireless LAN in terms of functions, applications, ease of use and encountered difficulties. The gathered information will serve us in order to be able to provide a technology (MobileMAN) that is near to the users needs and accessibility. A third activity will focus on the categories of elderly and disabled: we intend to do a study on their relationship with information and communication technologies in order to understand in what way MobileMAN would benefit them. The test of the MobileMAN prototype and a study of the concept of cooperation with a special regard to its application in information technologies will conclude this series of activities about the social aspects of MobileMAN.

LIST OF USED ACRONYMS

CNR	Consiglio Nazionale delle Ricerche
DSAS	Dipartimento di Scienze Sociali e Aziendali (new name of DLS, Dipartimento di Lavoro Sociale)
FAQ	Frequently Asked Questions
GPS	Global Positioning System
HUT	Helsinki University of Technology
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IIT	Istituto di Informatica e Telematica
IR	Infrared
ISP	Internet Service Provider
LAN	Local Area Network
MANET	Mobile Ad Hoc Network
PD	Participatory Design
PDA	Personal Digital Assistant
P2P	Peer-to-peer
R&D	Research and Development
SMS	Short Message Service
SUPSI	Scuola Universitaria Professionale della Svizzera Italiana
UMTS	Universal Mobile Telecommunications System
VCR	Videocassette Recorder
VoIP	Voice over IP (Internet Protocol)
WiFi	Wireless Fidelity (IEEE 802.11)
WPAN	Wireless Personal Area Network

1.   INTRODUCTION

The objective of MobileMAN is to investigate the potentialities of the Mobile Ad hoc NETwork paradigm. One innovative aspect about the project is its interdisciplinary approach. In fact, the research project aims at validating MobileMAN both from a technical, as well as from a socio-economic point of view. This document illustrates how the Department of Social and Administrative Sciences (DSAS) is analysing the social viability of MobileMAN. Such an early concern about the social dimensions of new information and communication technologies (ICTs) and the attempt to anticipate social responses are quite unique to MobileMAN. Indeed, concerns about the social impact of new technologies generally only start to emerge once the technology has already been disseminated and adopted by the society, when it is too late to adapt it to people's requirements. Due to a gap between technology developers and intended end-users, emerging technologies are often used (or rejected) in unanticipated ways resulting in a significant waste of resources. A social evaluation of forthcoming technologies poses a number of conceptual and methodological challenges. As pointed out by Brown, 'predicting the future is a dangerous game' (Brown 2001:3). How can social responses and the impact of a technology that does not yet exist be anticipated?

This document presents the approach developed by the DSAS to study the social dimensions of some wireless ICTs in general, and MobileMAN in particular. The approach is based on a thorough review of secondary literature, on frequent interactions with the whole research team, and on a pilot experiment to involve potential end users in a dialogue about MobileMAN, whose results will be shortly presented later in this document. It may nevertheless be considered an experimental approach and we remain profoundly aware of the risks and limitations in predicting the future.

As will be discussed in detail in the following pages, the DSAS intends to assess the social viability of MobileMAN through a set of five interlinked activities:

1) **Enhance a dialogue between system developers and potential MobileMAN customers through an end-users oriented project website;**

As part of its endeavour to enhance a dialogue between technology developers and potential users the DSAS, in close cooperation with the CNR, is currently developing a user-oriented project website. This activity builds upon a pilot study that we carried out in 2003. The objective of this activity is not merely to ensure an information flow from 'experts' to potential customers, but also to obtain a feedback from concerned citizens that may be kept into account in product and applications development. Accordingly, the website is conceived as a tool to disseminate information, a strategy to enhance a dialogue between 'experts' and 'non-experts', and also as a research instrument. Through the website we seek answers to the

following research questions: How do potential users respond to the idea of a totally self-organised ad hoc communication paradigm? What type of questions and fears do they express? In what types of applications are they more interested? What type of advantages and disadvantages do they associate to MobileMAN in relation to existing mobile technologies? We plan to make use of an innovative and creative tool to stimulate users' thinking and to ensure their cooperation in answering the above presented questions. In fact, we believe that an innovative project like MobileMAN cannot rely only upon traditional methods of investigation. Instead, we will adopt more creative approaches that will empower traditional methodologies, which will be used for the social evaluation of the MobileMAN technology. We aim – in short – at employing a mixed approach, that will combine both traditional methodologies and more creative activities. One of these will be the use of WIKI instrument. This is a collaborative tool to create and edit a collection of information. Any person visiting the website will be able to edit the content of some web pages, remotely. We plan to make use of it for story and scenario building by website visitors, that will help us in discovering new and innovative applications for MobileMAN.

2) Study the social dimensions of wireless technologies in use as a strategy to anticipate responses to MobileMAN;

The study of people's relation to technologies in use is an approach that is increasingly adopted to anticipate the response to forthcoming technologies (Brown 2001). As pointed out by Woolgar (2002), new technologies supplement rather than substitute old ones. People's attitude and response to a new wireless technology may thus critically depend on their experiences towards existing ones. Based on these considerations, we intend to analyse the social responses to two wireless technologies in use, namely: mobile phones and wireless LAN (IEEE 802.11). With these case studies, which will be based on a review of secondary literature to be complemented with empirical investigation, we seek answers to the following research questions: What difficulties do different categories of people encounter in using the above mentioned wireless ICTs? Which functions and applications are most appreciated and diffused? For what reasons are some applications rejected? How do financial factors influence types and frequency of use? How did the adoption of wireless ICTs change patterns of social interaction? What are the implications for MobileMAN? Would they want to use them in places or contexts that are not served yet (e.g. where no network infrastructure is provided)?

3) Review the needs and concerns of the communities of elderly and disabled people in relation to wireless ICTs;

MobileMAN aims at reaching communities of users who are often excluded from the benefits of technological innovations, such as elderly and disabled people. The DSAS is aware that responding to the needs of these communities requires more than a declaration of intentions. If MobileMAN intends to pursue this objective, the specific requirements of these communities need to be clearly understood and kept into account in product development. As indicated by the growing body of literature on the subject, the role of ICTs for social inclusion of elderly and disabled people is increasingly gaining attention (see: Curry *et al.* 2002; Durieux 2003; Treffers 1998). It is recognised that ICTs have the potential to increase the quality of life and independence of elderly and disabled people. However, unless the design and functions of a technology keep into consideration the specific needs and constraints faced by these categories of users, they may turn out to be inadequate. With a study of elderly and disabled people's attitude, preferences, difficulties and uses in relation to existing wireless ICTs we intend to raise awareness about the socio-technical implication of targeting particular categories of stakeholders.

4) Test the MobileMAN fully functional prototype with a community of students;

We plan to take part into the test of the MobileMAN prototype that will take place in June/July 2004 in Finland. These are going to focus mainly on the verification of the technical functioning of a MobileMAN network of about 10 users equipped with a MobileMAN device (iPaqs or laptops). We will participate to these tests and gain information about the social aspects, that is, the contexts of use, the applications that they would like to use, etc. Depending on the device, (iPaq or laptop) that will be used within the framework of the prototype test, we will also verify the interface and its usability.

5) Analyse factors affecting cooperation in real life situations;

MobileMAN's goal is to define and develop a metropolitan, self-organised and totally autonomous network. There is no authority and no central control, since it is entirely made of users' devices (nodes), which are both service providers and service consumers. The underlying model is one of cooperation. For the system to function, users need to collaborate by allowing other users' information to pass through their MobileMAN devices (forwarding). The impact of ICTs on groups' opportunities to cooperate has attracted numerous researchers. It is generally assumed that ICTs reduce the costs of communication and coordination, thus allowing groups to overcome the obstacles to cooperation and collective action. This may lead to the emergence of new forms of self-organizing mutual aid institutions (Mele 2001; Smith 2000; Rheingold 2002; Kollock and Smith 1996). What thus far is unique about MobileMAN is that it is an ICT that does not only facilitate cooperation, but is contingent

upon it. But under what conditions will a group of people voluntarily organise and overcome the conflict between individual and collective interests? This critical question has attracted social scientists for several decades and continues to be subject of lively debates among collective action theorists (Olson 1965; Marwell and Oliver 1993; Hackthorn 1993). As part of the social validation of MobileMAN we intend to review relevant studies on collective action and to analyse how specific variables inherent to the group and to the context affect its capacity to cooperate. We also intend to study a widely used group of tools to collaboration and resource sharing over the internet, that is, the peer-to-peer programs used to build a network of files and resources sharing among users. Interestingly, only a small percentage of users shares their resources; the majority does not and is only concerned about personal benefits. What mechanisms of punishment or rewarding can be used to stimulate a cooperative behaviour in this context? Peer-to-peer or distributed systems are the core of the MobileMAN paradigm; therefore, this study will investigate a central aspect of the technology.

A detailed description of how the DSAS will carry out these activities is given in Chapter 3.

2.   REVIEW OF ACTIVITIES

2.1   GENERAL OVERVIEW

During the first 18 months the MobileMAN's social unit, in close consultation with the technical units, focused on developing and pilot testing an operational strategy fine-tuned to the specific reality of MobileMAN. Further, we explored whether and how the project was lending itself to the application of a participatory design (PD) approach (Duyne 2003).

An analysis of opportunities and potential strategies to adopt participatory design instruments indicated that at the current stage of product development there was only limited scope for an active involvement of potential end-users. Indeed, a review of concrete applications of this methodology within the framework of ICT projects revealed that participatory design is a powerful and effective approach for improving and adapting the design and functions of already existing technologies to the specific needs of users. However, it does hardly lend itself to explore social responses to technologies which do not yet exist and whose differences in relation to existing technologies are not easily grasped by non-experts. In order to establish a dialogue between system developers and potential end users, emphasis was to be put on communication.

Communication, that is, a dialogue between system users and system developers requires first of all the development of a common language used and understood by both system developers and system users. Hence, an important activity undertaken during the first project phase was

the development and pilot testing of user friendly information and communication material. The process and findings related to this pilot activity are briefly described below.

2.2   DEVELOPMENT AND PILOT-TESTING OF USER FRIENDLY INFORMATION MATERIAL

The development and pilot testing of user friendly information material was carried out by Brazzola (2003) within the framework of her MA (Master of Arts) thesis in communication sciences. Brazzola first of all 'translated' the technical information about MobileMAN in a user-friendly language. Examples about possible applications were given through brief stories, a technique commonly used in participatory design (Schuler and Namioka 1993; Cherkasky et al. 2000; Wall and Mosher 1994). The social response to the MobileMAN concept and to the communication material was analysed through a pilot test involving university students of theology, communication sciences, economics and architecture. The communication material was sent to a random sample of 80 students of whom 22 responded. The students were first given a questionnaire that would classify them as having low, medium or high expertise level about ICTs. Secondly, they were presented a booklet with a story having a structure that allowed the reader to make choices about how the story would continue. The story had the aim of presenting the MobileMAN technology in a real life situation that was very near to the social reality of the reader, so that they would be able to recognize it as potentially interesting and useful to them. After this exercise, the participants were given a second questionnaire aiming at testing how much of the concepts in the story they understood. Open questions were provided; these aimed at gaining thoughts and personal suggestions about the technology and its applications. In fact, it was assumed that the story would stimulate the respondents imagination and make them think of other possible applications from the ones we had illustrated (one-to-many communication, teamwork management, documents and resources sharing). This, however, was not the case. We interpreted the result of this experiment as a clear difficulty of visualising the place and the value of a technology that does not exist yet. For this reason, we will consider other techniques that will allow potential end users to envision future application scenarios for MobileMAN. (see later). An overview of the results of this pilot study are to be found in the Annex section to this document.

2.3   LESSONS LEARNT

The pilot study carried out by Brazzola (2003) showed that the PD instruments used may be more effective in relation to the refinement of already existing technologies, but somewhat inadequate to explore the viability of possible applications related to future technologies. For example, the Video Cassette Recorder (VCR) and cell phones nowadays are found in most households but are not always responding in all their technical details to the needs and preferences of end users. Many of the functions offered at high R&D costs are hardly ever used, whereas others potential applications are missing. These are examples of technologies whose improvement would strongly benefit from the adoption of a PD approach. What interests users if they are given an opportunity to participate in the development of a new technology? Most likely, they are not interested in the low-levels functioning architecture. They often do not even know how a device or system works at such levels. What they are interested in is the application level, and more specifically, the domain in which they can give an important contribution is the user-interface. Here, the focus is on the issue of usability. This may seem obvious, as it is logical that users have to find it easy and quick to understand and use an interface. However, in the last years, devices have become more and more complex and are offering a great number of new applications. This is a trend that we can see in all advanced technologies: telephones, VCRs, cameras, washing machines, etc. The complexity and the idea of "the more functions the better" have been pursued at the expense of a user-friendly interface. The prevailing approach does not focus on the user as the centre, but on the technology itself (Norman 1998). The user interface has become too complicated and in many cases does not trigger a desire to adopt new technologies. For example, if we asked a group of elderly people whether they would use a mobile phone if it had only basic functions, we believe they would be more willing to try.

These considerations show –as we experienced in MobileMAN– that PD might be more difficult to use at the initial stage of technology development, but can be extremely valuable later on, when it may allow to tailor the product to the intended users requirements, by focusing on the application and the interface sides in order to improve them.
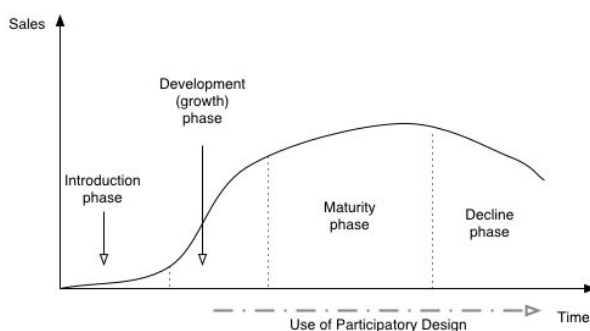

Figure 1: the product life cycle

Source: adapted from Guatri et al. (1999)

For the development of a new technology it is slightly more difficult to use PD, since in its initial phase it is not clear what the product will serve for, who the users will eventually be,

and the centre of the activities are to solve technical problems and less on the applications and the interface. As illustrated in Figure 1, the relevance of users' perspectives increases during the successive phases, when the activities focus on applications and usability and no longer (or less) on the low-level functioning architecture. However, some PD instruments may be employed to stimulate creativity on the use of the device.

The various tools and techniques associated to PD and the firm trust reflected in this approach that end-users have the right and can positively contribute to enhance the social viability of new ICTs nevertheless had a strong influence on the focus and methodology of our proposed research activities.

3.   PLANNED ACTIVITIES

The research activities on which we intend to focus over the next 18 months aim at a number of interlinked objectives:

a) Capture the present social response to the MobileMAN paradigm;

b) Anticipate some of the factors that may influence the dissemination of MobileMAN;

c) Evaluate the social viability of possible applications;

d) Raise awareness among system developers about the socio-technical implications of targeting specific categories of end-users, such as elderly and disabled people;

Our approach is based on the assumption that communities are not constituted by socially homogeneous groups of people. It is therefore necessary to underline the importance of social heterogeneity and to recognise that the introduction of new ICTs generate diversified responses (Woolgar 2002).

As shown in Figure 2, within society there are different 'pacesetters' in adopting advanced ICTs who distinguish themselves demographically, socio-economically, culturally and attitudinally. All of them have their specific knowledge and experience and can make a strategic contribution to socially informed technological development. However, to become successful, a technological product needs to appear and be beneficial to the majority of individuals, that is, it needs to be adopted by a "critical mass". And "these customers demand convenience, ease of use, reliability; they want solutions that simplify their lives, not technologies that complicate them" (Norman, 1998:32).

Our emphasis on the importance of social heterogeneity implies recognising that social responses cannot be captured by standardised research practices. As a consequence the social validation of MobileMAN is bound to rely through a number of inter-linked case studies. Methodologically, we will use a combination of traditional instruments and of new, more creative approaches. A special effort needs to be made to ensure the inclusion of those people

who are at risk of being excluded from the benefits of ICTs innovations, which is why we propose to carry out a case study about the specific needs and concerns of elderly and disabled people.
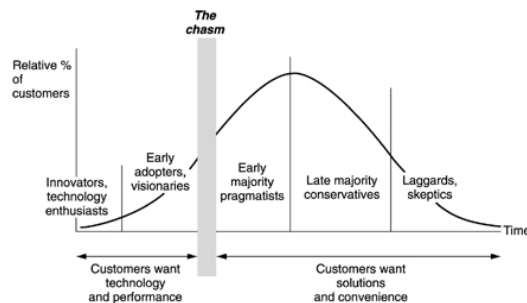

Figure 2: *Classification Scheme for adopters of innovative technologies*

Source: Norman 1998

3.1   USER-FRIENDLY INTERACTIVE WEBSITE

With the design and development of a user-friendly website we intend to disseminate accessible information about MobileMAN, to create a platform for a dialogue between system developers and a community of potential end-users, and to collect qualitative and quantitative data about social responses to build and maintain interaction and communication with a community of potential end-users.

3.1.1   Website Implementation

With the user-friendly project website we aim at reaching people with a relatively high level of knowledge and interest in innovative ICTs. In fact, people without this affinity are unlikely to reach such a site, no matter how user-friendly it is conceived. We intend to engage the visitors of the project website in raising questions about MobileMAN and in virtual collaboration that could generate ideas for the design and development of useful applications.

The information material about MobileMAN will explain briefly what MobileMAN is about, its similarities and differences in relation to existing wireless ICTs, its potential applications, advantages and benefits. This will ensure that the understanding of the concept and the involvement level will be the highest possible and constitute the basis for a virtual interaction among potential end-users and system developers.

We assume that if we are able to capture the attention of potential end-users about the potential advantages of MobileMAN, they will be willing to collaborate by participating in the collaborative activity we propose on the website.

The website content and design builds upon the pilot study we carried out during the first 18 months about communication between experts and non-experts in technological contexts (see Brazzola 2003 and Brazzola *et al.* 2004).

Website Visibility

The website visibility[1] will be ensured by using existing websites and discussion forums about technologies like WiFi, mobile phones, PDAs, Bluetooth, UMTS and websites related to relevant academic and research institutions. We will ask the respective responsible webmasters to insert links to the MobileMAN interactive website and present it at other websites forums. We will also make use of mailing lists of discussion groups about relevant discussion topics. We expect that these channels will allow us to reach a good amount of potential end-users that will eventually know MobileMAN and participate into the collaboration we propose.

Structure, Content and Tools

The website structure will be simple and clear to ensure that users will not be bored or confused, which would lead to an early site leaving. We aim at the potential end-users offering their highest possible collaboration by reading the brief information provided and by participating into the activity we will propose. For this reason we will take into account the necessity to have a clear navigation structure with an unambiguous definition of page levels, so that the website visitor will always have the knowledge of their position within the website and to avoid confusion.

The content of the website will consist of a minimum of information about the technology of MobileMAN and the possible applications that we have so far identified. We will present this information and scenarios by making use of text, visual elements, animations and sounds. We will consider all media types that will ensure users-involvement and create the content accordingly. Sections such as Frequently Asked Questions (FAQ) and a Glossary will be provided so that the user will be able to gain complete and comprehensive amount of information to ensure interest and understanding. Particular attention will be paid to how we can capture the interest of the visitor and make them willing to collaborate with us.

Users with particularly deep interest in the Mobile Ad hoc NETworks (MANET) technologies and in the project itself will be invited to visit the official project website, which contains a great number of documents and articles about the topic and which will be easily reachable through a direct link from the interactive website.

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[1] By visibility we mean the fact that the website will not be isolated but reachable through a series of links from other already existing website with content that is of technological nature and with an already established community of visitors, who might find interesting visiting the MobileMAN website.

We assume that the website users can provide us with constructive and valuable opinions and ideas about possible applications development. To gain this feedback, we will make use of the following tools:

a) An **online collaborative tool called WIKI:** WIKI is a conceptual model used to create an online open-content and also a tool (software) to realize it. The WIKI concept is based on a collaborative effort that allows three types of collaboration: participation can be in writing a contribution, checking the correctness or updating the information. It has been used for a few years and its most widely known application, "WIKIpedia" (the "democratic encyclopaedia"), is now very developed. After that, this model has also been used for other purposes, such as the collective writing of stories and scenarios. This latter application of the tool is interesting for our purpose. We aim at gaining new creative ideas and brainstorming about possible scenarios of use and applications for MobileMAN[2].

b) An **online questionnaire**. This will be provided in a second phase, when there has already been some interaction with the website visitors. It will serve us to gather data about this community of potential end-users. We aim at understanding the end-users opinions and attitudes towards issues such as the following:

- Role of costs in the technology adopting process

- Opinions towards electro smog issues

- Concerns about surveillance of communications (data storage, tracking)

- Desired applications that are not yet available

- Opinions towards the concept of collaboration with other users to make the network functioning

- Opinions towards the use of the collaborative tool used on the website

The questionnaire will be introduced during the last three months of the project website use time, to gain opinions and information. The reason why we will introduce it only in a second moment is that visitors will be more involved in the project and therefore more willing to participate into an online survey.

Mailing List and Newsletter

We might also consider using the strategy of registering visitors to the website in order to be able to remind them periodically to visit the website and participate in the proposed activities. This would also allow us to send a newsletter (with an estimate frequency of twice a year) to inform of the status of the project and the various results of the researches and to remind visitors to continue to visit the website and to collaborate with us.

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[2] This tool has also been used in a project that aims at developing Body Area Network technologies. See: http://borglab.media.mit.edu/wiki/borglab

The use of a Newsletter in the later months of the MobileMAN project could also be a tool for the dissemination phase; in this way, dissemination of the MobileMAN concepts and technology would start in advance, which would provide us with important benefits.

3.1.2   Website Update and Maintenance

As pointed out earlier, the website aims at constituting an effective interface between a community of potential end-users and system developers. For this reason, it will be updated and maintained throughout the period of its use. Moreover, it will be readjusted in case we observe that some of its components do not reach the intended objectives or are not understood or considered interesting by potential end users.

We will use the approach of website log analysis to identify possible problematic aspects of the website. The result of the analysis will provide us with valuable information about the users habits. Using this information, we will be able to make the needed (if this will be the case) adjustments of structure and content of the website.

3.1.3   Data Analysis and Website Evaluation

At project month 32, we will start with the analysis of the data collected through the website and with an evaluation of the website as a communication and research tool.

Data Analysis

The data collected through the website will consist of the **open-content** created with the WIKI collaboration tool and of the structured data collected through the online questionnaire. These data will raise our awareness about the specific concerns and interest of those who are likely to be the pioneers in adopting the MobileMAN technology and relate the provided information to their socio-economic profile (age, occupation, education, hobbies, knowledge and previous experience with wireless ICTs, etc). This information – to be published in a report – may be useful not only to anticipate the social responses to MobileMAN but may well influence the development of specific applications and the MobileMAN design.

Website Evaluation

Our website evaluation will focus on four key questions:

i) Were its content and structure adequate to the level of interest and understanding of the website visitors?

ii) Was the website – and especially the WIKI collaboration tool – an effective instrument to trigger a virtual dialogue and creative brainstorming about MobileMAN?

iii) Were the website and its various components (e.g. mailing list; questionnaire; Questions and Answers) viable and successful instruments for a project such MobileMAN?

iv) Were the website visitors' contributions relevant for a socio-technical validation of the MobileMAN paradigm?

Responsible for the website evaluation will be the DSAS. However, the exercise will involve all MobileMAN partner organisations.

3.1.4. Preliminary Test Phase

We plan to carry out a preliminary test phase with some communities of students. We will involve students from the following institutions: SUPSI, Eurecom, HUT, Cambridge University, University of Pisa. We also consider the option to involve other relevant institutions, in order to have a good amount of data. Students of computer science can be assumed to be rather near the target of the website[3], Moreover, using the WIKI collaboration tool, we intend to offer them the option to collaborate in a creative and "game-alike" way, which will be an interesting experience for them. We plan to have this preliminary test phase of the length of three months. We aim at involving a rough amount of 15-20 students from each of the named institutions. After this phase we will evaluate the website and the WIKI collaborative tool. Eventual readjustments and refinements will be then applied before the real use phase (phase two). This preliminary test phase will be conducted from project months 20 to 22.

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[3] The target of the website consists of users with interest into new technologies and who are likely to be identified as the "pioneers" in adopting a new one like MobileMAN.

3.2   ANTICIPATING SOCIAL RESPONSES TO MOBILEMAN THROUGH THE STUDY OF TECHNOLOGIES IN USE

Predicting the future by anticipating the social responses to a forthcoming technology is a risky and somewhat speculative venture. However, studying the social responses to pertinent technologies-in-use has been suggested and tested by a number of social scientists as a strategy to anticipate the responses to future technologies (Brown 2001; Cooper 2001). We intend to test this approach for the social validation of MobileMAN, by focusing on two wireless ICTs: mobile phones and mobile Internet access through wireless LAN (IEEE 802.11). As will be discussed below, with a social analysis of these two wireless ICTs we expect to be able to anticipate the attitudes and responses towards MobileMAN of different categories of stakeholders.

3.2.1   Technology of Mobile Phones

The first technology "in use" we will study is the mobile phone. Over the last decade mobile phones have experienced great development and market penetration. They have brought about profound changes in our lives and in our relationships. We can indeed agree that "mobile phones have modified our society" (Bautsch *et al.,* 2001:2).

Text messages – commonly known as SMS (Short Message Service) – have had huge hit without anyone predicting it. In fact, SMS was invented to serve business communication, and at first cross network messaging was not possible. As pointed out by Coates (2001) "The technology was designed for company messages to the phone user but nothing more than that. Until January 1999, it was impossible to send cross-network text messages. The mobile companies underestimated demand for SMS so much so that they could not handle the volume of messages being sent, hence the reason your phone often displays a 'network busy' response" (Coates, 2001:4). Now, operators of the mobile phone market make their best results thank to the massive use of short messages. According to Coates (2001), the comparatively low cost of sending an SMS may be considered the main reason behind this success story. To our opinion, this however may only be one of the reasons and may not explain the massive use by young people of this application.

As observed by several authors, the mobile phone has gained a status of the most used and significant ICT at present among society members, especially young people (cfr. Rheingold, 2002; Coates, 2001; Ito and Daisuke, 2002; Helyar et al. 2001).

The mobile phone and MobileMAN have several common aspects that make the phone interesting for us to study and gain some useful information. These are the following:

1)   Both are portable devices;

2)   They are wireless technologies;

3)   Text communication is possible (sms, e-mail) with them;

4)   They have to deal with size-limited interface and display;

5)   Video communication is possible;

6)   Other interactional applications (e.g. games, data exchange via IR or Bluetooth) are possible.

Apart from these evident similarities between MobileMAN and mobile phones, there are, however, also some clear differences that point at the fundamental distinction between the two technologies:

1)   The **network** that mobile phones use is centralized and controlled. It is owned by the mobile phone companies that provide the services. MobileMAN, on the contrary, is a self-organized network with no central authority since it is entirely made of users.

2)   Mobile phones do not require **collaboration**, whereas MobileMAN does. What is normally done by service machines and centralized databases has to be done collaboratively by the network users (node discovery, message routing and forwarding).

3)   Mobile phone users pay for the service but nothing or almost nothing[4] for the device; whereas for MobileMAN users pay for the device but the service is free. The concept of "**cost**" has a different meaning, comprehending for example the cost of the device, the energy related to the operation of the device for ones personal use as well as to allow other people to use their devices, and the 'cost' of cooperation. "Cost" in MobileMAN is for example the fact that a user could keep the device switched on even when not using it to provide packet forwarding for other users, and therefore consuming power for others and not for themselves.

Research Questions

The above-discussed aspects lead to the following research questions that we will investigate within this case study:

1)   What kind of **usage difficulties** are there for different users categories? In particular the categories of elderly and disadvantaged individuals, but also the group of people who chose not to adopt the technology of the mobile phone are interesting to consider, in order to understand the factors that intervene when deciding whether to adopt a mass technology or not.

2)   Which are the **functions** present in a mobile phone that are most used and which are not used? An increasing number of features and functions enriches the new models of mobile phones, but what do users think of this trend of making devices more complex?

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[4] This is however, not true everywhere: in Switzerland and UK mobile phone service companies have adopted the strategy to sell devices at very low prices and even for free, since they plan a return on this investment with the charges for the services (sms and phone calls). In Italy, this is not the case; we will therefore take into account these considerations for our future work with this case study on mobile phone use.

What do they think about sacrificing **usability** and user-friendly **interfaces** for greater complexity?

3)   In what way is the **cost** an adoption-driver factor for different categories? Is there a "club effect" for some categories, that is the fact that the cost is high is exactly the factor that makes it interesting?

4)   In what way is the fact that communication might be stored in the infrastructure-based networks like the mobile phone network? Is there a sense of "being controlled" and of state and private companies **surveillance** of individuals? How would the idea of being able to communicate with other individuals in a totally private way be welcomed?

The information that we will gain from this research will serve us as lessons learnt and will allow us to draw some anticipative ideas about the possible social responses towards the MobileMAN technology. Moreover, we aim at defining what groups or communities of users might be interested in adopting MobileMAN at the early stages of its development and market penetration. This will also be some valuable information for the dissemination phase of the MobileMAN project.

Methodology

For our study on the social dimensions of mobile phones we will primarily rely on secondary literature. In addition we intend to collect primary data relevant for our comparative analysis between MobileMAN and mobile phones within the framework of data collection in relation to our other research components. We will accordingly be able to collect qualitative and quantitative data from different categories of users whom we may reach through our website, and with the help of research institutions relevant for the MobileMAN project.

3.2.2   Mobile Internet Access

The second technology "in use" we intend to study for its similarities and differences with MobileMAN is Wireless LAN (IEEE 802.11), a technology that allows wireless Internet broadband connection through laptops and PDAs (Personal Digital Assistants).

When considering buying a new personal computer, more and more people choose laptops over desktop computers. Mobile and wireless computing is increasingly spreading: Internet Service Providers (ISPs) are in the process of installing wireless access points (devices that allow wireless connection to the Internet) in many public spaces (airport lounges, train stations, shopping centres, bars). These are the so-called "hot spots". Some of the access points to be used are subject to a fee payment, while some others are free of charge[5]. In these places, a user with a portable laptop (or PDA) equipped with a compatible wireless card can easily access the Internet and use all the related services (chat, mail, web, etc.). This is the

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[5] For example, hot spots in airports are subject to a fee charge whereas in places such the Starbucks coffee bars they are free of charge.

"anytime, anywhere" access to Internet and information. Hot spots are quickly developing and have reached an important number in every major city (see figure 3).
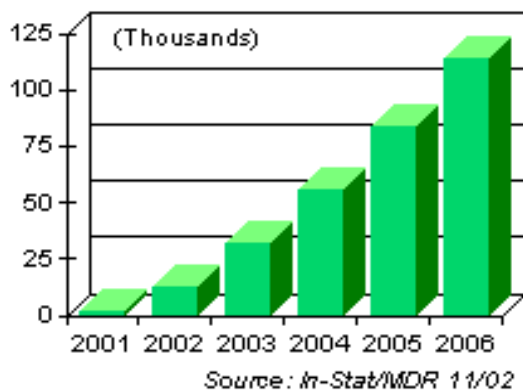
Worldwide Hotspot Location Forecast

Figure 3: *Forecast of Hot spots development*
Source: In-Stat/MDR 11/02

The opportunity to access the Internet from public places via wireless connection can offer great improvement to information access and communication from almost anywhere. Wireless LAN may also enhance collective action and **cooperation** by offering **communities** new opportunities to share hot spots and related services. As pointed out by Rheingold (2002), Wireless LANs for neighbourhoods are a way to strengthen the sense of community and to share the resource of internet access; instead of everyone buying access from an Internet Service Provider (ISP), only one buys it and creates a community network that will serve more users: by cooperating in this way, users can counterbalance the power owned by ISPs. This is a common aspect with MobileMAN: "It [MobileMAN] offers a solution to the problem of 'wireless operator as kingmaker' by introducing a new technical, economic and social model of a self-organized network" (MobileMAN, 2002).

We have selected this technology to be studied to anticipate social responses to MobileMAN – again, like with the mobile phone technology – because of the similar aspects that they have and that are now briefly listed.

The social responses to Wireless LAN are relevant to MobileMAN because the two technologies share the following features:

1)   Both are wireless ICTs;

2)   Both devices are portable;

3)   They give the opportunity to use services like chat, email, web surfing, file sharing;

4)   They offer the possibility to share documents and information with other users;

5) With Voice over IP (VoIP) there is the possibility to use voice communication applications;

6) Both are technologies that may foster a sense of community.

Equally interesting for our comparative analysis are the following differences between the two technologies:

1) **Cost of access**: in public places like airports or hotels the use of the installed access points is generally subject to a use fee charge; MobileMAN would allow communication and information/documents sharing without the charge.

2) **Server/client vs. ad hoc**: access and use of Internet go necessarily through the server-client paradigm, whereas MobileMAN does not use a hierarchical structure, being an auto-organized network. Hence, contrary to Wireless LAN, MobileMAN paradigm is contingent upon cooperation.

3) **Concerns about control and surveillance:** There is growing concern about privacy issues and anonymity (Green 2001; Mackay 2001). Whereas Wireless LAN lends further expands social control and surveillance opportunities, MobileMAN clearly allows to resist to this trend as its users will not leave any traces of their communication stored in some server or service machine. E-mail service providers on the contrary, keep logs of traffic for some period of time due to legal constraints.

Research Questions

With our study of Wireless LAN we aim at focusing on the following issues:

1) How do users of Wireless LAN **experience** this new technology?

2) What type of **uses** do they make of Wireless LAN (when, where, for what purposes)?

3) Among specific users such as university students, what are the socio-economic, educational, demographic and gender characteristics of the Wireless LAN **adopters**? Are there some categories of students who **decline** using Wireless LAN? For what reasons?

4) How do **cost** factors and other considerations influence their type and frequency of use?

5) How do concerns about **surveillance** influence the use of Wireless LAN? Are users concerned about a potential intrusion of new ICTs in their private life?

6) How do Wireless LAN users respond to the possibility to communicate and share resources and information on an **ad hoc network**? How do they feel about the related advantages and disadvantages?

Methodology

We intend to analyse the social responses Wireless LAN by focusing on the experiences gained so far with its introduction at the Federal Institute of Technology Campus in Zurich

and at the University of Lugano. These will allow to compare responses related to a context where the technology has already been introduced few years ago with those where its introduction is of very recent date[6]. Contact with these two institutions has already been established and they expressed an interest to cooperate with the DSAS's proposal to carry out a social evaluation of Wireless LAN application in their campuses.

We intend to review the data that these two institutes have already collected about students' uses and responses to Wireless LAN, carry out a number of interviews with key informants (experts and users) and eventually carry out online surveys.

3.3. ELDERLY AND DISABLED PEOPLE: A REVIEW OF THEIR SPECIAL NEEDS AND CONCERNS IN RELATION TO ICTS

New ICTs and their applications, rather than targeting groups of people with special needs, generally aim at triggering mass markets where there are financial returns available to offset development costs. However, if the special needs of specific groups of people such as elderly and disabled people are kept into account already in the development process, a new ICT may at the same time appeal to the masses as well as to people with specific requirements.

ICTs may have a dramatic impact on the life, for example, of elderly and disabled people confronting them with a new spectrum of opportunities and risks. ICTs may thus contribute to enhance their social inclusion, work opportunities, and independent living or may lead to their further marginalisation (Treffers 1998).

With our study of elderly and disabled people's experience, attitude, and use of ICTs we aim at raising awareness about the factors that need to be taken into account in technology development if a product is intended to target, not only the masses, but also people with specific needs and constraints.

This study will focus on two types of ICTs:

1)   '**mainstream technologies**', that is, technologies developed and designed for the masses, such as mobile phones; and:

2)   so-called '**assistive technologies**', understood as any type of ICT specifically designed to assist people who have difficulties, due to age or disability, to carry out everyday activities that enables independence for older or disabled people (Curry et al. 2002:7). This includes for example electronic bracelets, community alarm systems, telecare and smart homes.

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[6] In Zurich this technology was introduced in 2000, whereas in Lugano its introduction has just recently been launched.

Existing literature shows that wireless mainstream as well as assistive ICTs may significantly support independent living of elderly and disabled people in their homes, in safety and best possible health. Both the adoption of 'mainstream technologies', as well as 'assistive technologies' confront elderly and disabled people with a number of problems that may strongly influence their adoption. For example, they may refuse the adoption of assistive technologies because they remind them to their dependence and fragility and thus turn towards mainstream technologies associated to young people's freedom and independence such as mobile phones. However, elderly and disabled people may find out that these devices do not necessarily respond to their needs or that their specific design constrains their effective use.

Research Questions and Methodology

Our study on elderly and disabled people's attitude and use of ICT will be based on a thorough literature review as well as on an empirical investigation. Through organisations such as 'Pro Senectute', 'Pro Infirmis' and other service organisations catering at the needs of elderly and disabled people we will get in touch with elderly and disabled people who are currently using assistive technologies such as electronic bracelets. Through semi-structured interviews with a representative sample of elderly and disabled people currently using one or more wireless ICTs and through in-depth interviews with key informants (relatives, professional care givers, experts) we will aim at answering the following research questions:

1)   What **connotations** do specific ICTs have among elderly and disabled people?

2)   What influence do these connotations or prejudices have on their **adoption**?

3)   What specific operational, cognitive or emotional **difficulties** are they facing in making use of ICTs?

4)   What are the **benefits** and difficulties related to the adoption of ICTs by elderly and disabled people as perceived by their relatives and professional care staff?

The collected data will be analysed with specific reference to their relevance for MobileMAN to the extent that reflections will be made about the specific needs of elderly and disabled people to which some MobileMAN applications could respond and about the limiting factors that have to be kept into account if MobileMAN aims at having something to offer to these particular categories of people.

3.4.   MOBILEMAN IN USE: TESTS WITH USERS

The technical tests of the MobileMAN prototype scheduled for the project month 21 (June 2004) will be the occasion to have first feedback from users dealing with near devices. Tests will involve a fair amount of computer science students of the Helsinki University of Technology (about 10) who will be given the MobileMAN prototype to verify the functioning of the technical aspects, through its use.

The social unit of the MobileMAN project will intervene in these tests in two ways:

a)   by observing users behaviours while using the device with the provided applications

b)   by interviewing some of the involved users (if possible all of them) and conduct semi structured interviews in order to have insights in their experience and desired applications or encountered difficulties.

3.5.   ANLYSING FACTORS AFFECTING COOPERATION IN REAL LIFE SITUATION

3.5.1. A Theoretical Discourse

The impact of ICTs on groups' opportunities to cooperate has attracted numerous researchers. It is generally assumed that ICTs reduce the costs of communication and coordination, thus allowing groups to overcome the obstacles to cooperation and collective action, which may lead to the emergence of new forms of self-organizing mutual aid institutions (Mele 1992; Smith 2000; Rheingold 2002; Kollock and Smith 1996).

MobileMAN may become a device that further reduces the cost of communication and organisation, thus facilitating the group cooperation. However, whereas other ICTs may still continue to function even if some of its users are defecting, under such conditions MobileMAN would no longer be functioning. Cooperation, however, has a cost and the collective interests of a group to cooperate may not coincide with a person's individual interest to keep his own costs as low as possible.

Participation in collective actions may thus be constrained by so-called 'transaction costs'. Transaction costs refer to the costs related to the organisation of collective action, including search costs (identifying possibilities of cooperation), bargaining costs (agreeing on a scheme of cooperation), and monitoring and enforcement costs (Taylor and Singleton 1993). As pointed out by Hirshman already in 1970, if the costs of organisation become too high, people may opt for a technology not requiring any cooperation, even if such alternative option is associated to higher financial costs. From this we may deduct that people my turn down MobileMAN if the transaction costs associated to its use are too high and if MobileMAN does not offer them any application which they are not able to obtain from some other ICTs.

Through a review of secondary literature on collective action theory and research we will call attention on some of the factors that affect a group's capacity to overcome collective action problems. We will start by a review of Olson (1965), who even today is considered the touchstone of collective action theory by discussing how a group's size and other group characteristics may influence its capacity to pursue common goals and move to more recent research (e.g. Ostrom 1990) showing that this capacity critically depends on a number of group, contextual and collective good characteristics.

This study will conclude with some specific considerations about whether and how collective action problems may influence the social viability of MobileMAN.

3.5.2. The Example of p2p Networks on Cooperation

MobileMAN will be based on peer to peer mechanisms, that are collaborative by name: to be functioning a peer to peer network has be able to rely on collaboration among users who need to share files and documents with other users. Nowadays, p2p software that run on the Internet are very used for searching and downloading files. But how much real cooperation is there? Research has shown that the percentage of users who actually share content with others is just a small fraction of the entire group of users: most of them just do not share but wants shared content. Some p2p applications have developed an incentive mechanism to ensure that a greater percentage of users shares. This study will deal with p2p systems and understand first of all how collaborative these are and the possible reasons for that. After that, we will try to identify the mechanisms that may be used to ensure that a fair amount of collaboration is reached. In fact, the network will be working only if a limit of collaboration by its users is reached.

4.　TIMEFRAME AND MANAGEMENT

ACTIVITY	PROJECT MONTH															
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
PROJECT WEBSITE																
Website implementation	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓		
Phase I – Test with students		▓	▓	▓												
Phase II – Real users					▓	▓	▓	▓	▓	▓	▓					
Evaluation phase															▓	▓
COMPARATIVE ANALYSIS																
Mobile Phones	▓	▓	▓	▓												
Wireless LAN			▓	▓	▓	▓										
ELDERLY AND DISABLED						▓	▓	▓	▓	▓	▓					
TEST WITH USERS				▓												
COOPERATION												▓	▓	▓	▓	▓

Note: the website implementation will take the entire time used for the activities related to the website use. This is because, as already said, we intend to make website readjustments and updates in order to have it as effective and efficient as possible. For the phase I (test with students phase), we intend to provide an initial set up that will be completed in the following weeks.

We plan to have all the described activities ended and summarized in a final report by project month 34. Some results will already be reported in other project deliverables.

5.　DISSEMINATION

In order to bring MobileMAN to society members and communities, dissemination strategies have been planned. We intend not only to address potential end-users at the stage when technology is ready and functional, but also during the implementation phase as well. This will be conducted by means of the already mentioned website, which will allow communication with some categories of potential end-users.

However, we intend to make use of more media to communicate and disseminate the concepts and potential benefits of the MobileMAN paradigm. This for the simple reason that the website will only reach certain segments of potential end-users, as already mentioned. Other

categories (or communities) of potential end-users will be reached during our case studies already. However, we propose to employ other dissemination strategies towards the end of the project.

We plan to take advantage of the following opportunities:

-   **Radio**: a short presentation about the MobileMAN project has already be done through an interview session with some researchers at SUPSI. It was broadcasted during the month of February on the regional radio channel in Ticino, within the frame of a series of presentations of research project at University and SUPSI. The interview file will be also available on the radio company website in an mp3 format for later listening.

-   Technology pages on **newspapers**: we can foresee that we will have the opportunity to present the technology on some regional newspapers' pages on technology. This is an important opportunity to reach the "mass" and the "less technology-oriented people".

-   Articles on technology **magazines** and **journals**: we expect to publish and present the research results on more peer-oriented media.

-   **Presentations** in the contexts of universities or universities of applied sciences: we will consider the opportunity to present MobileMAN first of all in the project involved institutions (so for example at SUPSI or IIT), and on a second level other related institutions.

-   Presentations and conferences at **events** about emergent technologies: a presentation of MobileMAN is already scheduled at a public event (Lugano Communication Forum) in Lugano in April 2004.

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7.   ANNEX

7.1.   PILOT STUDY RESULTS

The pilot study consisted of a theoretical part about what aspects can be problematic when there is a communication situation between system designers ("experts") and end-users ("non-experts"). Then with those considerations in mind, some user-friendly material was constructed with the objective to allow communication between these two categories of people, in order to create a knowledge about MobileMAN that was common to them. The material had the format of an interactive story where the reader had to make decisions about how the story had to continue. The small investigation conducted aimed at verifying whether this user-friendly material was successful in reaching the intended objective.

The hypothesis for this research was the following:
The realized material to explain the concepts of the MobileMAN technology is understandable to potential end-users with low expertise in ICTs.

Definitions:
1)   **ICTs expertise**: here it was defined as having knowledge and use ease in four chosen ICTs (cell phone, internet, PDA and wireless technology). This variable has three values: high, medium and low.
2)   **Understanding**: the ability to answer correctly to some specific questions about the content of the material itself. This variable has four values: insufficient, basic, good and very good.
3)   **Understandable**: the material was defined as understandable when at least 85% of the respondents have reached a good understanding.

Sampling:

The sampling method was a simple random procedure, among the students of the departments of architecture, communications, economics and theology at University of Lugano. 80 students were chosen, 22 responded. Two questionnaires (one to measure the ICTs expertise level and one to measure the understanding degree of the concepts presented with the story) and the booklet with the story were sent per post with prepaid response envelope.

Results:

The main results of the investigation are now briefly presented.

Repartition of understanding:
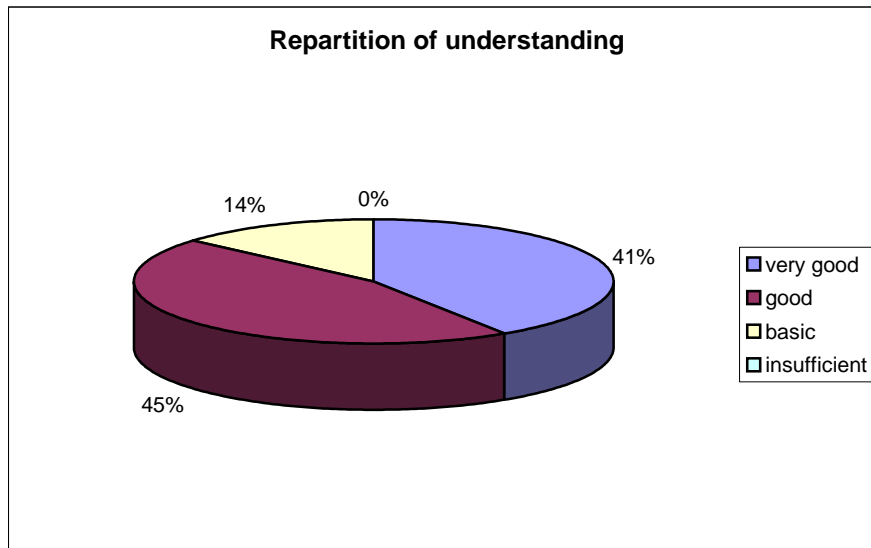
Repartition of understanding

Figure 1 – Repartition of understanding degree of the presented concepts

None of the respondents showed an insufficient understanding of the MobileMAN concepts presented. 14% showed a basic understanding, whereas 45% a good and 4% a very good understanding. Of the respondents with low expertise, 63,3% showed a good understanding and 36,4% a very good understanding. All respondents with low expertise, therefore, have at least reached a good understanding. The research hypothesis is verified.
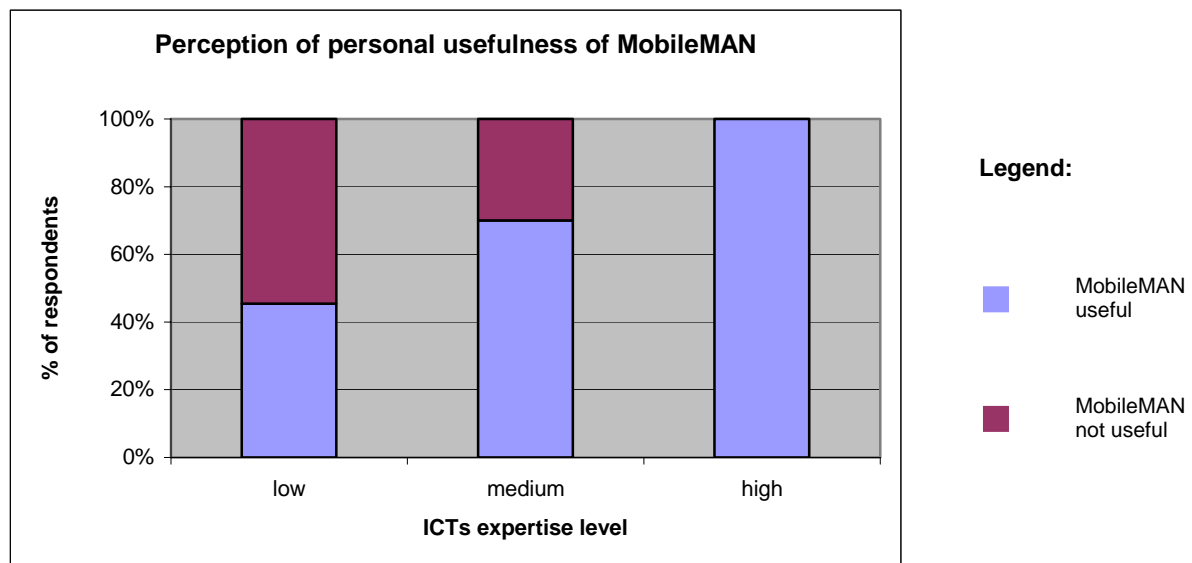
Perception of usefulness of MobileMAN:

Figure 2 – Perception of personal usefulness of MobileMAN

It is interesting to see that the higher the ICTs expertise level, the greater the perception of personal usefulness of the respondents.

Open questions to gain creative ideas about new applications:

The questionnaire that measured the understanding level of the presented concepts also offered some open questions that aimed at gaining ideas about new applications other than the ones suggested in the user friendly material. Although it was expected that users would come up with interesting ideas, this was not the case with one exception: the only respondent with high expertise in ICTs proposed the integration with GPS (Global Positioning System) and information about the local facilities (cinema, restaurants, hotels, etc.). Apart from that, no other idea was proposed by the other respondents. This was interpreted as a difficulty to picture and imagine a new and very future-oriented technology.

Conclusions:

The hypothesis that was to be controlled with the research was verified since that all respondents with low expertise in ICTs showed at least good understanding.

However, the second (and secondary) aim of the investigation to gain useful and creative contribution by the potential end-users was not reached, as already stated. This led us to the definition of the tools used to use the concept of participatory design within the MobileMAN project.

The full research report is available at:

http://www.bul.unisi.ch/cerca/bul/memorie/com/pdf/0203Brazzola.pdf