User-driven innovations? Reassessing the value of bottom-up approaches within an interdisciplinary mobile media context

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1. Context and introduction

In the context of an ICT environment characterized by trends such as market liberalisation, growing convergence and accelerating innovation and development processes, more and more authors tend to emphasize the importance of the end-user and the need for a thorough insight in end-users’ expectations and needs. Referring to the ‘innovation spiral’ concept - pushed forward by Poiesz and Van Raaij (2002, p. 32) to illustrate the increasing pace in ICT innovation processes - new product development in the domain of ICT has been challenged in various ways. In the evolution of ‘always faster and shorter’, companies have been pushed to shorten or even skip important research stadia. Often, user involvement is limited to one single stage (e.g. test market research, usability research) or to the final stages of the process.

As a result, more and more innovations seem to fail in ‘passing the chasm’ between the adoption segments of innovators and some early adopters on the one hand and the mass market on the other hand (Moore, 2002, p. 5-6; De Marez & Verleye, 2004, p. 33-34). De Marez (2006, p. 33-34) identified some of the most crucial problems in this respect, namely the lack of accurate insight in end-users’ expectations and requirements and the lack of adequate end-user involvement, from the early development stages on.

At the same time, some of the abovementioned evolutions seem to have influenced the empowerment of technology consumers or users, as these latter have turned into ‘harder to please’ (Kotler, 2003: 72), self-conscious and increasingly active stakeholders. In this respect, we can draw on many examples from the Web 2.0 sphere and beyond to illustrate the blurring boundaries (e.g. the boom of user-generated content). Some authors even use the notions of ‘prosumers’ and ‘produsers’ (Bruns, 2005) to illustrate this shift from passive consumption to active and dynamic (co-)production.

When considering this matter from a more theoretical point of view, it can be assumed that an important shift has taken place. Starting point is the the ‘technology-push’ idea, which was dominant for a few

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decades. In this perspective, technology is considered to be the prime mover of transformations: changes in society are assumed to be due to technological developments. This idea of ‘technological determinism’ fits in the broader framework of diffusionism (Rogers, 1995, p. 2003), stating that the adoption and use of technology follow a predictable path. Over the years, this deterministic perspective has however been challenged by more user-centered paradigms such as the ‘Social Shaping of Technology’, ‘Social Construction of Technology Approach’ (SCOT) (Haddon et al., 2005). These approaches emphasize the continuous interaction between technological and societal forces (Rickards, 2003, p. 1095, Trott, 2003, p. 836). Furthermore it is argued that societal forces also have the potential to influence the emergence of new technologies and the way technology is adopted and used (Haddon, 2005, p. 4). Boczkowski (2004: 255) describes this ‘interactionism’ perspective as ‘social shaping and diffusionism being so intimately tied that they should be seen as the two sides of the same innovation coin’. In addition, another part of the literature is dedicated to the use of technology in the domestic environment and to people’s interaction with technology in everyday life. This is referred to as the domestication framework (Lievrouw, 2002, p. 185; Silverstone & Haddon, 1992; Haddon et al., 2005, p. 4).

Given this important paradigm shift, the field of technology development and innovation is also believed to be characterized by a gradual evolution from the traditional ‘technology push’ to more ‘pull’-based strategies, building on bottom-up and user-driven approaches (Rickards, 2003, p. 1095; Trott, 2003; van der Duin, 2006, p. 15; Von Hippel, 2005). This shift seems to be supported by authors from various fields, such as Sanders (2001, p. 2), who supports the need for a better understanding of the user in order to drive true innovation from the ‘user’s perspective’. Similarly, Munnecke & van der Lugt (2006, p. 8) state that user values and experiences, are ‘dominant key values in future markets’ that thus need to be placed at the heart of the innovation process.

In this regard, we can also draw on various examples from the field of ICT development: e.g. Microsoft provided its Xbox 360 ‘lead users’ with developer kits; Philips has been using the ‘lead user methodology’ for beta-testing in its ‘leaduser.nl’ studies. Other big companies such as Nokia, Google … have launched similar bottom-up initiatives. It can be assumed that some of these approaches have been influenced by the work of Eric Von Hippel on ‘lead users’ and open, user-driven innovation. In this context it is also relevant to refer to the notable rise of living labs, which can be regarded as ‘user-driven innovation environments’, and to the creation of ENoLL (The European Network of Living Labs). Living labs are usually city-based, which is also the case for the living lab environment (i-City) that is discussed in this paper. The role of such living labs in user-driven innovation will be highlighted further in this paper. In spite of these examples and as we describe in this paper, there are however still a few problems and challenges to be tackled.

Expanding on previous research in the field of ‘user-oriented’ and ‘user-driven’ innovation, section two of this paper highlights important developments within this emerging research field. Furthermore, it focuses on the implications for traditional innovation and development processes. In this respect, three crucial challenges for scholars and practitioners are identified in the third section. Drawing on the empirical data presented in this paper, we illustrate how these challenges might be tackled and how users can be involved throughout the whole New Product Development (NPD) process. For the scope of this paper, we will focus on four distinct moments of ‘user involvement’ within three particular phases of the NPD-phases: i.e. opportunity identification, concept evaluation and test market. The results of these studies, which are discussed in part five, are part of a larger research project that should be situated in a living lab context (cfr. supra). To conclude, the final section critically reflects on the role of living labs within user-driven innovation and makes some suggestions for further research.
2. User-driven innovations: more than a hype?

As stated above, important changes at the ICT market (and beyond) have entailed various new barriers for successful innovation. Traditional product development strategies have shown their shortcomings since they are no longer able to guarantee the successful adoption and diffusion of new ICTs. In this respect, the growing number of failing innovations has alerted to the need for more accurate user involvement in order to develop innovative and user-centered products (Sleeswijk Visser, Van der Lugt, Stappers, 2007, p. 35). Although ‘the consumer’ has always been important to a certain degree, companies are now increasingly forced to put user needs and customer-understanding at the core of their innovation strategies in order to sustain a strong market position and to pursue product development, which meets customers’ demands better than before (Magnus et al., p. 6). Or as Veryzer & Borja de Mozota (2005, p. 133) state: ‘Given the ever-accelerating rate of technological leaps – and the products they can spawn – a user-orientation is essential if the product outcomes are to be embraced by customers’.

In view of this, the notion of ‘user-led’ or ‘user–driven innovation’ has arisen as a hot issue over the last couple of years. Considering what is at stake however, user-driven innovation strategies are more and more considered to be a necessity for successful innovation development, rather than only a hype. In current definitions, ‘user-driven innovation’ refers to the process of collecting a particular type of information on users’ needs, wants and expectations. More specifically, it deals with those user insights that are not just at hand and difficult to grasp (Rosted, 2006, p. 22). Such information is crucial for companies since it provides ‘a greater chance of achieving commercial success and increased customer satisfaction’ (Magnus et al., p. 6). A review of the literature has shown that several terms (such as user-centered design, participatory design, user ethnography) are used in this respect. Regardless of terminological differences however, these approaches all have the same goal: to gain those crucial user insights by uncovering users’ needs both at an acknowledged, observable level as well as at a latent and rather tacit level.

Several approaches have been pushed forward in order to collect this type of knowledge. Undoubtedly, Eric Von Hippel’s work on ‘lead users’ can be regarded as pioneer work in this respect. Von Hippel (1986, p. 791) states that a specific group of users, namely ‘lead users’ can serve as a kind of ‘need-forecasting laboratory for marketing research’. He defines lead users as ‘users whose presents strong needs will become general in a marketplace months or years in the future’. Von Hippel’s research strongly advocates the importance of end-users in new innovation development. His ideas seem to have inspired many companies in search for new innovations (e.g. Philips, Nokia, Microsoft etc.).

In addition, over the years, the traditional user research arsenal (including methods such as focus groups, interviews etc.) has been extended with alternative analytical methods and tools (e.g. personas, archetypes, contextual inquiry, ethnography, sensitizing packages …) from various disciplines (such as design, sociology and anthropology), in order to support user-driven innovation. Whereas the so-called ‘traditional’ methods usually focus on what people say and think, methods from other disciplines are now used to ‘dig deeper’ in what people do or want (e.g. ethnographic research, observations, user toolkits, …) and feel or dream (e.g. generative methods) (Sleeswijk Visser, Stappers et al., 2005, p . 123).

As described in the introduction, the rise of living labs should also be mentioned in this context. The European Network of Living Labs (EnoLL), which was launched in December 2006 under the Finnish EU presidency, already groups over 50 living lab settings (such as i-City in Hasselt, Belgium) from 17 different countries. Living labs are city-based innovation areas, which provide full-scale test bed possibilities for inventing and prototyping as well as for the interactive testing and marketing of (new)
mobile technology applications (Experientia, 2006). In contrast to other test beds, living labs provide a more ‘natural’ testing environment. They strongly emphasize the role of the user in the process of shaping new applications and furthermore encourage constant and meaningful interaction between developers and producers on the one hand, and users on the other hand. Living labs can thus be considered as environments that provide possibilities for advanced and strong user involvement. However, one could question whether these ‘natural settings’ provided by living labs, truly reflect the way end-users use and interact with technology in their daily lives.

In this respect, it is also relevant to consider the various degrees of user involvement in product development, as classified by Jeppesen (2005, p.349-350). He identifies three general levels of user involvement ranging from traditional to rather strong and more advanced involvement practices. Listening to the consumer (e.g. by means of interviews, focus groups etc.) is considered to be a relatively weak form of consumer involvement, while methods that focus on interaction with advanced users (such as lead users or experts) are classified as ‘moderate’ forms of user involvement. However, methods that require a more active role of the user (such as user toolkit methods, living lab testing etc.) are referred to as strong forms of user involvement. According to Jeppesen (2005, p. 350) ‘Letting consumers carry out essential design-by-trial-and-error-processes avoids costly iteration and speeds up the process’.

When considering the differences between some of the abovementioned ‘new’ approaches and the ‘traditional’ practices at a more generic level, it can be assumed that the latter have characteristics such as e.g. ‘a technology driven focus, limited multidisciplinary cooperation and development prior to user validation’ (Vredenburg, Isensee, and Righi, 2002, p. 2), whereas on the other hand, user-oriented approaches tend to be user-driven and multidisciplinary. Furthermore such approaches focus on current and future users and their experiences instead of only focusing on current customers (Vredenburg, Isensee and Righi, 2002, p. 2). This cross-disciplinary approach, required for successful user-driven innovation, has often been emphasized in the literature.

Nevertheless, the current initiatives for broadening the new product development process in terms of multidisciplinarity, also entail new challenges and complexities, such as the integration of knowledge from these various traditions: ‘disparate disciplines, each with their own emphasis and sense of ‘product direction’, have overlapping and sometimes conflicting areas of concern with respect to a product being developed’ (Veryzer & Borja de Mozota, 2005, p. 133). Furthermore, interdisciplinary initiatives are often still lacking or insufficient in practice. Another concern in this respect is the ‘fundamental tension between a technology-driven and a user-oriented focus’ (Veryzer & Borja de Mozota, 2005, p. 129). In the following section, we will discuss the important challenge ensuing from this tension. In addition, two other challenges connected to the notion of user-driven innovation are put on the agenda.

3. Challenges and objectives

As stated above, the literature on the role of end-users and user-oriented innovation approaches has boomed over the last couple of years. Despite all these theoretical and methodological contributions concerning user-driven innovations however, there often remains a gap between ‘theory’ and ‘practice’ (cfr. supra). Several scholars have focused on the fact that there are rather few companies that effectively involve the customer or user in the innovation process (Alam, 2002; Kristensson et al., 2004). Kristensson et al. (2004, pp. 4-5) attribute this discrepancy between theory and practice mainly to the lack of empirical ‘evidence’ on the benefits of user involvement and user-oriented strategies compared to traditional R&D.
Although research has indicated that if NPD projects fail, it usually went wrong from the beginning (Khurana & Rosenthal, 1998), user involvement is too often limited to one single stage (e.g. usability testing) or to only the final stages of the process (e.g. evaluating) (Haddon et al., 2005, p. 10). This was also observed by Mulder and Steen (2005): ‘many projects aim to put end-users central and aim to combine multiple perspectives, but very often this ambition is not completely realised. For example: end-users may be invited to react to prototypes only after they are finished’. However, the benefits of involving users more closely and throughout the whole process have already been investigated by some. In this respect, it has been demonstrated that users who are in close interaction with a particular company, can come up with suggestions and ideas for future products that are perceived as ‘unique’ and ‘valuable’ (Kristensson, et al., 2004, p. 4). Furthermore, Limonard and de Koning (2005, p. 176) state that new products and services aimed at successful adoption and diffusion require ‘some kind of re-conceptualization’ by the present and future users in order to be accepted (Limonard and de Koning, 2005, p. 176). Such user-driven and user-validated ideas and feedback are considered to be very important for the success of the innovation.

We can thus argue that in practice, companies often fail to establish a continuous interaction mechanism (through the various phases of the NPD-process) between the users of technology on the one hand and the industry (technology developers and suppliers) on the other hand. User-driven innovation should go beyond merely asking users for feedback when the technology or product has already been developed (e.g. after the phase of test market or piloting) or launched. Users should be involved throughout the whole process, from the early, more generative phases (as a means to anticipate future needs and expectations) until the post-launch evaluation phase. An illustration of how this first challenge was tackled is presented further in this paper.

A second important challenge concerning user-oriented approaches has to do with users’ assumed lack of imaginary capacities. This issue was also mentioned by Limonard and de Koning (2005, p. 176): ‘without having a fully developed ICT device at their disposal, users do not have a clear-cut idea of what they require, want or need’. Likewise, Mallard (2005, p. 41-42) notes that: ‘users often ‘just’ reproduce what has been thought in advance for them by designers’. This matter can be linked to the abovementioned problem of gaining insight in those needs and expectations that users cannot easily articulate. In this respect, traditional user research methods have shown their limitations. It can thus be argued that the tacit nature of this kind of information, in connection to the limited imaginary capacities of users, has forced development teams to explore new and interdisciplinary methodological tools and approaches. In the empirical part of this paper, it is suggested how this challenge can be countered by a combination of approaches. In the ROMAS-project, which is introduced in the next section of this paper, the i-City living lab setting was complemented with different research methods.

The third and last challenge that will be addressed in this paper refers to the increasing cross-disciplinarity in user-driven innovation and the problems it entails. Several authors have mentioned the tension between the user-oriented and technology-oriented approach in the field of ICT development. In this regard, the adequate translation and transformation of user insights in more technical requirements (and vice versa), are considered to be an important challenge: information on users’ needs, expectations, wants... needs to be passed on to the development team in such a way that it can be successfully incorporated in the development process. In this respect it is relevant to mention the prevailing gap between Quality of Experience and Quality of Service, two important concepts in the field of ICT development. The former deals with the all dimensions and factors influencing users’ experience with technology (e.g. usage context, personal context, expectations...), the latter represents the technical parameters and performance metrics such as latency, jitter, packet loss... that influence users’ experiences. The sharing of insights on users’ experiences and expectations (in a particular context or for a particular application) with engineers still appears to be a missing link. To this end, a
A new interdisciplinary methodology for correlating user experience to QoS parameters in a living lab environment is introduced further in this paper.

In summary, drawing on empirical data, we will focus on three challenges:

- The need for continuous feedback and interaction between technology users and technology developers
- The challenge of successfully involving users in the development process, while overcoming the problem of users’ limited imaginary capabilities
- The gap between user-oriented and technology-oriented approaches and more concretely, the adequate integration of both

To this end, the empirical part of this paper focuses on three distinct moments of user involvement within the New Product Development process, which more or less consists of six phases (cfr. illustration).

**Figure 1: New Product Development process**

<table>
<thead>
<tr>
<th>INNOVATION-DEVELOPMENT PROCES</th>
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<tbody>
<tr>
<td><strong>Prior-to-Launch</strong></td>
<td><strong>Post-Launch</strong></td>
</tr>
<tr>
<td>Opportunity Identification</td>
<td>R&amp;D</td>
</tr>
<tr>
<td>Concept-design</td>
<td>Concept development &amp; evaluation</td>
</tr>
<tr>
<td>Innovation development &amp; production</td>
<td>Test market &amp; piloting</td>
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<tr>
<td></td>
<td>Launch</td>
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<td></td>
<td>Adoption diffusion</td>
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</table>

We first focus on user involvement in the phase of ‘opportunity identification’. Subsequently, the interaction with users in the phase of ‘concept evaluation’ is discussed. Finally, illustrations of user involvement at two different moments in the phase of ‘test market’ are given.

### 4. General methodology

The empirical data described in this paper are an illustration of the way we have tried to overcome some of the abovementioned challenges. The studies presented here are part of a larger project, ‘Research on Mobile Applications and Services (ROMAS)’ which is funded by the Interdisciplinary Institute for BroadBand Technology (IBBT). IBBT is a research institute founded by the Flemish Government, focusing on information & communication technology (ICT) in general, and applications of broadband technology in particular. User-centered innovations are increasingly considered as being of paramount importance in research projects and user research is more and more being conducted in living lab environments. For instance, for the development of a mobile television transmission network in Flanders, transmission equipment was installed in the city of Ghent and a network with a local range was activated. Users were provided with mobile DVB-H devices in order to test the quality of the transmissions. In the ROMAS project, the living lab of i-City Hasselt is of the utmost importance.

The goal of this project is to conduct a user-oriented assessment of (future) wireless city applications and services within a large-scale living lab environment from an interdisciplinary approach. These technological applications are being put to the test of social value, market relevance, legal conditions, usability requirements as well as quality of experience performance. In addition to this, the project will

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3 More information can be found on www.ibbt.be
4 Flanders is the Northern part of Belgium, home to the Dutch speaking community.
5 This living lab was incorporated for the IBBT project MADUF (Maximizing DVB-H Usage in Flanders).
also deliver an interdisciplinary research methodology framework for pre-testing and co-developing new and innovative applications. This will inform the developers and companies on central, non-technological drivers and constraints regarding service innovation and on pre-development research techniques in order to optimally meet up to social and user requirements and experiences. A constant interaction between the research teams on the one hand and the industrial partners on the other hand are essential in order to bridge possible missing links (Lievens & Pierson, 2006).

The setting of i-City Hasselt, a wireless city environment, offers unique possibilities for this extended user research. Using technologies such as WiFi, Bluetooth, GPRS, Edge, Mesh, UMTS, HSDP, Wimax etc., i-City offers several wireless applications for PDA’s, portable computers, smart phones etc. to a large panel of test users and is therefore the largest living lab in the world for testing mobile applications on a large scale in real life situations. Several work groups cover a large number of topics like health care, mobility, tourism, culture and heritage, logistics, education, e-government, food and retail. The i-City mobile platform is supported by the Flemish government and several industry partners such as Microsoft, Telenet, Siemens, Concentra, Fujitsu-Siemens Computers and Research Campus Hasselt (i-City, n.d.).

Research into the potential success of innovations is not always very straightforward. The quality of this kind of research is highly dependent on the consumer’s comprehension of the new concept. Therefore, the access to the i-City living lab environment and its individual users and communities offer some great advantages. All test users have joined the research panel voluntary and are therefore very committed to and familiar with the ‘mobile city’ concept making them an ideal population for testing new mobile applications. The drawback of conducting our research among this type of sample is the non-representativity for a larger Flemish or Belgian population. Since this i-City panel is ‘more than average’ interested in mobile technologies, dominantly male etc …., we need to be cautious with generalizations. The explorative nature of this project and the open access to the panel, however, justifies the choice for this research setting. In the end, i-City aims is to build a test panel of ca. 4000 test users. At the moment of the research, 450 consumers (374 Hasselt, 61 Leuven and 15 undefined) were members of the i-City user panel.

5. Results

5.1 Phase 1: Identification of opportunities

The first phase, the identification of mobile opportunities, started with a wide scan of possibly interesting mobile applications for a wireless city environment. The purpose of this scan was to generate input in order to identify current and future mobile applications which could make significant differences to consumer’s everyday lives and generate revenues for technology providers. One of the major challenges in this phase of the research was to overcome the limited capacity of the user to imagine future technological opportunities.

Firstly, extensive desk research was conducted in order to list existing mobile applications and new concepts developed by the mobile industry. This inventory was used as background information for the familiarization of the researchers with the possibilities of mobile technologies.

Secondly, in order to generate some new (wild) ideas for future mobile city services, users were involved. Two focus groups were organized in order to generate some ‘wild ideas’ for non-existent mobile applications. The first group consisted of members of the i-City panel, all familiar with advanced technology.
mobile applications and their use in a city environment. The second group consisted of regular consumers, only familiar with the basic applications of the traditional cell phones. Unfortunately, an often recurring issue in user research is the lack of imagination to break loose from the existing reference framework such as the existing technology and truly reflect on future needs and applications. Users often keep referring to familiar technologies like MMS, making phone calls etc. and find it very difficult to empathize with other users lifestyles e.g. a 25 year old reflects only on his daily activities and has difficulties to imagine oneself in the life of an elderly person.

In order to eliminate these shortcomings, the framework of time spending was used in the focus groups. Research on time spending was conducted and eight large categories of time spending during the day were identified. The categories were ‘social participation’, ‘household activities’, ‘study’, ‘work’, ‘transportation’, ‘leisure’, ‘health’ and ‘sleeping & resting/relaxing’. Three archetypes of users were developed to help the users empathize with other lifestyles. Working with archetypes is an alternative way of conducting user research inspired by design practices (cfr. Supra). The first archetype was Dimitri, a young single male, 27 years old, loves playing sports and hanging out with his friends. He has a busy lifestyle and believes his career is very important. Patricia, our second archetype, is a 40 year old women and a manager of a large international company. She is married with two children and in between work and the kids, there is not much time left for leisure activities. The third archetype is Gerard, a retired man with lots of free time for his grandchildren, his wife and hobbies. For each archetype, we listed a series of daily activities within the time spending framework.

Table 2: Archetype Dimitri and some of his daily activities

<table>
<thead>
<tr>
<th>Time Spending</th>
<th>Specific activity</th>
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<tbody>
<tr>
<td>Social participation</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Meet with brother &amp; sister in Brussels</td>
</tr>
<tr>
<td>Household</td>
<td></td>
</tr>
<tr>
<td>Dating</td>
<td>Check out dating profiles on a site</td>
</tr>
<tr>
<td>Friends</td>
<td>Call friends, chat, meet</td>
</tr>
<tr>
<td>Social life</td>
<td>Participation in youth movement</td>
</tr>
<tr>
<td></td>
<td>Organisation of parties for the youth movement</td>
</tr>
<tr>
<td></td>
<td>Webmaster for his volleyball club</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
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<tr>
<td>Fulltime Job</td>
<td>Meet with colleagues for lunch</td>
</tr>
<tr>
<td></td>
<td>Payment in the company restaurant</td>
</tr>
<tr>
<td>Looking for a job</td>
<td>Searching for a new job</td>
</tr>
<tr>
<td></td>
<td>Applying for a new job</td>
</tr>
</tbody>
</table>

Participants in the focus groups were asked to describe their daily activities for different times of the day using questions like ‘what do you normally do on a work day between 7 and 9 AM?’ with simple answers like ‘Take the kids to school, have breakfast, drive to work, read a newspaper, take the bus to the university etc.’ The participants were asked to think about how mobile technologies could facilitate these activities. The archetypes were used to reflect on activities of people with other lifestyles.

During the brainstorm, participants envisioned to be in the year 2010 and therefore, were not restricted by the current legislation and technological limitations. 47 ‘wild ideas’ were generated in these sessions, all original and very usable for the next phases in the research project. When combining the wild user
ideas with the results from the desk research, a list of 80 mobile applications was created. The list was preliminary divided into 8 categories based on the time spending research.

Although the full list of 80 applications (Table ...) is too long to be discussed in detail in this paper, it still serves as input for the composition of attractive and successful application clusters (phase 2). Table 3 contains the list of 80 applications

Table 3: The final list of 80 (future) mobile applications

| 1. Finding people with same interests | 28. Note taking | 55. Reader |
| 3. Practical & admin. information for students | 30. MapQuest Find Me | 57. Prescriptions |
| 5. Mobile information services | 32. Mobile flirt | 59. E-care |
| 6. Sport events on mobile | 33. Mobile chat | 60. Finding lost elderly |
| 7. Tourist Portal | 34. Mail/agenda on mobile | 61. Video surveillance |
| 8. Keeping up hiking & cycling routes | 35. Mobile domotica | 62. Shared agenda |
| 10. Find shops | 37. Parking ticket on mobile | 64. Meal help |
| 11. Movie Choice | 38. E-ticket | 65. Mobile administration |
| 12. Download presentations or other information | 39. Shopper | 66. School agenda & report |
| 13. Consultation of available places in cinema | 40. eQuick Recipes | 67. Mobile academy |
| 14. Smart domotica | 41. E-meal | 68. Study mentor |
| 15. Smart machines on mobile | 42. Study choice guide | 69. Restaurant order & payment |
| 16. Medication prescriptions & schedules | 43. Mobile learning | 70. CV on mobile |
| 17. Public transport schedules | 44. Mobile terminal | 71. Accident reporting |
| 19. Mobile dating | 46. Automated tolling | 73. Shop alert |
| 20. Smart Mobile Messenger | 47. Mobile blog | 74. Receipt download |
| 21. 'Independent living’ support | 48. Mobile feed reader | 75. Motoring organisation aid |
| 22. Free mobile surfing | 49. Restaurant Finder | 76. Identity & medical info on mobile |
| 23. Location based advertising | 50. Photo service | 77. Hartbeat information |
| 24. Making appitizers | 51. Scanning information | 78. Dentist appointment |
| 25. Mobile Video Calling | 52. Webcam | 79. Blind aid |
| 27. Mobile search | 54. Event information | |

We hereby list some examples of the user’s wild ideas:

- **Mobile domotica**: Smart home appliances ‘read’ the contents of the owner’s agenda and adjust their internal clocks to it. The coffee-maker automatically sets coffee when you get up, the heating is turned on an hour before you come home etc. Today, all these applications are possible but you have to program them individually and change the instructions manually. This system would automatically turn on/off all appliances at once and change them if your daily routine changes.

- **Crib death alarm**: your mobile warns you when your baby is getting sick at night and therefore avoids risks such as crib death.

- **Making appetizers**: With this application you can enter all the ingredients you need to make appetizers. Your mobile device automatically searches the store were most ingredients are for sale and checks the availability of the items. It can also suggest a combination of supermarkets in the same area, so you can save a significant amount of time during shopping.

Next step was asking feedback from the supply-side, as content and service providers they can also be considered as ‘professional’ users of the mobile applications and can therefore also provide valuable
input for the technological developments (cfr. supra). Potential service providers were contacted and probed for their interest in the use of mobile application to support their existing products and services.

- **Mobile city guide**: This application is a tourist guide for mobile devices. The interest of a publisher of ‘paper’ tourist and other guides was investigated. They are currently involved in a European project which offers guides for nature walks on PDA’s. They already possess a significant amount of location based information in a database, available in different languages and compliant with different technologies. There is a large demand for these kind of applications from the consumer’s end but the availability of the devices and the outline of the costs are crucial for its success.

- **Mobile shopping**: This application helps consumers find the products they need. For example, your mobile device contains your personal product and services preferences. When you pass by a store which sells these products or services you receive a warning on your mobile device. This can be an indication of availability of the product, a discount etc. We investigated the interest of a major chain of book stores. They were also looking for new ways to attract customers. They expressed some concerns about privacy issues and spamming consumers. If these problems could be resolved they would be very interesting to work on a research project which targets consumers based on their personal preferences.

Finally, the new ideas were mapped on the daily activities of the three archetypes with an indication of the origin and status of the mobile application. Applications described by a red color are applications which are user-generated applications which the industry is not currently developing. Green applications were suggested by the focus groups but are already being implemented by the industry. White applications are existing applications which are being developed or are already commercialized by the mobile industry but were not suggested by the users in our focus groups (push driven).

**Table 4: Integration of research results with archetype 1: Dimitri**
5.2 Phase 2: Concept evaluation (Application and user clustering)

All applications considered in the first phase of this research, were transformed into workable paper concepts and presented to a large audience in order to evaluate the adoption potential of these applications and identify interesting market segments. For this evaluation, we chose to conduct a large survey within the i-City panel (n=420). The advantage of a concept evaluation within this panel is their familiarity with mobile city concepts and experience with actual working applications.

Firstly, we tried to cluster the 80 applications and/or ideas in an attempt to summarize the long list of applications/ideas in some clearly distinguishable ‘application clusters’. The criterion for this application clustering is the correlations and similarities in ‘interest patterns’ for certain subsets of applications. The difference in interest for each of these ‘application clusters’ can be considered as a first exploration of the potential of different kinds of applications. Secondly, the application clusters were ranked in order to identify the most promising application(s) (clusters).

Factor analysis on the interests of the 312 respondents in the 80 ‘mobile city application(s) (ideas)’ by means of Principal Component Analysis (in 28 iterations) learned that these interests can be summarized in 21 factors, still explaining 67.5 % of the total variance (R²= 0.67482). This score is very good although it does not allow us to immediately use these factors for further analysis. In order to do that, we first need to investigate the reliability of each factor using Cronbach’s Alpha. If the Alpha value exceeds .65 the factor proves to be reliable or internally consistent. Thirteen clusters were discovered using this methodology. Since each of the clusters represents a set of applications for which there appeared to be strong correlations in (dis)interest among the 312 respondents, they can also be considered as a ‘potential added value domain’ for mobile city applications for a certain part of the market.

These are the 13 application clusters:

- **Food and shop help**: A cluster containing 7 applications that help in the preparation of food/meals and the search for ingredients (and restaurants) (cronbach alpha = 0.871).
- **Tourist information**: Five applications that provide tourists with all necessary city information (cronbach alpha = 0.775).
- **Mobile social contact & Friends** (cronbach alpha= 0.789): This cluster contains 6 mobile city applications to keep in touch with social contacts and friends.
- **Doing ‘usual, daily tasks’ more effective by mobile** (cronbach alpha= 0.812): 8 mobile applications that will enable users to do some daily activities in a more efficient way.
- **More effective health care** (cronbach alpha= 0.812): A cluster of 4 applications that can make health care more easy and user-friendly.
- **Mobile high tech** (cronbach alpha = 0.790). This cluster contains 6 applications that bring existing ‘high tech’ services into a mobile context.
- **Mobile help for studies (& work)** (cronbach alpha = 0.764). The 7 applications represent the (potential) added value of a help tool to make studies and work easier and more efficient.
• **Doing unusual tasks more effective by mobile** (cronbach alpha = 0.776). This cluster contains 8 applications which can help with unusual activities such as the reporting of accidents, that can be done more effective for some people in a mobile context.

• **Payment & Money affairs** (cronbach alpha = 0.763) is a cluster of 5 applications which can make monetary transactions more effective.

• **Help with serious health issues** (cronbach alpha = 0.721) is a cluster of 2 applications with a potential of added value in helping with more serious health issues.

• **Multimedia** (cronbach alpha = 0.654), applications like note taking, mobile video calling and photo services.

• **Administration** (cronbach alpha = 0.760) is a cluster which contains 4 applications that can help people with their administration on different levels.

• **Mobile news and information** (cronbach alpha = 0.679) are 4 mobile applications which have the additional value of offering access to news anytime, anywhere.

16 applications could not be clustered and will be analysed separately. Clusters and single applications were ranked based on the interest level of the respondents. The overall average interest ranking for all the clustered learned that the most important innovation of these mobile applications are not the most high tech innovations but applications enabling to save time and ensuring and improving participants’ quality of life.

Most interest (4.23/5) was expressed for the application that enables to ‘screen’ the number of available parking spaces, before entering the city perimeter. In many cases, it would imply a significant time gain if you would not have to ‘check’ every possible parking (space) with your own eyes. Another transport related application for which there is a high interest is mobile access to public transport schedules. A third transport or traffic related application is the ‘traffic jam alert’ (4.01/5): if your mobile could remember some of your regular routes (to work, to the sports club …), it would be valuable if that mobile would alert you in advance if there are traffic jams on that route. Further, people are also very interested if mobile technology could help them to make all kinds of payments (e.g. tickets, parking, grocery store, gas station …) and other financial transactions, or in the search for a specific shop or selling point where they sell the product you are searching for. Maybe somewhat surprising for an investigation among a non-tourist population is that they are also strongly appreciating the cluster of applications that ensures easier access to tourist information. Through projecting this to a situation in which they are the tourist in a foreign city it seems they would certainly be interested in portals containing all kinds of interesting information and interactive applications as reservation applications or interactive city tours; in using their mobile as a museum guide (instead of the brochure or headphone) etc. With the added value in ensuring and improving quality of life, we envision the outspoken interests in applications that can be a guide to for blind people, for people in ‘independent living’ projects or for parents of children with a higher risk on crib death.

Among the applications for which there is hardly any interest, we notice some remarkable findings. Despite the popularity of the ‘virtual social contacts’ on the web, the cluster of ‘mobile social contacts and friends’ is certainly not appealing to the majority of the population (2.94/5). Despite the high rankings of ‘news’ in ‘most wanted content rankings’, the mobile news cluster had only an average interest of 3.11/5. Also for ‘sports on mobile’ (2.74/5) there does not seem to be great enthusiasm either. A possible explanation for this may be found in the vague description of the application ideas.
Table 5: The ranking of application clusters and separate applications based on interest level of the respondents (on a 5 point scale)

<table>
<thead>
<tr>
<th>Application (cluster)</th>
<th>Average Interest (1: Not interesting at all – 5: Very Interesting)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very appealing</strong></td>
<td></td>
</tr>
<tr>
<td>Indication of parking spaces &amp; availability</td>
<td>4.23 / 5</td>
</tr>
<tr>
<td>Practical &amp; administrative information for students</td>
<td>4.20 / 5</td>
</tr>
<tr>
<td>Public transport schedules</td>
<td>4.11 / 5</td>
</tr>
<tr>
<td>Payment &amp; money affairs (Cluster Money)</td>
<td>4.01 / 5</td>
</tr>
<tr>
<td>Traffic jam alerts</td>
<td>4.01 / 5</td>
</tr>
<tr>
<td>Help with serious health issues (Cluster Health II)</td>
<td></td>
</tr>
<tr>
<td>‘Independent living support’</td>
<td>3.99 / 5</td>
</tr>
<tr>
<td>Free mobile surfing</td>
<td>3.92 / 5</td>
</tr>
<tr>
<td>Find shops</td>
<td>3.92 / 5</td>
</tr>
<tr>
<td>Tourist Information (Cluster Tourist)</td>
<td>3.87 / 5</td>
</tr>
<tr>
<td><strong>Moderately appealing</strong></td>
<td></td>
</tr>
<tr>
<td>Mobile search</td>
<td>3.78 / 5</td>
</tr>
<tr>
<td>Doing ‘usual, daily tasks’ more effective by mobile (Cluster Effective I)</td>
<td>3.73 / 5</td>
</tr>
<tr>
<td>Consultation of available places in cinema</td>
<td>3.72 / 5</td>
</tr>
<tr>
<td>More effective health care (Cluster Health I)</td>
<td>3.68 / 5</td>
</tr>
<tr>
<td>Doing ‘unusual tasks’ more effective by mobile (Cluster Effective II)</td>
<td>3.60 / 5</td>
</tr>
<tr>
<td>Download presentations or other information</td>
<td>3.55 / 5</td>
</tr>
<tr>
<td>Administration (Cluster Administr)</td>
<td>3.53 / 5</td>
</tr>
<tr>
<td>Multimedia (Cluster Multimedia)</td>
<td>3.57 / 5</td>
</tr>
<tr>
<td>Movie choice</td>
<td>3.54 / 5</td>
</tr>
<tr>
<td>Mobile help for studies (&amp; work) (Cluster Study)</td>
<td>3.43 / 5</td>
</tr>
<tr>
<td>Mobile ‘high tech’ (Cluster High Tech)</td>
<td>3.43 / 5</td>
</tr>
<tr>
<td>Keeping up hiking &amp; cycling routes</td>
<td>3.42 / 5</td>
</tr>
<tr>
<td><strong>Not appealing</strong></td>
<td></td>
</tr>
<tr>
<td>Food &amp; Shop Help (Cluster FoodShop)</td>
<td>3.23 / 5</td>
</tr>
<tr>
<td>Mobile news &amp; information (Cluster MobNews)</td>
<td>3.11 / 5</td>
</tr>
<tr>
<td>Spare time suggestions</td>
<td>3.10 / 5</td>
</tr>
<tr>
<td>Mobile social contacts &amp; Friends (Cluster Social)</td>
<td>2.94 / 5</td>
</tr>
<tr>
<td>Carpooling system</td>
<td>2.93 / 5</td>
</tr>
<tr>
<td>Location based advertising</td>
<td>2.78 / 5</td>
</tr>
<tr>
<td>Sport events on mobile</td>
<td>2.74 / 5</td>
</tr>
</tbody>
</table>

Further and deeper analysis is certainly necessary to make definite conclusions about the appeal of each of these applications.

Thirdly, the correlations between interests in the different kinds of applications will also be used to cluster participants. We hereby hope to obtain some valuable insights into which types of applications are appealing to which type of user clusters by profound analysis of interest, perceived added value and willingness-to-pay for some applications.

Clusters are groups of participants with similar interest patterns for the list of 80 applications and are internal homogeneous and external heterogeneous groups. K-Means Clustering is used to detect the similarity in interest patterns. Internal homogeneity and external heterogeneity are investigated by analyzing the ‘user cluster profiles’ on socio-demographics variables, the attitudes towards the mobile city concept and a more elaborate analysis of interest in some applications. Using the answers on the five point interest scale for the 80 application ideas as input, we have obtained a 6 cluster solution by K-Means clustering (in 28 iterations). 23 respondents had unreliable answering patterns. The table below shows the distribution of the remaining 289 respondents over the 6 user clusters.
Table 6: The distribution of participants over the 6 user clusters

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of (mobile) potentials</td>
<td>19</td>
<td>6.6%</td>
</tr>
<tr>
<td>Cluster 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global interest I: organisation &amp; health</td>
<td>81</td>
<td>26%</td>
</tr>
<tr>
<td>Cluster 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific interest I: Information Junkies</td>
<td>3</td>
<td>1.0%</td>
</tr>
<tr>
<td>Cluster 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global interest II: Leisure</td>
<td>58</td>
<td>20.1%</td>
</tr>
<tr>
<td>Cluster 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific interest II: Payment</td>
<td>35</td>
<td>12.1%</td>
</tr>
<tr>
<td>Cluster 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile innovators</td>
<td>93</td>
<td>32.2%</td>
</tr>
</tbody>
</table>

- **Out of (mobile) potentials:** This is a segment of people for which hardly any of the 80 mobile city applications has potential. For this segment of 19 respondents (6.6% of the sample) there certainly does not exist any ‘killer application’. The ‘out of (mobile) potentials’ cluster holds a more or less dual profile. On the one hand, we find a number of students younger than 25 years old, not married and still living with their parents. On the other hand, ‘out of (mobile) potentials’ are also (female) users between 45 and 54 years, married with children. Both groups are to be considered as laggards when it comes to the adoption of mobile city concepts.

- **Mobile Innovators:** The sixth user cluster of ‘Mobile innovators’ contains a group of people for which practically all mobile city application ideas are very appealing. Most of them are young adults (<34 years old) with a fulltime job.

Next to these clusters with extreme opinions, we have also identified four other cluster types. The members of the first two clusters are interested in a substantial amount of applications although the focus of the first ‘global interest’ cluster is on organizational and health applications while the second ‘global interest’ clusters is favorable towards all kinds of leisure applications. The interest of the second group of clusters is very restricted to a limited amount of applications. ‘Specific interest’ cluster number one is very excited about mobile news applications while the second ‘specific interest’ cluster is only interested in payment-related mobile applications.

- **Global interest I: Organization & Health:** More than the rest of the clusters, the users of this cluster are between 35 and 54 years old, married and having children. They have two incomes and live a rather busy life (but still enough spare time). They are interested in applications that can help them with organizational or work related tasks and applications to help them save time. They are also interested in different medical applications.

- **Global interest II: Leisure:** Cluster 4 ‘Global interest II: leisure’, containing the users with a higher interest in leisure related mobile city applications, has a younger profile with an overrepresentation of (male) respondents younger than 25, not married and still living with their parents. Most of them are students.

- **Specific interest I: Information Junkies:** Cluster 3 ‘Specific interest I: information junkies’ only contains 3 participants, which is too small for deriving generalistic profiles.

- **Specific Interest II: Payment:** The members of the cluster ‘Specific interest II: payments’ are specifically interested in different payment-related applications that can make their busy life a lot easier. More than the rest of the sample, they are married, higher (university) educated, between 35 and 44 and living in busy full-time working households with young children.
The segments with the highest interest in the mobile city applications - the mobile innovator (32.2%) and the global interest clusters (28% and 20.1%) - are clearly the largest segments. On the contrary, the segment for which these applications have no potential (out of mobile potentials) is quite a small cluster (6.6%). Therefore we can conclude that there is a certain potential for mobile city applications, however this may not be generalized or extrapolated to the total (Flemish or Belgian) population. We need to be aware of the ‘positively biased’ character of our sample of i-City test panel members. Compared to the average Flemish or Belgian citizen, these respondents are clearly more interested in and aware of the mobile city concept and applications.

Nevertheless, this clustering remains very valuable as an explorative indication of the applications with most potential and a detection of advantageous user profiles. Based on this information, the industrial partners can prioritize developments for the mobile platform. Once a choice is made for the development of a specific application, interest and potential can be analyzed more extensively.

5.3 Phase 3: A test market for mobile news applications

Finally, a single application, mobile news, was selected from the list by the project industrial partners as being the most interesting application for the development in a business environment. This was a rather surprising choice, since mobile news was generally assessed as not appealing (3.11 on a 5 point scale) to the users. Although, we found a user cluster being very enthusiastic about the mobile news application, it contained only 3 respondents. It would have been more logical to develop one of the highest ranked applications like ‘Indication of parking space and availability’, ‘public transport schedules’ etc. Other factors like the high involvement of the inhabitants of Hasselt in the local community, several existing local news initiatives, the presence of a community of city reporters and one of the industrial partners being a local content provider (Concentra) with a proper local news TV channel (TV Limburg) expressing the need for a ‘cross-media’ approach must have played an important role in the decision of the project’s industrial partners.

The industrial partners aspired to test the application and assess the adoption potential of the mobile news application based on a working prototype. Therefore, the mobile news application was developed by Concentra and users of the i-City platform were able to try it out since February 1, 2007. The mobile news platform contains the following six news services: ‘RSS+’, ‘Mobile Telekrant’, ‘Mobile TV Limburg’, ‘Mobile City Portal’, ‘Hasseltlokaal on PDA’ and ‘Het Belang van Limburg Palmnieuws’.

In the following paragraphs, we describe the main characteristics for every news service. For more elaborate information on these services, we would like to refer to the i-City website.

- **RSS+:** This news service allows the user to receive his RSS feeds on his mobile device. The user will receive the information on a webpage (mynews) based on his or her personal preferences.

- **Mobile Telekrant:** Telekrant is a service of the local TV station TV Limburg. It is an additional channel with a constant feed of short news messages with still images. This news can be foreign news, domestic news but also local news. The news is always up-to-date and accompanied by background music. The same service is available for mobile phones through the iCity platform.

- **Mobile TVL (TVL Live):** The public can watch their local TV channel TV Limburg live through this service.

- **Mobile City Portal:** The mobile city portal is a portal website containing practical information on different city services e.g. which pharmacist is open on Saturday? The site can be consulted on a mobile device.

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• **Hasseltlokaal on PDA**: HasseltLokaal.be, is a website which contains information about Hasselt, mostly supplied by the inhabitants of the city. This news service can be consulted on a mobile device.

• **Het Belang van Limburg Palmnieuws**: The newspaper ‘Het Belang van Limburg’ offers a mobile selection of news. Three news categories, headlines, sports and ‘in de rand’ (remarkable random information) can be consulted on a mobile device.

Members of the i-City panel were alerted by e-mail of the launch of these mobile news applications and were asked to test them in order to assess the technological performance and usability aspects of these applications. As requested, most users used the 6 mobile news applications, unfortunately, the majority of the users accessed these applications only once or twice out of pure curiosity. This might be due to the fact that the mobile news application was pushed by the developers.

The next phase in this research project was an assessment of the adoption potential of the mobile news application. A large survey was conducted within the i-City test panel in order to divide the participants in the classical adoption segments **Innovators**, **Early Adopters**, **Early Majority**, **Late Majority** and **Laggards**. This segmentation is based on the traditional **Diffusionism paradigm** (Rogers, 2003) and more particularly on the **Product Specific Adoption Potential Scale (PSAP)** (De Marez & Verleye, 2004). The technology specific adoption potential was compared to the theoretical adoption segments and all adoption segments were profiled based on socio-demographic data, lifestyle data, media usage, technology usage, etc. The results of the research into the adoption potential of the mobile news applications will provide us with valuable information which is indispensable input for future business models and the communication strategy at the point of market entry. Using the experienced i-City test panel we can be assured of the reliability of conclusions derived from user data.

Assuming ‘Mobile News’ is a mobile city application for which the respondent will have to pay a certain amount per use or a certain subscription fee, potential for the **Mobile News** application seems to be moderately positive. With only 17.5% short term potential (innovators + earlier adopters), and almost half of the market being ‘lower potentials’ for **Mobile News** in a ‘paid’ scenario, there certainly is potential for the application, but the enthusiasm is not overwhelming. In a free scenario (scenario in which the use of the application is free for the consumer, but (s)he has to accept advertisements) the application’s potential significantly increases.

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9 For more information, please visit [www.hasseltlokaal.be](http://www.hasseltlokaal.be)

10 The website of the newspaper is [www.hbvl.be](http://www.hbvl.be)
These results confirm the conclusion of the previous survey were we discovered only a low to moderate interest level for this application. Among the 80 applications a ‘Mobile news & information’ cluster was detected, although in the ‘top 29 average interest ranking’ this mobile news cluster was only at place 24 with an average interest score of 3.11/5.

Every adoption segment already has access to a wide range of news channels and is generally satisfied with this, so mobile news does not immediately meet the demands of a large market. The success of the mobile news application(s) will largely depend on the added value it can create for the consumer.

As the applications are presented at the moment, they are only moderately appealing. The i-City platform already supports a few mobile news application but they are rarely used. The trial rates remain low, the services are perceived as having a relatively small added value, satisfaction scores are moderate and are linked with negative appreciations like information that is not up to date and different technical difficulties. For now, the mobile news applications do not meet the needs and expectancies of the consumer.

With the analysis and profiling in this deliverable, a diversity of information is offered that can be a starting point for different offers to create that very necessary added value. Technical difficulties, of course, will have to be solved. But next to that, there could decided to continue on the development of specific news services like ‘online news videos’ for the early majority, ‘local news’ for the innovators or more serious topics for early adopters ….

Firstly, we can make some general observations concerning the different innovation segments.

- Less innovative segments contain more women;
• Innovative segments already own a lot of new technologies. Less innovative segments for mobile news consumption do not own most of these new technologies;
• Innovative segments use more traditional media than less innovative segments, although some exceptions can be found;
• Innovative segments consume more news online than less innovative segments.

Secondly, we describe the main characteristics for each individual cluster.

I. Innovators: the ‘local & leisure’ accent

The members of the cluster innovators are all male. We distinguish two groups: one group younger than 25 years old, still living with their parents and a group of people between 45 and 54 years old who have a family of their own. Both groups have a busy lifestyle since they are either students or working full time, and most are higher educated.

They possess most new technologies both in their household as well as personal technologies like a PDA or an advanced cell phone. The ownership of MP3-players is lower, but this may be due to a higher ownership of sophisticated mobiles (containing MP3 players).

For most (traditional) media, innovators can be considered as ‘heavy users’. TV is watched every day. Regarding TV news they have an outspoken preference for the local TV news, but their TV usage mainly serves ‘leisure’ purposes. They use teletext only a few times a week to consult information on television programs and the weather. Most innovators use the internet quite often but there is a small group of people who only use it a few times a month. They mainly use it for both work and private purposes. Innovators read newspapers a few times a week and they prefer local newspapers like Het Belang van Limburg. Clearly, they are very interested in local news as they are also heavy viewers of the daily news programs of their local television station.

Regarding the most important news source for this innovator segment, newspapers are equally important for them as TV (internet is less important to them for news than for the rest of the sample). When looking at more innovative ways of receiving news we see that they are quite familiar with news SMS services, and that they are actively consulting news and news videos online.

II. Early Adopters: ‘information please …’

The members of this segment are predominantly male. They are between 25 and 34 years old and are living with a partner. The have a busy lifestyle since most of them have a fulltime job as a civil servant or an executive.

Early adopters are moderate to heavy TV viewers and have a preference for news programs, human interest programs, movies and documentaries. VT4 (movies) and Canvas (informative programs as news, documentaries, human interest) are among the most preferred channels. Television news is watched a few times a week, both on a national and a local station. Teletext is mostly used few times a week, and the ‘information-seeking’ nature of the early adopters for ‘mobile news’ is also reflected in their newspaper and magazine readership. Regarding newspapers quality newspaper ‘De Standaard’ is among the most preferred titles and the preferences regarding magazines is going to topics as science, nature and computer.

Compared to the rest of the sample, early adopters use the internet more for professional than personal purposes. Internet is also a more important ‘news source’ to them: they are heavy online news consumers as they visit news sites, watch news videos, read and post messages to news forums every
day; and occasionally they would even manage a blog. More than by the rest of the sample, early adopters are loyal ‘radio news’ consumers.

III. Early Majority: the ‘moderates’ ...

Members of this cluster mainly have a double income, a household with 1, 2 or 3 members and they are highly educated. They are moderate TV users with a preference for reality shows. Also for ‘local news channels’ they are moderate viewers, which strikes with their loyalty to ‘Het Belang van Limburg’. Teletext is not used very often, but when they do, they mainly use it for news information. Nevertheless the internet is an important source of news for the early majority, they are also moderate users of the internet and online news, as well for professional as personal purposes. However, striking may be a subset of regular ‘news video consumers’ in this segment. Most outspoken at last, may be their loyalty to the radio news.

IV. Late Majority

Both in the late majority and the laggards segment we see more females than in the total sample. Also the education level drops from here on. The other characteristics of the segment resemble the repartition in the sample. TV is less important to this late majority as a news source, which strikes with their ‘moderate TV viewership’. Newspapers are more important, since they are heavy newspaper readers. When they use teletext, they mainly look for news information. News sites are visited a few times a week. Compared to the early majority, also the late majority is a segment of ‘moderates’, but without any outspoken preference for specific types of news sources.

V. Laggards: ‘traditional & serious’ ...

The laggards have a large share of women and – maybe surprisingly – also a substantial part between 25 and 34 year olds. These people do not have a family of their own yet, they live alone or together with a friend. They consider their life as rather busy, and do not have the latest technologies in their households.

They do not watch TV very often although they watch for a long period of time, and have a rather ‘serious’ TV profile. Most laggards have teletext but never use it. The people who do, mainly use it to consult sports information. A large group of laggards uses the internet a few times a week for a long period of time and mainly for professional purposes, but it is not an important news source for them (also low online news consultation). Nevertheless they are only moderate TV viewers and light newspaper readers, TV and newspapers are the most important news sources for the laggards.

The survey contained questions on six different mobile news applications: RSS+, Mobile ‘Telekrant’, Mobile TV, Mobile City Portal, Hasseltlokaal on PDA and Belang van Limburg Palm news.

- **RSS+** is generally perceived as interesting and a modest added value is perceived compared to the ‘traditional’ RSS technology. Despite of this positive attitude towards the application, people are not willing to pay for its use. Only a third of the innovators and early adopters are willing to pay, the other segments are not.

- Compared to RSS+, the second mobile news application Mobile Telekrant seems to be less interesting to the participants. This can also be concluded from the very low trial rates and the low satisfaction score (5.84/10 on average). Only the innovators and the early majority are moderately enthusiastic. There is hardly any willingness-to-pay and perceived added value for this application.
The interest level in **Mobile TV Limburg** is situated somewhere between RSS+ and the Telekrant. 45% is interested in this application. More than half of the innovators and early adopters are interested and more than half already tried it once. For these segments, there seems to be a small willingness-to-pay and a small value perception. This application mainly appeals to the innovators who have an urge for local information.

Similar to RSS+, the **Mobile City Portal** application appeals to many people. More than 70% of each segment is interested in this application. Among the early adopters and both majority segments, a moderate willingness-to-pay of about 10% can be noticed.

The mobile news application, **Hasseltlokaal on PDA** does not appear to be very interesting to most people. This low interest level equals a low willingness-to-pay and a low perception of added value.

The application **Belang van Limburg Palm news** on the other hand, is an application with mass market appeal again. 70% of all segments (except the laggards) are interested in this application. This interest level equals an adequate trial rate during the first weeks after its introduction to the iCity platform. The satisfaction scores for this application are high and there is a good willingness-to-pay and perceived added value.

So we can conclude that the applications ‘RSS+’, ‘Mobile City Portal’ and ‘BVL Palm news’ have the potential to reach a mass market and deserve further development efforts. The Mobile telekrant application barely has any potential, and for the ’Mobile TV Limburg’ and ‘HasseltLokaal’ applications potential seems to be limited to the local oriented innovators and some early adopters.

Looking at the willingness-to-pay of the different applications, it is clear that a ‘paying scenario’ only has a potential for the niche segments of innovators and a few early adopters. If the goal is to reach a large market, the ‘free advertising based model’ seems to be the only option.

There are three applications (BVL Palmnieuws, RSS en mobile city portal) which have the potential to reach a mass market. The application which seems to be in the best position to obtain this goal is Belang van Limburg Palm news.

In addition to the combined research approach described above, a more qualitative approach was followed by a fellow research group, SMIT (*Studies on Media, Information and Telecommunication*). By means of ethnographic research, in-depth insight in the daily life of the user segments was acquired. The recruitment of ‘interesting’ users was facilitated by the detailed description of the adoption segments. Their use of mobile devices, their activities in relation to the city and their social networks were investigated in order to contextualise the concepts for future mobile application, particularly the mobile news application and integrate them in existing social settings (Lievens & Pierson, 2006).

5.4 Phase 4: QoS optimisation vs QoE

By means of this fourth and last moment of user involvement (in the phase of test market), we try to tackle the challenges of (1) continuous interaction with users and (2) translating insights drawn from user research in technical requirements that can be incorporated in the development process. Closely connected to this matter are the concepts ‘Quality of Experience’ (QoE) and ‘Quality of Service’ (QoS). Whereas the latter (referring to technological and performance metrics) used to be the ‘ultimate measure’ in this respect, this role has shifted to the QoE-concept. Literature shows that the importance of QoE (~user experience) has notably increased: it is assumed that a good QoE is important for both adoption and loyalty purposes (Crisler, Turner et al., 2004, p. 61; Jain, 2004, p. 96-97). In this respect, Pine and Gilmore (1999, p. 2) refer to experiences as a ‘fourth economic offering’, a ‘new source of
value’. Furthermore, Corrie, Wong et al. (2003, p. 2) argue that ‘QoE is how the user feels about how an application or service was delivered, relative to their expectations and requirements’, thus emphasizing the importance of end-users’ expectations and experiences.

De Moor and De Marez (2007a; 2007b) looked into Quality of Experience at a conceptual level: with reference to both objective and more subjective (user-oriented) dimensions of QoE, a study of the literature and the consultation of an expert panel, resulted in a broad conceptual model of QoE consisting of five main building blocks:

- **Quality of Effectiveness**: this building block is all about the accuracy and technological performance, at four levels (application/service, server, network, device/handset).
- **Quality of Efficiency**: Does the application, device… work well enough for the user?
- **Usability**: how easy is it for the user to accomplish tasks?
- **Expectations**: This dimension refers to the subjective character of the ‘experience’ concept. The degree up to which the expectations are met, will then determine the Quality of Efficiency.
- **Context**: Since experience does not happen in ‘a vacuum’, it is also necessary to consider experience in its broader context.

To date, given these various parameters and factors that influence users’ experiences with technology (e.g. usage context, personal and social context, technical issues etc.), the adequate measurement and translation of what users expect and experience in a specific context, remains challenging. Although social researchers have a number of methodological tools at their disposal in this respect, sharing findings from user research with engineers and developers appears to be a missing link. As a result, engineers and technical experts often regard QoS optimisation as a means to optimise end-user QoE. In current practice however, incorporating users’ wants, needs, expectations… is increasingly considered to be a means for enhancing end-user QoE successfully.

To this end, a new, interdisciplinary methodology for correlating user experience to QoS parameters in Living Lab environments was developed within the living lab setting of I-City11. This five-step interdisciplinary approach does not only take into account the ‘hard’ technical parameters, it also aims focus on the more subjective (social, contextual etc) QoE-dimensions and the translation of user requirements in technical requirements. The five steps include:

1. **Pre-usage user research** i.e., to detect “most relevant QoE dimensions” and users’ expectations (combination of qualitative and semi-quantitative methods)

2. **Pre-usage translation workshops** to find optimal match between ‘user-indicated QoE dimensions’ and ‘measurable QoS parameters’

3. **Monitoring during usage** of QoS parameters

4. **Post-usage questions** on device (e.g. PDA)

5. **Post-usage comparison** expectations versus experience (based on information gathered in step 3 and further user research) in order to identify and explain differences/matches between both.

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11 This methodology is the result of a collaboration between two IBBT-research groups: WiCa (Dept. of Information Technology, Ghent University) and MICT (Dept. of Communication Sciences).
This approach was tested in a small-scale study (N=10)\textsuperscript{12} of two mobile applications: the i-City Wineguide\textsuperscript{13} and the i-City Photoblog\textsuperscript{14}. For both applications, a wireless internet connection is required.

The first phase (pre-usage) was aimed at uncovering participants’ expectations concerning mobile city applications in general, and more concretely concerning the two selected applications. This phase included a semi-qualitative group session (with both groups), which started with a free listing exercise. We asked the participants to reflect on those dimensions or issues that are crucial for having a good experience with a mobile phone. Some of the issues that were mentioned in this respect were battery lifetime, price, easy navigation, speed, display size…

Subsequently, the participants were asked to reflect on their current and future mobile applications usage (usage context etc.) in a more formal and structured way: they were invited to fill in a short questionnaire (4 questions), which was discussed in group. Building on this group discussion, a brainstorm on ‘mobile applications and services that would make life easier’ was initiated. Ideas such as traffic jam alerts, public toilets-locator, house for sale-locator etc. were mentioned.

Next, the focus of the discussion was narrowed to the two selected applications: Wineguide and Photoblog. After a brief introduction of these applications, we tried to gain more insight in the participants’ expectations towards the two applications. We used the conceptual model for QoE (configured as a list of items) as an ‘experience-breakdown tool’. It can be assumed that by using such a list, users are stimulated to reflect about their future expectations in a multidimensional way. Furthermore, it can elicit them to be more ‘exhaustive’ and ‘creative’ when thinking about optimising

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\textsuperscript{12} Ten test users were involved in this study.

\textsuperscript{13} The wineguide is an application that assists people in searching and finding information about wines. The application also gives the possibility to create a personal wine collection.

\textsuperscript{14} This application allows I-City test users to share their photos with others and to tag and comment others’ photos.
their experience for each of these dimensions. In addition, the list provided us with an overview of the important subdimensions (as considered by the individual participants) for both applications. Aspects such as personalisation of content, price, speed, display size etc. were found to be important. To conclude, this step was followed by a prioritizing exercise: the participants were asked to make a top 3 of most relevant Quality of Experience-dimensions. Often mentioned were e.g. speed, display size, personalisation, usage context, easy navigation.

The second phase (pre-usage) consisted of translation workshops between the social scientists and engineers involved in the case-study. In one of those workshops, the parameter ‘download speed’ - which was found to be important in the pre-usage research -was configured by means of a photo-download application that simulates different download times (ranging from 0 to 5 seconds). The developed ‘translation tool’ thus allowed us to go beyond merely listing the important subdimensions. The feedback given to the technical developers included the following results: the 0; 0,5; and 1 second scenario was found to be acceptable for respectively 100%, 100% and 90% of the respondents. The 3 seconds scenario was found to be acceptable for 60% of the respondents, whereas the 5 seconds scenario was found not to be acceptable for the majority (70%) of the respondents.

During the third phase (i.e. usage) the respondents were invited to test the selected applications. Different usage scenarios had to be completed by the test users. Furthermore, the scenarios were completed under different reception levels. During usage, one parameter was continuously monitored, namely signal strength (influencing the reaction speed of the applications).

Figure 9: illustrations of the usage phase

Immediately after usage (fourth phase) of the application for a specific scenario, the test users were asked to fill in a short experience-questionnaire of 6 questions (5-point Likert scales) on the device (PDA). The data gathered in this phase were correlated with the data from the monitoring and pre- and post-usage user research.

Figure 10: example from the questionnaire on the device)
The **fifth and final phase** (post-usage) consisted of a comparison, drawing on the user information from the previous phases. Whereas we particularly focused on ‘expectations’ in the first phase, the emphasis was now on the participants’ actual ‘experiences’ with the applications. We opted for a semi-qualitative group sessions (with both groups) in which some of the steps from the first session were repeated. Once again, the participants were asked to **freely list** the components and dimensions of a good mobile user experience. Secondly, we focused on the **conceptual model** of Quality of Experience by once again using the list of items as a means to stimulate discussion and to get an overview of the importance attached to every subdimension. In addition, the respondents were asked to ‘**score**’ their experience on every dimension a 10-point scale. This step was followed by a **prioritizing exercise** similar to the one used in the first phase.

This phase intends to link the pre-usage expectations to after-usage experiences in order to identify differences gaps between both. To this end, the data gathered from the usage phase and post-usage questionnaire were compared. For example, let’s take a look at the results (Wineguide) for person B (male, 30 years old), involved in the study. The graph below shows the rating of the answers to the small questionnaire as a function of the median signal strength: there is a gradual degradation of the rating for decreasing signal strength. Apparently speed is an important factor for person B. His user satisfaction is thus correlated with signal strength. Furthermore, the second graph (on the left), shows that person B’s level of frustration was higher at the first location (with best reception quality) then at the second location (with lower reception quality). This could be explained by a ‘first usage frustration’. The results for the third and fourth location indicate that person B’s frustration was the highest in those locations with the worst reception quality. These findings were also supported by the pre-usage reseach in which person B had mentioned the dimension ‘speed’ in the prioritizing exercise.

**Figure 11: Results questionnaire in function of the signal strenght (left graph) and results frustration in function of the location (right graph)**

Despite the small scale of these first tests, it has been exemplified how end-user experience could be measured by an interdisciplinary team and how insights from user research might be adequately translated in technical requirements. Future research will include the testing of this methodology with a high number of users and usage contexts in a living lab setting.

To conclude this empirical section, it can be argued that the four moments of user involvement described above, have illustrated how users can be successfully involved throughout a user-oriented
development process and how the problem of limited imagination can be tackled. Furthermore, it has been shown that the tension between technology-oriented and user-oriented research can be released by means of productive interdisciplinary cooperation.

Conclusion

Insight in current research literature and practices shows the predominant position of the user in today’s technological innovations and the new product development processes. It is clear that user-driven innovation has surpassed the hype and has become a necessity for successful product development. The traditional methods for user research are being extended with alternative research methods originating from complementary disciplines such as sociology and anthropology. Different challenges still present themselves but can be overcome by most of these new methodological orientations.

In a changing media environment, broadcasters and publishers are converging into cross medial entities offering content on different platforms e.g. in Belgium some well-known examples are a women’s magazine extended with a ‘mobile brand’, a youth TV-channel starting with online radio or broadcasters experimenting with mobile television and newspapers setting up trials for ‘mobile news’. Clearly, the evolution towards a cross media landscape poses some major challenges for the sector, and due to the empowerment of the user, innovations will surely have to be tested in living lab settings before launching a new type of media or technology on the market.

The downside of most existing living labs however, is their push-driven nature. Often, they are still imposing technologies on the recruited consumers offering them a free device and a free subscription to several services. Unfortunately, the usage of these devices and services remains rather limited due to the lack of integration and domestication of these services and applications in the daily life of the test users. The ‘free devices’ remain nothing more than a gadget for a majority of test users, next to the devices they bought themselves and were domesticated in their lives. Furthermore, this kind of push approach also attracts a certain type of users, often predominantly male and technology-oriented, biasing the generalization of the test results.

The rise of living labs certainly is a major step towards more user-centric innovation development, but still leaves a significant margin for improvement. The establishment of a more pull-driven living lab environment could tackle these obstacles and would provide a more accurate insight in the performance and potential of new devices and services in the daily lives of the users. In such living labs, user panels could be recruited based on the devices and services they adopted and domesticated themselves. The applications to be tested would therefore only be an additional layer on top of the networks and devices which are naturally domesticated by the test users. This could be a starting point for research with more accurate insight into the natural habitat of the users.

In the context of the cross medial challenges facing today’s media and communications industries, it would be very valuable if such living labs could be installed on locations where all major transmission networks are available (cable, ADSL, Wimax, 3G, DVB-H, etc.). In view of the current developments in the European Union with regard to the analogue switch-off, the digital dividend may offer opportunities to establish such true user-centric living labs using the liberated spectrum for new transmission technologies as DVB-H.

References


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