ROADiBROM

Roadmapping Digital Broadcasting / Mobile Convergence

RTD 2015

Project No. IST-045437: ROADiBROM - SSA

Workpackage 3

D3 "Gap analysis report (identification of needs)"

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Status : V09 (submitted)

Date : 30 November 2007

Distribution : WP3 participants ROADiBROM consortium

Project funded by the European Community under the IST 2.6.5
Contract no: IST-045437

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1 Executive Summary

The ROADiBROM is a joint EU-China roadmapping project addressing digital broadcasting and mobile convergence towards 2015 (IST-045437). It is sponsored by the European Union 6th Framework research program (FP6- IST). ROADiBROM is closely working with the European NEM technology platform and with China stakeholders to develop a strategic roadmap towards an innovative landscape of digital broadcasting and mobile convergence in both Europe and China. It is intended to be exploited as a guideline and instrument to set up a joint Europe and China Think-tank in this area.

The objective of WP3 is to “Identify the development needs (gaps), which will serve as the rough input for constructing the roadmap and reaching the stated vision of ROADiBROM”. This document is a report of the Gap Analysis done in WP3. The analysis is a direct input for the WP4 Roadmap workshops and the WP 4 draft roadmap report.

In WP3, we already incorporated the feedback of first two WP4 workshops in Brussels and Shanghaii. Furthermore, we did additional interviews and participated in other mobile digital conferences to collect more visionary input. The first WP3 activity was to analyze the results of WP1 and WP2 by deploying a SWOT analysis. Next, in a highly interactive process with the ROADiBROM partners we analyzed and discussed the gaps which led to the first assessment of gaps formulated as R&D themes as showed in Chapter 4. During this process, we decided to introduce the term ‘Mobile iTV’ to describe the future mobile digital broadcasting service which will be a combination of the current lean-back TV services and the interactive Internet services.

The results of the GAP analysis are the elicitation of the R&D questions prioritized as short, mid and long term actions. In addition of these we add a category with research questions that currently have the attention of the industry and which can benefit from exchanging experiences. We also make a distinction between general research activities that can be studied on a global scale and activities that have to be studied with a special emphasis on the European/Chinese differences and similarities. The last ones are marked with an asterisk (*).

<u>Supporting research activities currently relevant in the Industry</u>

These are research activities that already take place within the industry and that need support to faster develop the market and capture more rigorous results. This can be done by activities like exchanging best practices, sharing experiences, network-of-excellence workshops underpinned by academic verification and falsification. Organisations like the BMCOforum might also play a role in this. The research themes and belonging research question(s) to be answered by these activities are:

Context of future use:

- What will be the contexts in which Mobile iTV will be used? *
- Which target group likes which kind of content? *
- How to know what kinds of applications are most suitable for Mobile iTV? *
- What is an acceptable service quality / price balance? *

Quality of Service and Ease of Use:

- What is a suitable design process for an optimal ease-of-use service with the required Quality of Service?*

Modularity supporting development:

- How to develop a Service Oriented extendable Architecture with a defined interface language able to publish and process semantics on device features, abilities, and available services?

MyDevice:

- Can the functions of devices be easily defined? And can the devices be easily operated and maintained. Are there enough new services that can be supported by the new functions of devices?

Value chains:

- What will be the future value web? What will be the role of incumbents versus new entrants?*
- Money steers the value web: where will money be generated? Who pays whom?*

Urgent research activities

These are short term research questions with a quick win potential (start in 2008 and finish before 2010) that have to be done by academics and practitioners together.

Everybody is a reporter:

- What is the impact on trust in content (information) from citizen journalism?*

Mobility and content availability:

- Can mobile receiving technologies support the upcoming bi-way high speed broadband services?

Modularity supporting development:

- Is the hardware (physical layer) modularity for different Mobile iTV standards available?

Business models for infrastructure:

- What is the role of the government in infrastructure business models?*

Government policy on licensing:

- There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful?* *(nb: the BMCO-forum is looking into this)*
- What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? Can government policy on licensing help to improve the situation for investors?*

Short term research activities

These are short term research questions with high priority but will take time to investigate (start in 2008), and that have to be done by academics and practitioners together.

Anywhere, anytime optimal access:

- What are models to shorten the payback horizon of infrastructure providers in order to have more investments in new technologies? (related to licensing)

Mobility and content availability:

- How can the complexity of a multi-standard multi-protocol world be reduced as much as possible?

- What scenarios can be developed to allow transparency to users whether their needed content is online or offline? How can backup and synchronization be established without the usual hassle for the user (maybe as a service level)?

MyDevice

- Increased autonomy by context aware device can make user feel detached and out of control. From a psychological/social point of view: what kind of context aware device behaviour is desired and what is unwanted behaviour?*

DRM: revenue models for the media industry:

- The royalty system will not hold; who will change the DRM system? The telecom or broadcast providers, or the media industry itself? What can/will replace this?*

Battery problem of devices:

- How to improve the power supply and consumption of devices to solve the battery problem?

Power consumption:

- How to bear the responsibility that there will be enough electricity that is needed for accessing stored content and operating a wireless infrastructure.

Harmonization by self regulation or by law:

- What is the criticalness of role of the regulation (self-regulation and harmonization by law) in different phases of a high tech innovation (mobile digital broadcasting)? In different political and cultural systems (EU and China), is there different effective solutions? How do these solutions work from short-term and long term perspective?*

<u>Mid-/long term research activities</u>

These are research activities for the Mid term (start between 2010 and 2012) that have to be done by academics and practitioners together. Depending on resources and unforeseen developments some of these might even be start on the long run, after 2012.

Context of future use:

- What is the influence of ideology on the delivered content?*

Everybody is a reporter:

- How will societies change with ample new sources of information?*

Privacy:

- How to combine convenience with option for users to control privacy settings? *
- European people like the possibility of watching TV on their own; in private. The Chinese people have greater emphasis on interpersonal relationships. How can Mobile iTV support these different cultural values related to personal settings?*

Anywhere, anytime optimal access:

- What are attainable and plausible scenarios to convert the current infrastructure to an all-IP based network infrastructure?
- How should the service portfolio of a successful access provider look like?

Security model:

- How to create end-to-end security that covers all aspects of security that enhance people to have everywhere access to content?

Scarcity:

- How to deal with the scarcity in bandwidth?

Regulation to support local industry:

- Is it true that having own standards will protect its own local industry? Eg using European standard (by Europe) and Chinese standard (by China); what is the impact of the standard to the protection of local industry?*

Policy on cultural heritage:

- How can societies keep heritage cultural heritage? And what role should policy play to keep our cultural heritage? E.g. to keep content industry?*

The mobile digital (broadcasting) convergence is developing in a fast speed. In order to keep Europe competitiveness in this new area, the research should not be focused on the traditional technological R&D research, but more research related to service innovation, regulation and policy implication, value chain developments and social impact of the new converged technologies. The technology related research questions can mostly be investigated in general. But most of these important other research questions have to be investigated by assessing the similarities and differences in Europe and China. Progress and real advantage can be realized if Europe and China can find a way to cooperate.

In the following steps of the project, the next Roadmapping workshops in WP4 will be held and will be instruments for openly discussing these R&D questions then create the wider awareness and impact.

2 Objective and methodology of the gap analysis

The ROADiBROM project aims at identifying and characterizing the key Research & Development challenges, required constituency, and the implementation model for a comprehensive European & China joint initiative on holistic and innovative applications of converged digital broadcast and mobile communication in 2015 and beyond.

The vision is to transform the Digital Broadcasting/Mobile Convergence landscapes of Europe and China into a coherent community anticipating diversified customer needs and leveraging the potential of the diversity and innovativeness of Digital Broadcasting/Mobile Convergence applications.

The project will develop visionary scenarios for Digital Broadcasting/Mobile Convergence 2015 and a detailed roadmap for the implementation process. The roadmap will define measures to take in research, development, demonstration, implementation, dissemination, promotion, assessment, and standardization.

Method applied in the project

We use an innovative web based roadmapping approach which effectively support the flexible roadmapping process with better co-evolution mechanisms for these different key elements in a roadmap. Figure 1 shows a snapshot of the homepage of the roadmapping method.

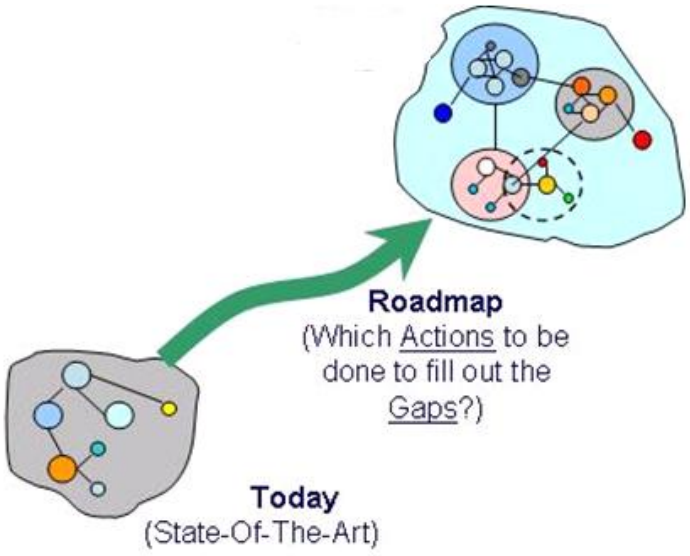

Figure 1 Roadmapping approach

In this WP3 we identify the Gaps. We do this based on, and in interaction with, the activities and outcomes of the detailed characterization of the baseline (WP1) and the definition of vision for the future including strategic goals (WP2). The main objective of this work package is to:

- Identify the development needs (gaps), which will serve as the rough input for constructing the roadmap and reaching the stated vision of ROADiBROM.

Table 1 shows the tasks of this WorkPackage and how these are related to the chapters in this Deliverable.

Table 1: The Task/Deliverable table

Tasks in WP3	**Position in the Deliverable 3**
Task 3.1 Detailed SWOT analysis This task will deliver a sound analysis on the strengths, weaknesses, opportunities and threats of the baseline (identified in WP1) towards the identified vision for digital broadcasting / mobile convergence in Europe (WP2). The results of the SWOT analysis will feed into the Task3.2, "Identification of R&D issues".	Chapter 3
Task 3.2 Identify necessary R&D Elicitation of the research gaps in the view to reach the visionary scenarios of WP 2. Within this task major needs for R&D will be identified. The R&D issues identified will be stated as short-, mid- and long-term actions and will be prioritised according to the relevance for achieving joint European and China competitiveness and specifically for making the **ROADiBROM** vision a reality.	Chapter 4, Chapter 5

We derived the R&D questions by executing the tasks in the following steps:

- Task 3.1: the SWOT analysis in which we describe the highlights of the current state of the art in terms of strengths, weaknesses, opportunities and threats related to the vision.
- Task 3.2: A holistic framework in which the changes in society and business related to media usage that are going on are represented and the categories by which these changes can be analyzed.
- Task 3.2: The critical choices which have to be made in the categories that are grounded by the found gaps.
- Task 3.2: Identification of R&D issues to make ROADiBROM vision reality.

Definitions of terms

For a clear common understanding of the work results and gap analysis methodology within the context of ROADiBROM, the following definitions of terms are important.

→ First, we like to introduce the term **Mobile iTV** since Digital Broadcasting / Mobile Convergence is quite a long term. People often just refer to Mobile TV but we think this is not an appropriate term since we discuss a new kind of services which is a combination of TV and Internet via a Mobile Device. Therefore we will use the term Mobile iTV. The ‘i ‘ relates to interactive, internet, i-centric, etc. We are aware of the fact that Apple also use these ‘i ‘ words for the iPhone, iPod, etc. This is an advantage since Apple wants to express the same meaning with these words. We keep using the term Mobile TV when we refer to just the lean back broadcasting services for mobile devices, for example the screens in buses with TV shows.

→ A **category** is defined as a cluster/group of similar dimensions leading to a more holistic understanding of digital broadcasting. As such, categories denote a domain or interactions between domains of the holistic framework for digital broadcasting. In each category we identified issues that we discussed in the workshops.

→ **Issues** are aspects/elements in a category. Each issue is described by a brief storyline that includes gaps.

→ A **gap** is the difference between the 'as is' and the 'to be' status. The 'to be' status in this project in D2 and summarized in a 3 pages vision summary that we used for the interviews.

List of activities

The list of activities below is made to clarify the activities in WP3 and how they relate to the activities of the other Workpackages:

1. Formulating vision based on desk research; a 3 page version of this vision is provided to the interviewees and used as basis introduction presentations in the first workshops. [WP2]
2. Interviews in which we discuss the draft vision with people from different domains who are working on Mobile iTV, e.g. telecom operators, TV broadcasters, new internet entrants, government officials, hard- and software providers, consultants, researchers etc. (see list of interviewees in D2). We also visited the business conference Mobile Broadcasting Forum 2007 (marcusevans conference 26-28 November in Barcelona) to get an overview of the state-of-the-art of telco's, broadcasters and media companies in Europe including gaining insight in current pilots, launches, etc. [WP2]
3. SWOT analysis based on the state-of-the-art and the vision. This task delivered a sound analysis on the strengths, weaknesses, opportunities and threats of the baseline (identified in WP1) towards the identified vision for digital broadcasting / mobile convergence in Europe (WP2). [Task 3.1]
4. Identification of categories and issues for which critical choices have to be made: Elicitation of the research gaps in the view to reach the visionary scenarios of WP 2. We constructed a framework with the categories which we improved after each new input. In each of the categories we identified issues and described these. This is written in a table at the beginning of each category [Task 3.2].
5. Two initial workshops to get first feedback in Europe and China: Brussels and Shanghaii workshops. [WP4]
6. Next step within task 3.2: identification of major needs for R&D. The issues as discussed in the workshops and elaborated as gap storyline including identified gaps. These gaps were assessed by both European and Chinese ROADiBROM partners. After the assessment of these gaps some of the issues were slightly reformulated as R&D themes and R&D questions with a short-, mid- and long-term priority according to the relevance for achieving joint European and China competitiveness and specifically for making the ROADiBROM vision a reality. [Task 3.2]
7. Two follow-up workshops to further discuss and redefine the critical issues in Europe and China: Amsterdam and Beijing. Parallel: online survey to provide broader audience platform to react. Redefining the vision. [WP4]
8. Consolidation workshops in which we discuss the research agenda (1 European and 1 Chinese) including assessment of importance of the research issues. [WP4]
9. Dissemination report. [WP5]

This report includes the Gap Analysis based on the interviews and 2 workshops; thus captures the knowledge retrieved in steps 1, 2, 3, 4, 5 and 6.

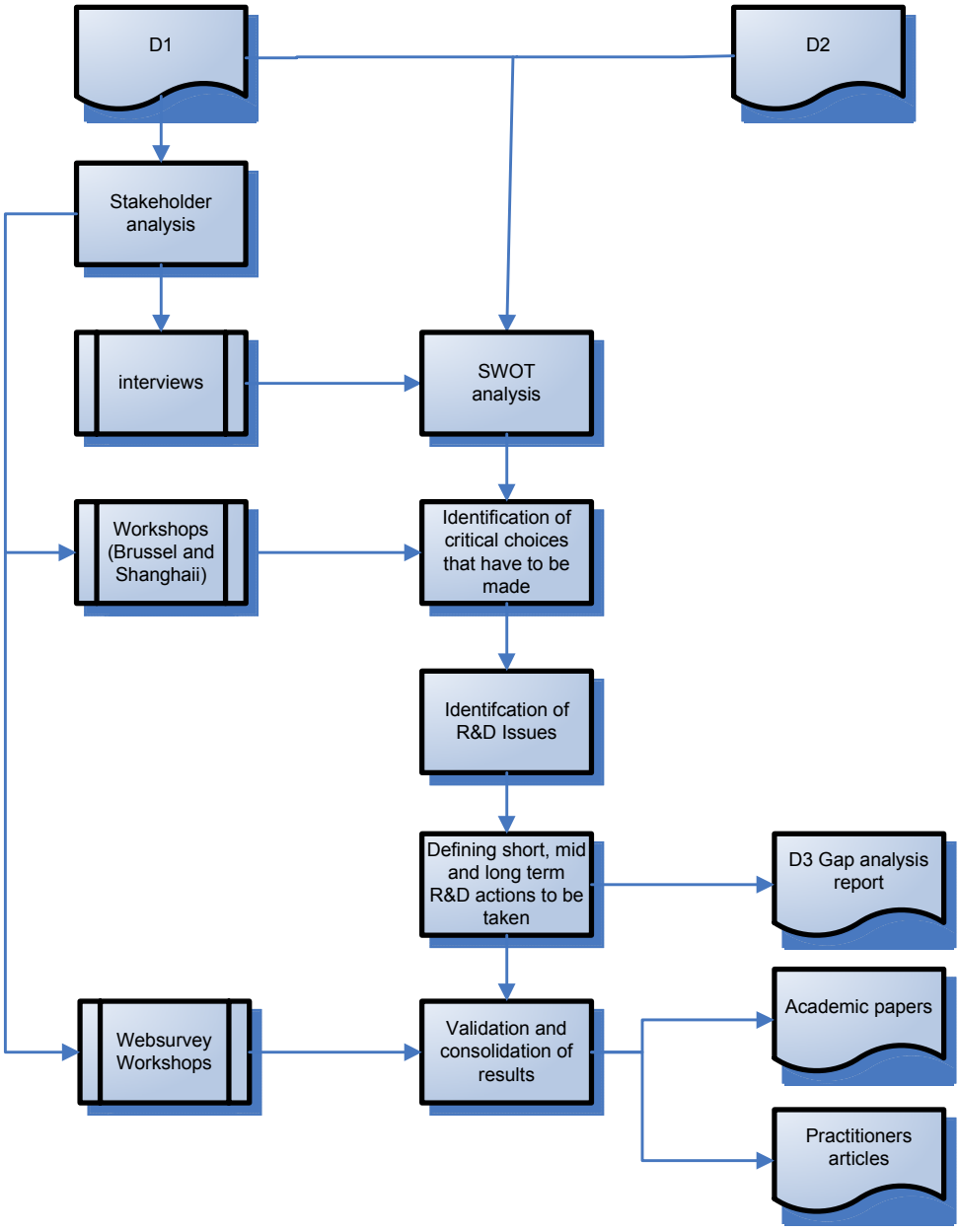

Figure 2: Overview of activities in WP 3 and activities directly related to WP 3

3 SWOT Analysis

In WP 2 we mentioned the driving forces for the relevant mobile broadcasting categories: Services and user trends; Devices; Technology barriers and challenges; Value chains; and Changes in the regulatory framework. We discuss the strengths, weaknesses, opportunities and threats for these categories.

Strength

From the view of mobile services, the current trend exists where the mobile device offers much functionality like the MP3 player, the photo camera, and camcorder and access to different networks. This implies that the mobile device can be tuned into a portable PC with added multimedia software. Thus it will be a small step to add mobile TV and Internet browsing functionality to it as well. Many operators already sell mobile television over their third generation networks and most of them started pilots to broadcast mobile on mobile devices.

Unlike traditional TV services that people have to sit in front of TV and wait for the programs begin, mobile TV users can choose whatever he/she likes and whenever he/she wants. With broadcasting digitalizing and becoming mobile as well, the strength of this new service will be personal, participatory, anything, anytime and finally also anywhere. Mobile iTV offers the opportunity to combine the three basic human needs related to telecommunication and media: communication, interaction, and watching. There is this opportunity to get from 'Shrunken TV' to Full Interactivity'[1]

The mobile phone is becoming a multi purpose product, with the benefit for the customer of taking along only one device. In 2007, WiFi entered the product, which allowed the mobile phone to become part of a data network. In the mean time, the performance of the phone has increased so much that it is possible to download applets into the local storage device and run on the device (e.g. games). In addition, TV-on-mobile is already available in certain markets. Besides, the high renewal and replacement rate makes it an excellent candidate to drive the technology development in the future in the mobile TV domain.

Traditional broadcast network operators that normally set up the DVB-T network have a preferred initial situation when building a DVB-H network. Since DVB-H is an extension of DVB-T no separate transmission network has to be set up and operated. It is also possible to transmit DVB-H with DVB-T in the same multiplex. Thus, broadcast network operators are suitable as value partners for a possible Mobile TV business model. Furthermore, vertical integration tends to take place; e.g. producers of end devices like Nokia and Ericsson expand their value by going into the service providers business.

The European Mobile Broadcasting Council (EMBC) was set up by GSMA Europe, EBU and BMCOforum to align the different business partners to agree on the way forward. This was inspired by the success of the HDTV standard. Participation in EMBC is open to any stakeholder, who has an interest in introducing mobile broadcasting successfully in the EU. It issued a roadmap for the launch of mobile TV in February 2007. Interoperability, a light regulatory touch, exchange of best practices, and a coordinated European approach to spectrum policy are mentioned as the key ingredients in the report. It might be seen as strength that the EU expressed its opinion about their favourite bearer, i.e. DVB-H.

Weakness

Although many operators already sell mobile television over their third generation networks, there is no sufficient quality in term of screen, content or a user-friendly interface. This has largely hampered user adoption. 24% of the respondents who had tried mobile video and TV

[1] Quote Vodafone presentation 28 November 2007.

said they stopped using it because of concerns about service quality and reliability. People still don't want to spend a lot of time looking at video on small mobile screens; this will change just like as with watching video on the Internet.

With the TV content becoming more product pull than (traditionally) product push, advertisements during programs are becoming less effective, and users tend to be the producers of content. Thus the pattern of both TV content and advertisement needs to change. The content has to be optimized for short sessions, the advertisement has to be targeted to the individual users, etceteras. To do this successfully a cautious design approach is necessary with beta testing, pilots and other activities to really understand the customers wants and needs. There is so much content, so many different images; and it is all about snacking which images. How to decide which images to broadcast?

Digital convergence means the device's hardware and software will support applications offered via the broadcasting, Internet and the telecommunication network. However this support cannot simply mean the device needs to support all underlying standards and the cost for the development, integration and release of the functionality will also grow considerably. The very slow decision making process on licensing the frequencies by government creates a legacy problem in the market. When decisions on the broadcast network (DVB-H, CMMB, CDMB-T, etceteras) have been made and the licenses have been given to business actors it still takes time to get the necessary market penetration of handsets which can combine broadcast and interactivity services. These last services can also be based on a singlecast or multicast network (HSDPA, etc.) Therefore it is a real problem that the standardization discussion and licensing process is still not settled.

Lack of compliancy and interoperability with standards, protocols and services will take a bigger share of the devices development cost. The device itself will experience hard times following the increasing functionalities and standards that are thought up to realize the ultimate goal of ease-of-use. E.g. the DRM systems are very scattered: there are rival DRM standards. It is difficult to combine the current broadcasting and telecom platforms, from a copyright point of view these are two separate platforms for which actors two times have to enter into contracts and pay royalties. Both service protection and content protection are necessary. Service protection is arranged by conditional access, thus only access for paying customers. Content protection is arranged by DRM and DRM can be done in many different ways, on sim card, smart card or devices. For Mobile iTV this should be integrated but there is no scenario yet on how this should be solved[2].

Many mobile services are restricted by limited battery capacity. As mobile services increasingly rely on multimedia applications in combination with the reduction in size and weight of the handheld devices, the requirements on the power management and battery performance increase.

Telecommunication network operators count on their UMTS network in the short run. The business models for Mobile iTV don't look very well at the moment. However, consumers consider changing from their mobile operator if their operator does not offer mobile TV. The BMCOforum has 110 members and does research into this and supports open innovation, and compares the different business models in various countries. This varies because the regulation differs in the various countries. It is still unclear how the power battle between the network operators and the broadcast operators will evolve. There is a commercialisation lag in most of the countries having lots of pilots worldwide. Frequencies availability does not seem to be the problem but the biggest problem are regulatory issues.

It is possible in almost all European countries (except GB) to have mobile tv services on a DVB-H frequency. However, a lot have to be arranged to offer pan-European Mobile iTV services, to make it possible to watch the same mobile TV content anywhere, like roaming agreements, etc. Although it is clear that the European Commission hinges more towards 'a

[2] Telecom Italia Mobile strongly advocates to use the SIM for conditional access.

light touch' approach compared with China. This moment it is not clear what is the best role regulators should play for mobile TV, from both the EC and the Chinese government.

Opportunity

The number of end users of Mobile TV services is growing in a steady rate especially in China. Broadcasters point out the opportunity for midday prime time as good moment for users to watch mobile TV. Thus there seems to be a shift in the time of day when people watch TV for leisure. This is backed up by consumer trials of mobile TV in Europe, which revealed heavy usage of mobile TV during the day as well as during the more traditional early morning and late evening "prime time". People are likely to watch mobile TV to fill idle times in their day, particularly in waiting situations. Pilots conducted in China showed that mobile TV has proven to be an irreplaceable source of information for people waiting for a bus and waiting at the airport.

It is an opportunity for traditional content creators (eg Reuters) to provide the same content on different platforms: tv, radio, newspapers, internet, mobile. Specially for breaking news which is very popular on mobile TV. The possibility which rise is a multiplier effect with 'snacks': short, fresh, often local, news. This will create a viral effect→ short snaps are send around as link, clip, embedded, etc. Requirements are ubiquity, breadth, speed, nexus of interest niches.[3] This generates traffic and, with an advertisement model, this generates revenues. Snacking is becoming popular, video is becoming more popular. Newsgathering with mobile device with photo/video camera generates easily and much 'snacks', increases opportunities for getting a lot of fresh news.

There are opportunities in the pricing structure. People are used to have flat rate subscriptions for TV, for mobile also the pay-per-use model is common. Besides the advertisement model supports the revenue generation of content providers on both TV and the Internet. Therefore Mobile iTV service providers can experiment with the best of those models to support optimal customer behaviour. Overlay advertisement is mentioned as a way to apply the advertisement model on mobile TV where short clips of about 90 minutes have to be financed by advertisement. New advertisements models will appear in which interactivity and lean back tv are combined.

As the mobile device integrates more and more functionality, the size and complexity of software are growing exponentially, which implies that the time to develop, test and integrate the various functions becomes too long and too costly. The use of Open Source solutions, standardized interfaces and designing for re-use can be used to overcome these issues. The common understanding is that this approach provides the best potential solutions to shorten the development throughput time. Now many players put an effort in the development of open source mobile operating system.

It is assumed that the proceeding convergence, driven by technological innovations and changed user preferences, will accelerate the developments to integrated media and online transmission system operators. E.g. peer-to-peer developments (like the Slingbox) to watch your hometv on your mobile phone. This won't be a mass market because it is difficult to do the set-up at home. The customers mobilize content for their own usage, e.g. with the mobile as set-up box for your home tv is coming.

With the limited possibilities of the 2.5G and 3G network bandwidth and the disadvantage of broadcasting networks without upstream transmission, integration of mobile networks (eg HSDPA, WiFi) and broadcasting networks (eg DVB-H) is the optimal approach to realize the mobile iTV. Most (European) mobile broadcasters are involved in trials on 3GPP and DVB-H mobile tv services and investigate the possibility for convergence (e.g. Telecom Italia, Telefonica, KPN Telecom, Hutchinson 3G Austria).

[3] Reuters presentation 27 November 2007

Regulation and policy play an important role in letting this new cross-industry mobile TV sector flourish. All countries must face this urgent situation, identify the critical barriers at the moment and look for feasible solution. A good regulation scheme could foster the cooperation between different stakeholders in this new industry.

Threats

People working in the mobile TV business warn that this market should be developed carefully, step by step. It is a learning process to find out what kind of mobile iTV services people will favour and what they are willing to pay for various services. Traditional TV is often perceived as free by customers, and it is an uncertainty of whether or not people are willing to pay for the TV service from mobile. Even users are willing to pay, the lack of a clear pricing model keeps hindering the mobile market. Potential sources of income for mobile iTV service providers are subscriptions to PayTV, pay per use for video-on-demand services, advertisement[4] and income from interactivity services.

Internet and services are getting more and more personal but when an end-user is online, he/she is just an IP-address; this IP address can be tracked and then people are not anonymous anymore. Privacy and security become a big issue in this case.

With the existence of DRM, a lot is at stake for both content providers and users. The content owners may decide to make their contents available either late or not at all depending on a good DRM solution. Consumers may decide not to adopt the system and its services when they are not able to play the content on his/her personal device. The devices have to be capable of understanding multiple content protection systems; however, this solution is very costly. Right situation depends on technology: for DVB-H is not settled or the broadcasting or terrestrial right system must be applied. Rights are a tricky situation and differs per country. Each country has different collection organizations (e.g. there are 11 in Austria).

Operating systems provide standardized interfaces for power management, multimedia hardware, memory management, network, and security facilities. Operating systems will become more complex over time, and kernel stability and proper handling of memory management becomes a prime concern.

The diversity of infrastructure systems is huge and grows. In the end it would be great when there will be a service oriented architecture on top of all these networks that provide the customers seamless access to the network which suits best their context and the required quality of service. This would be possible from a technological point of view, but successful realization remains up to the current stakeholders in the value chain. Capacity problems are foreseen when 3GPP networks (eg HSDPA) will be used on mass for streaming video, especially in long run. Therefore new popular channels will have to be broadcasted on broadcast networks like DVB-H or CMMB and for niche markets it is fine to the unicast networks. WiFi and WIMAX might work from a technological perspective but not from a service perspective. There are too many different standards at the moment in development. It looks like that China and Europe are not following the same path; and why did QUALCOMM not join the DVB-H consortium but in stead developed MediaFlo? All actors want to win, to take it all, but the risk is that nobody will earn anything. It will take a long time to enable seamless access to different networks.

Insecurities arise in the actual potential of Mobile TV. There is the problem of the different standards in technology, which leads to the threat that end device producers and network equipment producers are not willing to cooperate. There is also insecurity that whether traditional TV content is suitable for small displays or whether new TV formats with accordingly short sequences have to be developed.

[4] Mobile advertisement market in Europe is expected to rise from 0.11bn dollar in 2006 to over 3.4bn dollar by 2011 according to Telefonica presentation 27 November 2007.

The precondition for corporation between telecommunication and digital broadcasting is not stable because no reasonable scheme for profit sharing and responsibility distribution has found yet.

Another threat we discovered was the growing problem of the availability of electricity. Hosting providers have problems finding space *with* electricity to install their servers. Also, the general public becomes more and more aware of the environmental issues. These are also related to charging the devices with which they are confronted each time their battery is down. Therefore we decided to add an extra category on sustainability.

Currently telecommunication and broadcasting industries are heavily regulated in both Europe and China. For the mobile broadcasting services, they must cooperate with each other and also with the IT and consumer electronic industries which have traditionally not been regulated. This multi-layer cooperation definitely introduces tensions and value differences between existing institutions. These differences are likely to have a major impact on the process of change and convergence.

Conclusion

The SWOT analysis shows that there are currently strengths and weakness in the current markets that make it difficult to predict the future Mobile iTV scenario. How to take the opportunities and deal with the threats to make Mobile iTV a success? Key success factors expressed by the BMCOforum to realize this success are: an open end-to-end standard systems worldwide (repeat the success of GSM); Good reception characteristics (indoor coverage); Attractive content (brands, mobile content); Interactivity for successful business models; and Choice of terminals. [5]. We see these issues also discussed in our SWOT analysis and the opportunities and threat to realize this. The SWOT analysis also showed that there are strong interdependencies between, for example, devices and network technology. Also issues to create a sustainable business like the availability of electricity, bandwidth and spectrum the categories influence the foreseen success of Mobile iTV. We decided to slightly change our framework by integrating the device in the technology category and to add a category on sustainability.

[5] BCMOForum presentation 28 November 2007

4 Categories of Gaps

4.0 Introduction

In the eighties the shift of thinking from centralized towards network-centric started with the rise of the Internet. Coming years next step of this trend will take place in the media industry. This media industry is still dominated by central broadcasted content via television channels to the living room. However, this is shifting towards a networked environment in which the mass market vanishes since many consumers become many producers who watch content anyplace anytime according to their personal context. Furthermore, the users of content won't accept expensive, unreliable and difficult technologies anymore. It will be about the users' experience.

The consequences of this are that the field of players will change (e.g. brokers who help production companies to reach this mass market will be out of business) and that the principles behind the technologies have to change (e.g. access content by an infrastructure that is best available, priced and reliable at particular moment).

In our vision the paradigm shift can be described by the field as illustrated in Figure 3.

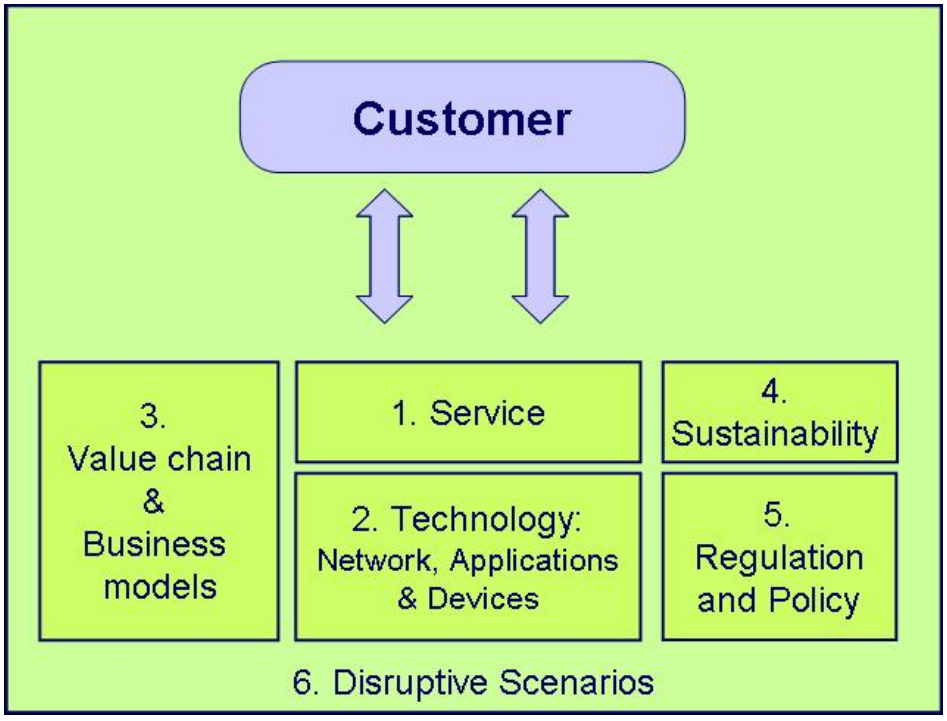

Figure 3 Holistic frame work with categories of gaps

We explain the gap between the current state of the art and the vision for each of these categories. The issues as identified before the workshops and brought into the discussions in these workshops (Brussels and Shanghaii) are described in tables in at the start of each section. In these tables is also mentioned how the participants prioritized these issues. Here we explain how we present these priorities and why we chose for this method. One of the purposes of the workshops of Brussels and Shanghai was to identify the critical choices. We started the discussion with presenting the issues as we identified in each category based on

our state of the art study, the vision we developed and the feedback we received in the interviews. We chose a different method for both workshops because of cultural differences between Europe and China. In Brussels we divided the participants in groups, asked them to divide 10 votes on the critical choices they considered as most important. Next, we discussed the choices with the most votes. This way of working could not be used in China because people are not used to have group discussions but in stead they are used to prepared presentations and panel discussions. It does not fit in the Chinese culture that participants stand up and openly discuss upcoming ideas in a group discussion. To also gather data on what the individual Chinese participants consider important we gave them questionnaires they could fill in on paper. For this we used a 1-7 likert scale to rate each issue.

Differences in opinion about what is important depend on many factors like the kind of field people are working (e.g. telecommunication professionals or journalists), their personal view, experience, attitude towards innovation, etc. Whether somebody has a European or Chinese background is only one of the aspects. Therefore we are very cautious on drawing conclusions on our findings in the workshops regarding the Europe/China differences. To give an indication we decided per issue if the workshop participants considered it as very important, important or not important. This means we chose for a three-point scale. We translated the results form the workshops as follows:

Brussels voting results are translated as follows (n=35):

- 15% and more votes: 3
- 10-15% votes: 2
- <10% votes: 1

The Shanghai survey results are translated as follows (n=22):

- 6-7 scores have highest percentage: 3
- 3,4,5 scores have highest percentage: 2
- 1-2 scores have highest percentage: 1

We checked this with our observations on the discussions and the results are presented in the tables in each category.

For the data and a more detailed analysis we refer to the workshop reports.

In the next sections we first present the issues and how they were prioritized in the Brussels and Shanghaii workshops. Next, we discuss each issue with a brief storyline. The gaps are discussed and assessed by their relevance in both Europe and China. The category sections all conclude with the research themes as identified per gap storyline and the belonging research questions. In the conclusion we integrate the disruptive scenario issues.

4.1 Services: to be used by the user

The drivers for the changes in society are that there is a rising Community Feeling, increasing digital Literacy, and Increasing Mobility.

Table 2: Issues in the Services Category

Issues	**Questions**	**Prio Europe 1-3 scale**	**Prio China 1-3 scale**
Context of (future) use	How will Mobile iTV be used? Combination of broadcast and narrowcast? Social and user-Centric? In which context? Especially by Youngsters?	3	3
Everybody is a journalist	What is the impact, e.g. on professional journalists, trust, behaviour? Are new realities created (social constructivism)?	3	2
Privacy	May everybody know everything about everybody else? Do users have control over personal data? What information may be collected about me?	2	3
Quality of Service Ease of Use	How to manage Quality-of-Service? How to manage Ease-of-Use? Can they discriminating factors in gaining market share during transformation?	2	3

For each of the issues we describe the Gap Storyline considering the situation in both Europe and China.

4.1.1 Context of (future) use

Gap storyline brief: in which circumstances will people use mobile digital broadcasting? Views differ from 'this will never be a success, look at the failure of handheld tv' to 'there will be a high adoption of this service in all different kind of situations (toilet, car, park, etc). The uncertainties are related to the target group, their motivation and participation, location of people, type of content and type of application.

Gaps covered in this storyline:

- Target groups differ: who will watch Mobile iTV; in what context? How will they watch tv. Separate this by target group: *who wants to see what and where, who wants to pay what and what is the role of advertisement* (young generation does not want to watch tv anymore). The context will change: e.g. in China the peak of watching Mobile TV is during lunch in stead of the traditional time at/after dinner. In Europe many people are so busy that it seems impossible to find time slots to watch mobile iTV. The advice is to do studies to investigate which target group likes which kind of content.

- *Motivation for usage might be social or I-centric*: do users they want to share information, to stay in touch, to communicate with friends, to be entertained? More social or user centric? This influences the unicast/multicast/broadcast balance.
- Location of usage suitable for Mobile iTV: *where will Mobile iTV be used*: on the road or at home? In public transport or in cars? At school, at work, in holiday resorts? Screens hanging in buses and in cars become standard in some cities. E.g. luxurious cars in China have TV screens and SMG provides television in the buses in Shanghaii; also the trams in Amsterdam have TV screens. It is uncertain or this will be replaced or complemented by personal devices in future. The location of usage might be used *to localise the content* and in this way influence the type of service. It is a question to what extent push versus pull way of delivery can be used.
- Popular content for Mobile iTV: Circom showed market research in which breaking news was mentioned as most important followed by sports. However, also soap as most interesting broadcasting mobile tv service is mentioned by youngsters. What is the sex industry doing with Mobile iTV? They are always ahead with new media. The results of the introduction of mobile TV in Austria show clearly that 'sex sells'. MTV confirmed the cliché that: 'sex, pain, humor and animation' sells. Interviewees also agreed with the vision that *user centric and personalized services to empower users to participate and contribute will be utmost important*. This also impacts the kind of application: will personalized content be organized through software or through community? Mobile iTV is the third screen for users next to the traditional TV and the PC/Internet combination. These will *complement and co-exist*: what are the requirements for the type of content per screen? This is interdependent with the target group and interdependent with the location of usage. The currently rising power of social bookmarking (reddit, Digg) could also be implemented for short clips typically for the Mobile iTV market.
- Interactive applications usage: What kind of interactive applications will users like? Voting? Is it a technical or content challenge to offer these services? There will be a blending long-tail-broadcast, with environment, with content. Looking at usage: *how can one use interactivity* in a mobile situation? (while driving, in train etc): consumer definition of interactivity. The scenario can learn from the development of applications like second life, gaming, and other interactive applications based on My channel, street TV, and always on instant messaging functions on mobile TV that support social networking,. Broadcaster think that the combination of broadcasting and a return channel for interactivity will be most interesting. Some info on "new" types of TV-watching (YouTube-like clips, product clips, geography related info (tourists) that do not make much sense in a traditional TV setting (fixed TV @ home) but that might be the raison d'etre for Mobile iTV. It is like a new medium adding to the existing ones instead of replacing it (concerts – theatre – cinema - radio – TV – VCR – Internet – Mobile iTV - …). On the other hand, mobile service must be very simple to work!

Table 3: Assessment of 'Context of (future) use' gaps

Europe	**China**
High: a. It is unknown in which context people will use Mobile iTV; Making wrong assumptions about what kind of content people will like b. Youngsters cope differently with new media and they will be the majority in future c. What kind of applications will make	High: d. How to solve the conflict between the scarcity of attractive content and the ideology issues concerned by the national department who monitor and check the delivered content?

Mobile iTV a success: • User centric services will be important • Geo-tagged applications will become more important (see Google Earth, StreetView, MS Photosynth, …) • Interactive applications link people and need to be offered more.	
Medium: e. People perceive tv now as free, but mobile iTV need to be financed. f. Opportunity to localize content (people see their street news)	Medium: g. People are now not interested in the content of Mobile iTV; will this change?
Low: h. When people use interactive applications in mobile situations this might be difficult or dangerous. How to solve this?	Low:

The gaps with high risk and/or relevance are reformulated as the following research questions:

- Which target group likes which kind of content? This will differ in Europe and China; Chinese have more free time due to more labour sources in China. They are online mostly for entertainment to pass the time rather than for work. Comparatively, entertainment and leisure products are suitable for Chinese.
- What is the influence of ideology on the delivered content? In China, the national department monitors and checks the delivered content. In Europe, special features like 'parental watch' exist to provide possibilities to control the content.
- What will be the contexts in which Mobile iTV will be used?
- How to know what kinds of applications are most suitable for Mobile iTV?
- What is an acceptable service/ price balance? As a developing country, China has much less income than the developed countries. Therefore, consumers are rather sensitive to prices and a lump sum payment of the mount. Consumers like keeping up with each other and be out of the ordinary, as a result of more demand for performance, style and function. Meanwhile, they have a certain degree of blind consumption and may not really buy their desired products.

4.1.2 Everybody is a journalist

Gap Storyline Brief: Consumers will become prosumers meaning that they will as well actively produce the consumable content. What will be the impact of this new kind of journalism? For professional journalist; for trust in quality; for behaviour of people (celebrities) who might be always spotted; creating new realities (social constructivism). Actually the consumers will report the news and professional journalism will mainly add value in the back office where the news is shifted, analyzed and interpreted.

Gaps covered in Storyline:

- Trust: citizen journalism will become more and more obvious. The increasing content pose the other challenges for citizen: which content I should trust? Hence, trust is important for new generated content. Trust is an important component of the brand image. Recent statistics shows BBC is the most trustful source in the world (73%; source Circom). What is the impact on trust in content (information) from citizen journalism? What is the role of the government? Will they forbid individuals to use certain channels (especially relevant for China).

- Combination of privately generated content with the rights of content. This won't be an issue since this is about speed, in combination of trust. Sometimes users get paid when they upload content (by network operator for traffic generation or by broadcaster for the content when very interesting).

- Role of traditional journalists: What is the role of a Journalist? The role of traditional journalist does not change that much. He/she still performs analysis about the collected news or other sources to put them in perspective. There are simply more resources to be used. There will be a shift from less reporters to more journalists.

- What types of communities will there be in the future? Definition of local community (trust factor). Size of the community: newsletter – newspapers for smaller communities, local news, virtual communities. It will be a community of interest rather than physical, a successful example is flirting applications. It needs personalizing content. There is evolution of communities – once met or never.

- Design of the society: What is the role of "control" and elements of control, and which works better in a new environment? Hence: how to design society based on the new converged technology and the availability of all new sources of content that are easily accessible? Can we design the society, or should we just let it happen. The design of society changes with the ability to gather opinions from everybody the society changes. Will content be mainly developed and consumed within communities? What type of communities will this be? E.g. Chinese consumers are susceptible to influence public opinion and the views of others. In addition to access to relevant information from salespersons, the most related information is obtained from the Internet. So it will be very helpful for the universal network in promoting mobile television services.

- Catch the audience: Inter-influence and interaction of default medias (newspapers, TV). Finding content: selecting, content regulation and control, traceability of content (trust)

Table 4: Assessment of 'everybody is a journalist' gaps

Europe	**China**
High: a. What is the impact on trust of the audience on information when this will be developed by citizen journalists? b. How will societies change when everybody is a reporter? Will content be mainly developed and consumed within communities? What type of communities will this be?	High: c. It is probably forbidden for individuals to broadcast the content using public channels due to the strict policies enacted by national policy which is enacted by the national department who monitor and check the delivered content.

Medium: d. How can the audience be reached with the very large volumes of content? Search agents? Multimedia strategies?	Medium:
Low: e. What will be the role of professional journalists?	Low:

The gaps with high risk and/or relevance are reformulated as the following research questions:

- What is the impact on trust in content (information) from citizen journalism?
- How will societies change with ample new sources of information? The design of society changes with the ability to gather opinions from everybody the society changes.

4.1.3 Privacy

Gap storyline brief: we (will) know everything about each other: how to deal with it? This has psychological, social and cultural dimensions. The perception of privacy differs in China and Europe. The Chinese people have greater emphasis on interpersonal relations, hence, the means to strengthen interpersonal relationships are very interesting, such as a phone. Privacy also includes the meaning of having privacy to watch something on your own, without being watched by others. In China, moderation and harmony are traditions; services are more attractive when they are characterized by human and thoughtful performance. In Europe, freedom and this privacy seem to be utmost important values that have to be enabled by Mobile iTV.

Gaps covered in Storyline:

- Transparency: are our available content and especially our activities getting fully transparent? Do we want to hide away? Somebody might not mind to provide all his/her personal information and retrieve services for free including personalized advertisements. There might also be persons who want to keep his/her information secret and pay for the services.
- Convenience: Will people just go for convenience enabled by converged technologies or go for privacy? At the moment, it seems that people prefer the convenience. The discussion about it just starts in Europe.
- How to deal with fact that we already know everything about each other? Do we need guidelines for dealing with privacy? Do we need to protect people from their own carelessness or indifference?
- European people like the possibility of watching TV on their own; in private. The Chinese people have greater emphasis on interpersonal relationships. How can Mobile iTV support these different cultural values related to personal settings?

Table 5: Assessment of ‘privacy’ gaps

Europe	**China**
High: a. How to combine convenience with option for users to control privacy	High: c. The Chinese people have greater emphasis on interpersonal relationships. How can Mobile iTV

settings? b. European people like the possibility of watching TV on their own; in private. How can Mobile iTV support this?	support this?
Medium: d. What are the guidelines for privacy rules regarding who is allowed to know what?	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research questions:

- How to combine convenience with option for users to control privacy settings?
- How can Mobile iTV support these different cultural values related to personal settings?

4.1.4 Quality of Service and Ease of Use

Gap Storyline Brief: When combining trial results and current development on the web, most obvious conclusion is that TV is a choice of consumers on how they want to interact with "video" content. This might be by different interfaces like the traditional TV, HDTV, TV via the Internet or Mobile iTV. Consumers want those services to be easy to use and to have some minimum level of quality (see e.g. the failure of the first WAP services). In trials we observe that the interaction of consumers with Mobile TV shows differences in preferences and habits across demographics. This means that demographics and culture aspects have to be taken into account.

Gaps covered in Storyline:

- How to overcome the gap between what mobile users might do with their phone and what they actually do? It seems that operators as gatekeeper hinder because they want to earn money.
- How should the men-machine interfaces be designed? Is it possible to let the machine decide on e.g. when the phone will produce a sound and when not (for example in a theater)? Optimal use of a wearable screen and keyboard: how should they be designed? The content has to fit on the screen. Developments like the iPhone show that this will be solved by the industry. The success of Apple, the unified GUI. To enrich user experience pure technology can no longer win. Brand promise of Philips (following Apple?): designed around you, easy to experience, and advanced. The real challenge is to include an increasing list of features, options, and possibilities in a device while at the same time making it more accessible, easier to use (at least the daily use), and better customizable to the specific needs of an individual user.
- How to derive the absolutely needed ease-of-use of mobile devices since this seems to be culture dependent and those differences are difficult to take into account because of the economical needed large-scale production? The expected coverage area in China is huge, a lot of uses, economic development gaps between different areas. All these factors make is difficult for QoS, especially in those under developed areas.
- How will the internet browser be used? Is it possible to use a internet browser for services based on different infrastructures like 3G, dvb-h and satellite? Simplicity seems to be key.

- Content and community: finding, regulation and development; visualization and locality; trust of content and trust within community. Globalization versus localization.
- How to let people choose whether they want pull or push? When apply the opt-in and when apply the opt-out principle? How to develop devices/applications that support this?

Table 6: Assessment of 'QoS' and 'ease-of-use' gaps

Europe	**China**
High: a. How to derive the absolutely needed ease-of-use of mobile devices since this seems to be culture dependent and those differences are difficult to take into account because of the economical needed large-scale production? b. What is a suitable design process for optimal men-machine interfaces? To 'design around you, easy to experience, and advanced'.	High: c. The expected coverage area in China is huge, a lot of uses, economic development gaps between different areas. All these factors make is difficult for QoS, especially in those under developed areas.
Medium: d. Role of communities in searching and finding	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- What is a suitable design process for an optimal ease-of-use service with the required Quality of Service?

4.1.5 To summarize on services

Table 7: Summary on Services

Cat.	**R&D theme**	**R&D questions**
Services	Context of future use	● What will be the contexts in which Mobile iTV will be used? ● Which target group likes which kind of content? ● What is the influence of ideology on the delivered content? ● How to know what kinds of applications are most suitable for Mobile iTV? ● What is an acceptable service quality / price balance?

	Everybody is a reporter	● What is the impact on trust in content (information) from citizen journalism? What is the role of the government? ● How will societies change with ample new sources of information?
	Privacy	● How to combine convenience with option for users to control privacy settings? ● How can Mobile iTV support these different cultural values related to personal settings?
	Quality of Service and Ease of Use	● What is a suitable design process for an optimal ease-of-use service with the required Quality of Service?

4.2 Technology: network, applications and devices

Seamless networks will enable voice, video and data convergence; those networks will be invisible for consumers and consumers will be able to access services anytime, anywhere, anyway. They do this with wearable/portable devices. Ambient awareness and context sensitivity will make devices "disappear": this implies that sensors are important, and that mobile devices are wearable.

Table 8: Issues in the Technology Category

Issues	Questions	Prio Europe	Prio China
Anywhere, Anytime optimal access	How to create ubiquitous service availability? How can users easily and transparently connect to the best available networks?	3	3
Mobility and content availability	How to connect to digital information always and everywhere? How to allow instant access to information and content?	2	3
Modularity supporting development	How to setup a modular platform (Hardware – Software – (sub) Systems)? Interoperability and standardization. Open Source contribution?	1	2
Performance	Will Moore's Law continue? Does it hold for bandwidth as well?	1	2
MyDevice	How to combine "All features in one device" with "Device tuned to my needs"? What is necessary in integration & miniaturization?	3	2
Portability of feature-packed devices	Can ease-of-use be combined with small portable devices? What limits do people accept?	1	2

4.2.1 Anywhere, Anytime optimal access

Gap Storyline Brief: The three networks for phone, TV and computer are replaced by generic IP based networks. In the end it would be great if we could decouple the logical network (the operator/access provider/broadcaster/etc.) from the physical network (cable/fiber optics/wireless/etc.). A user pays a subscription for a portfolio of services including the type and level of access available. Anywhere the type of service is available for that provider the user can have access. Access anywhere anytime would then mean a premium subscription. This would be possible from a technological point of view, but successful realization depends on the business models to be implemented by the current incumbents. The same principles currently used in the mobile phone business could be used (prepaid cards (= bytes to down/upload) and subscription (= right to down/upload to a certain amount including broader access)).

Gaps covered in Storyline:

- Harmonization on network level: if we consider the OSI model we can identify the network level and above that the applications and services level. Above the network level a wholesale model is possible to enable Mobile Virtual Network Operators (MVNO's). This is related to regulation.
- What about different scenarios for building networks. E.g. networks with low antennas, low power (kind of mesh networks). Mesh technology: will people organize access themselves or go to an access provider? User preference to balance between costs and (quality/level of) services.
- How to create Mobile iTV availability? Anywhere; but content might not be available due to local regulations.
- Difference between fixed and mobile will become transparent to the consumer; so network operators might become just access providers. Consolidation happened in fixed networks and will also happen in mobile networks.
- Seamless switching between networks will ultimately be possible. A way to approach this is to start with two parallel models: spectrum for broadcasting (DVB-H) and linear broadcast via 3G/4G. Next, the question is how to make it possible to switch seamless between broadcast network and operator network? Seamless roaming is not working: how to make it possible for consumers to use the most appropriate network at any given time?
- How to get an installed base of devices in the market which can handle broadcasting (eg via DVB-H); AND capacity for linear broadcast (eg via HSDPA)?

Table 9: Assessment of Anywhere, Anytime optimal access gaps

Europe	**China**
High: a. Complex non-transparent service offerings can put people off. b. Parallel incompatible network types continuing for too long can have consumers postpone their choices (compare: Blue Ray – HD-DVD). c. How to provide seamless access to the different networks? d. Network technology type used (meshed)?	High: a. The automatic switching between networks makes people difficult to choose networks they preferred to. b. How to implement a rule to select the optimal network? c. A nationwide Single Frequency Network?
Medium: d. Availability of service is considered a "sine qua non". e. Hampering progress due to regulation differences.	Medium: e. Availability to provide the same service with the same QoS for different networks? f. Availability to rebuild all the networks used now to all IP based ones before 2015? g. What is the cost of coverage?
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- What are attainable and plausible scenarios to convert the current infrastructure to an all-IP based network infrastructure?
- How should the service portfolio of a successful access provider look like?
- What are models to shorten the payback horizon of infrastructure providers?

4.2.2 Mobility and content availability

Gap Storyline Brief: How to connect to digital information always and everywhere? How to allow instant access to information and content? Standardization and interoperability of operating systems is uncertain. Increase of cheap memory will offer the opportunity to store offline as well as online. Will users be able to understand the choice between the two and the implications of their choices? Can virtual storage be implemented anywhere (to give users the MyOnlineSpot experience) and transparently? Can online-storage/offline-storage/backup/synchronization be done transparently to the user (see for instance the TimeMachine in the new Apple OS Leopard).

Gaps covered in Storyline:

- How to develop standards so that travelers can use mobile video services (like traffic info) all over world? Easy to find and get your information 'everything with me'.
- Not all content on the phone but easy access using the phone.
- Broadcasting model for life events (news, sport) – technology can influence value chain.
- Implementation of zapping (build-in) in digital TV.

Table 10: Assessment of Mobility and content availability

Europe	**China**
High: a. Non-uniformity of standards and protocols leading to complexity and unnecessary roaming.	High: b. Non-uniformity of standards and protocols leading to complexity.
Medium: c. Complexity of online vs. offline (including synchronization) d. Having available what is needed/wanted (irrespective of online/offline)	Medium: e. The limitation of the number of the VOD (broadband services) subscribers f. The availability of technologies that support the upcoming bi-way high speed broadband services.
Low: g. Consistency of Mobile iTV with broadcasting TV	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- How can the complexity of a multi-standard multi-protocol world be reduced as much as possible?
- What scenarios can be developed to allow transparency to users whether their needed content is online or offline? How can backup and synchronization be established without the usual hassle for the user (maybe as a service level)?

- Can mobile receiving technologies support the upcoming bi-way high speed broadband services?

4.2.3 Modularity supporting development

Gap Storyline Brief: It is a risk for Mobile iTV service providers to choose for one network or application standard to develop their services. To reach a mass market the to-be-developed services and content have to be able to be accessed by the networks and applications used in the market. To create growth in service development it is necessary to have an architecture in which interfaces are defined so that the existences of more standards are workable. Therefore, solutions like 'modularity' and 'interoperability' are important. The 'open source' solutions also might help, many players put effort in the development of open source mobile operating system (e.g. Symbian, OMA, …). It is necessary to have a middleware layer that can cope with different device structures, to enable a blend between fixed and Mobile iTV.

Gaps covered in Storyline:

- How will the architecture look like? See the complex current pictures of the BMCOforum. Need for standardization of the building blocks? Next, interoperability plug-in? and defined interfaces for specified services? One content storage and different distribution system all over the world? One payment system?
- China: There are industry standards (eg CMMB of SARFT), association standards (eg CDMB-T), company standards (eg TMMB of NUFRONT, and CMB of Huawei), university standards (eg ADTB-T from SJTU, and DMB-TH from QHU) and state standard for terrestrial broadcasting.
- Open source operating system for mobiles: many players must put in effort. First open source operating system for mobile appeared; software will be developed etc. (Android)

Table 11: Assessment of Modularity gaps

Europe	**China**
High: a. Standardized open interfaces for specified services and features.	High: b. How to unify the standard for mobile iTV?
Medium: c. The risk that a multitude of closed (proprietary) interfaces and building blocks emerge.	Medium: a. The hardware (physical layer) modularity for different Mobile iTV standards.
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- Develop an extendable architecture with a defined interface language able to publish and process semantics on device features, abilities, and available services?
- Is the hardware (physical layer) modularity for different Mobile iTV standards available?

4.2.4 Performance

Gap Storyline Brief: Will bandwidth be a problem? Although CPU power, memory space, and communication bandwidth are limited they will continue to increase. The (wireless)

infrastructure of the future will have to become cheaper, more reliable and will have to take into account the CO_2 footprint of the whole system. Energy efficiency will become a major attribute of any infrastructure device (see also 4.4). Furthermore, the infrastructure has to deal with interconnectivity issues relating to communication over multiple networks, or switching between them to get optimal reach and performance.

Gaps covered in Storyline:

- Adoption of high bandwidth: why is mobile wimax not used?
- Compliancy is uncertain: at the moment there are many different standards, Compliancy is necessary for seamless usage; but this cannot be too expensive. All hard- and software has to be IP based.
- Legacy systems: backwards compatibility.

Table 12: Assessment of 'performance' gaps

Europe	**China**
High:	High:
Medium: a. Multiple systems with basically the same functionality operational in parallel due to historical growth drive up cost.	Medium:
Low: b. Balance between legacy (not voiding old devices) and increased capacity and efficiency c.	Low: d. The trade-off between the mobility and the size of terminals (especially the size of antenna).

The gaps are also discussed in the sustainability category and partly covered in the ease-of-use issue. Therefore Performance is removed as separate issue.

4.2.5 MyDevice: Functionality explosion and diversity

Gap Storyline Brief: The younger generation has other (typically more relaxed and inquisitive) relationship with their mobile phone. MyDevice will take place for them, devices are personal. Therefor it won't work to have just 2 models of devices when introducing new services like Mobile iTV. Trends in sensor developments allow devices to become context aware which will greatly influence the use of devices. An ambient intelligence can emerge. Devices will be connected 24/7 and can be used for accessing and using several (multimedia) services when available or cheap, in order to facilitate the user to consume them when desired. Easy interaction with the device is paramount. Cost and efficiency will remain important.

Gaps covered in Storyline:

- The devices will probably have a hard time following the increasing functionalities and standards that are invented to facilitate the user.

- Due to the global warming people become more sensitive about sustainability. This might influence the buying of new devices and the usage of more electricity.
- The Swish pocket-knife concept: some people like combination of navigation, webbrowsing, photo-/video camera, calculator, electronic book, phone, instant messaging, sms/mms, etceteras; some don't. This is also related to brands: Nokia makes good phones and Nikon makes good cameras.

Table 13: Assessment of MyDevice Gaps

Europe	**China**
High: a. Flexibility of devices increases vulnerability (viruses) and decreases ease of use. b. Flexibility of devices to follow the availability of new services and features	High: c. Flexibility of devices increases the complexity of operation and maintenance and in return limit the use. d. Flexibility of devices increases the cost and power consumption. e. Availability of emerging services to use the flexibility of devices.
Medium: f. Increased autonomy by context aware device can make user feel detached and out of control.	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- Can the functions of devices be easily defined? And can the devices can be easily operated and maintained? Are there enough new services that can be supported by the new functions of devices?
- Increased autonomy by context aware device can make user feel detached and out of control. Behavior of context aware devices is key for their acceptance. Psychological/social studies need to reveal what is desired and what is unwanted behavior.
- Define architectures and protocols that are flexible yet inherently safe.

4.2.6 Portability of feature-packed devices

Gap Storyline Brief: Miniaturization is continuing. Question is how wearable devices can become considering that a screen is needed. Maybe a rolled screen? The ease-of-use issue is already discussed in the Services category; and the device developments are discussed in the MyDevice section. Therefore this issue will not further be elaborated.

4.2.7 To summarize on Technology:

Table 14: Summary of Technology

Cat.	R&D theme	R&D questions
Technology	Anywhere, Anytime optimal access	• What are attainable and plausible scenarios to convert the current infrastructure to an all-IP based network infrastructure? • How should the service portfolio of a successful access provider look like? • What are models to shorten the payback horizon of infrastructure providers?
	Mobility and content availability	• How can the complexity of a multi-standard multi-protocol world be reduced as much as possible? • What scenarios can be developed to allow transparency to users whether their needed content is online or offline? How can backup and synchronization be established without the usual hassle for the user (maybe as a service level)? • Can mobile receiving technologies support the upcoming bi-way high speed broadband services?
	Modularity supporting development	• Develop an extendable architecture with a defined interface language able to publish and process semantics on device features, abilities, and available services? • Is the hardware (physical layer) modularity for different Mobile iTV standards available?
	MyDevice: Functionality explosion and diversity	• Can the functions of devices be easily defined? And the devices can be easily operated and maintained. Are there enough new services that can be supported by the new functions of devices? • Increased autonomy by context aware device can make user feel detached and out of control. Behaviour of context aware devices is key for their acceptance. Psychological/social studies need to reveal what is desired and what is unwanted behaviour. • Define architectures and protocols that are flexible yet inherently safe.

4.3 Value chains and business models

The drivers for the changes in our economy are the changing Powers, The Rise of the Long Tail, Open Source movement, and increasing amount of Free Content. The main uncertainties in the new value chain are:

a. Power of incumbents vs. power of entrepreneurs; it is not clear at the moment whether, in the emerging new value chains, existing incumbents (e.g. telecom operators, broadcasters) will become the dominant players. The visions expressed from large corporations and entrepreneurs show different directions for the future. The status of today as well shows that all parties are trying to take the most powerful position in the new value chain, no matter if they are incumbents or new entrants.

b. Uncertainty about business models; people realize that there will be more emerging disruptive business models in the future, however, most of them are still exploring what the feasible business models in the emerging value chain are.

Table 15: Issues in the Value Chain & Business Models Category

Issues	Questions	Prio Europe	Prio China
Value chains	What value chains for Mobile iTV will arise/survive? What is the likelihood of each one? Incumbents versus new entrants?	2	3
Business models for infrastructure	Why and how to invest in infrastructure (long pay-back time)? Related to business model of end-service? time)?	2	3
DRM (revenue models for the media industry)	How to organize paying mechanisms? What (who) will be the revenue generator for the media industry?	2	2
Power of brands Power of new entrants	Which brands will/can dominate? How do brands come into being? Managing industry transformation by branding to allow for disruptive innovation?	1	2

4.3.1 Value chains

Gap Storyline Brief: How can the industry transformation be managed so that Mobile iTV can become a success, maybe even be a disruptive innovation? Currently there is a complex value network of device manufacturers, regulators, application providers, operators, retailers which hinder innovative content/service providers to be successful.

Gaps covered in Storyline:

- How to *break through* the current business models which hinder content distribution? An extreme solution is that one actor controls the whole value chain from device to retail; from network to content. Another solution is to make the value web transparent by a wholesale model. The usage of neutral sims will encourage this.

- The value chain will be *steered by* money. Is this advertisement? What will be the role of advertisement? Will people be locked in by brands?
- How will have the *power* in the future value chain and how will this be created? Who is 'the boss' in the Mobile iTV world and who earns the money? The telco or the broadcaster? What will be the role of Telco's if they just offer access? Content revenues are not interesting for telco's. Who is supplier and who is customer? Maybe 3rd parties should rise to create a break-through. Also new coalitions like Nokia cooperating with media companies like MTV for mobile services.
- What will be the *revenue model* for Mobile iTV? Will the customer pay? Will the service satisfy the potential requirement of customers? Who will pay the bill? What's the suitable billing model? Will the revenues be shared by partners?
- Horizontal markets, vertical markets, walled garden, open model: how to explore mobile iTV so that it satisfies customers' wants and needs; and also generates revenues for the service providers? Can network operators share content with competitors? Now, sometimes the situation is that customers can see some content only with a subscription from a specific network operator and not with another subscription.
- Offering Quality of Service is the selling point of service providers. Will these players be powerful? Who will be those players: the incumbents or new entrants?

Table 16: assessment of Value Chain gaps

Europe	**China**
High: a. How to break-through the current value web which hinders innovation? b. Money steers the value web: where will money be generated? Who pays whom?	High: c. Who will gain the license to operate the future Mobile iTV services? d. Which standard of Mobile iTV will be adopted? And will the government allow the mobile terminal compatible with multi-mode function like DVB-H and 3G or CMMB (Chinese version)?
Medium: e. Changing powers: telco versus broadcasters; new entrants versus incumbants	Medium: f. Currently 2.5G / 3 G streaming multimedia services and broadcasting services co-exist. What are the future killer applications or advantages compared with these? The supplier who has best starting position might have advantage and become most powerful on the market?
Low:	Low: g. Will the service satisfy the potential requirement of customers? Who will pay the bill? h. What's the suitable billing model?

The gaps with high risk and/or relevance are reformulated as the following research questions:

- What will be the future value web? What will be the role of incumbents versus new entrants [see also 4.3.4]?
- Money steers the value web: where will money be generated? Who pays whom?
- What will be the role of licensing by the government? [see Regulation & Policy category]

4.3.2 Business models for infrastructure

Gap Storyline Brief: the business model for traditional network operators is that they invest a lot of money in infrastructure and have to realize a return on this investment in about 20 years. The current dynamics in the market make it very difficult to have this time horizon. Most investments have to be done in the networks to make Mobile iTV a success and especially investments in the network are necessary to cover the indoor usage of mobile broadcasting networks. Can network providers share networks to minimize costs? The revenue potential for these gate keepers is a question because the mass market also perceives (public) TV as being free. Furthermore, a combination of infrastructure is necessary because of spectrum fragmentation and technology fragmentation at least the coming 15 years.

Gaps covered in Storyline:

- What is a good combination of networks like satellite and DVB-H/T, DVB-H and UMTS/HSDPA, etc.
- Mobile broadcasting is most advanced in Korea. What can we learn from their free to air model and advertisement model?
- There is a big differences in Europe between the infra models for broadcasting. There is a demand for the results of a comparative study about the infrastructure situation (related to the license situations) in European countries at the moment. Including the assessment of it. Like, what when only one company get a 'much deliver' license; and What are advantages and disadvantages of harmonization?
- What will be the business model for access? How will the access role develop? Will we keep bandwidth? Which technological developments are important for this? E.g. IPv6?

Table 17: Assessment of Business models for infrastructure gaps

Europe	**China**
High: a. Will network operators invest in new network technologies anymore? Headache of 3G and long horizons in very dynamic market. b. There are big differences in Europe between the infra models for broadcasting. What works best?	High: c. Broadcast operators now try to invest on Chinese version standard Mobile iTV trial network to go ahead on the new market. d. Telecom operators pay more attention on the 3G license and future combination and competition in this field, at the same time will try to prevent the multimode terminal into market in a short term view.
Medium:	Medium: e. The billing agent by telecom is necessary for Mobile iTV service. But without the

	guarantee of the combination of telecom and broadcasting, back-end billing like advertisement model by broadcast will be still on for a long time.
Low:	Low: f. The new 3G standard: WiMAX will bring new choice to the future Mobile iTV infrastructure's construction.

The gaps with high risk and/or relevance are reformulated as the following research themes:

- What is the role of the government in infrastructure business models? Do a comparative study about the infrastructure situation in European countries at the moment. What can we learn from Korea? What is the situation in China (see also policy&regulation)

4.3.3 DRM

Gap Storyline Brief:

Regarding the protection of content through Digital Right Management it remains to be seen if this is the way to go, or that DRM-less products will prevail on the market. The storage type that is used (online vs. offline storage) also remains unclear as both remain possible in the future. Device manufacturers claim that DRM first needs to be clear before it is possible for them to develop devices. There is clear revenue model for the traditional media, but this is not clear for the new media. There is not a good revenue model yet, media companies (like SMG) are researching DRM for their new media. In general we observe that the current model won't last: the mass market want most content for free. Since we found that there are also professionals who won't agree we should say: it is a discussion if and how much people will pay for content. This differs per local situation: in some countries the public broadcast channels are for free; in other countries people pay a lot of money to see e.g. soccer games. Besides content protection we can distinguish service protection, e.g. by smartcards solutions.

Gaps covered in Storyline:

- Is it not possible to have a non DRM system at all? This might be a good question for a R&D project (like bikes in Amsterdam). The model of royalty free content is inescapable; unless QoS.
- Content owners have very strong rights which restrict the possibilities for business models. What are options for new business models to breakthrough? Many DRM systems have link with infrastructure.
- Content: is there convergence in security models to protect revenues?
- If people pay for content: how to organize paying mechanisms→ for performance in stead of piece of content? Or will the advertisement model solve it? We should not get into the dot.com fall situation again; it is not just advertisement which will bring the money.

Table 18: Assessment of DRM gaps

Europe	**China**
High: a. The royalty system will not hold; what will replace this?	High: b. Who will change the DRM system? The telecom or broadcast? It's still a puzzle.

Medium:	Medium: c. Internet brings a new world in which everything could be free download and the customs are familiar with it. What is the impact of this on DRM?
Low:	Low: d. Is the service or content the king?

The gaps are reformulated as the following research question:

- The royalty system will not hold. Who will change the DRM system? The telecom or broadcast providers, or the media industry itself? What will replace this?

4.3.4 Power of brands/new entrants

Gap Storyline Brief:

Consumers will follow 'brands'; will brands have the power to control the value chain? Who might be able to dominate the whole chain (Apple covers the end-to-end market for music and expands this further; what about Huawei? Nokia? Murdochs? Google? Yahoo?). Telecom operators do not have strong brands. What are the strategically implications for incumbents and new entrants?

Gaps covered in Storyline:

- What is the power of Brands? How are brands created? What is the role of Brands for the mass market?
- Are new entrants hindered by their unknown brand? Or is it an advantage to be not associated with the old era? (There will always be an "alternative circuit" to oppose the power of the big brands: Microsoft/Intel vs. Apple – Microsoft Windows vs. Linux – etc. And on top of that it also about fashion: what is hot and what is not (Nike – Asics – Adidas – etc.).

Table 19: Assessment of Brands gaps

Europe	**China**
High: a. Who can create and maintain popular brands and dominate the value chain?	High: b. Will Telecom or Broadcast's brand dominate the new market, compared with internet elites?
Medium:	Medium: c. Local content providers or service providers will be bonded with operators to become more attractive to customers.
Low:	Low: d. Innovative service providers will enjoy the motivative environment created by competitive operators.

The gaps are reformulated and integrated with the 'value chain' research issue.

4.3.5 Summary of Value chain and Business Models

Table 20: Summary of Value chain and business models

Cat.	R&D theme	R&D questions
Value Chain and business models	Value chains	● What will be the future value web? What will be the role of incumbents versus new entrants? What will be the role of licensing by the government? ● Money steers the value web: where will money be generated? Who pays whom?
	Business models for infrastructure	● What is the role of the government in infrastructure business models? Do a comparative study about the infrastructure situation in European countries at the moment. And compare that with China (see also policy&regulation)
	DRM (revenue models for the media industry)	● The royalty system will not hold; Who will change the DRM system? The telecom or broadcast providers, or the media industry itself? What will replace this?
	Power of brands Power of new entrants	This is integrated in Value chains

4.4 Sustainability

Some of the issues mentioned in interviews and workshops were difficult to posit in the initial framework with services, devices, technology, value network and regulatory categories. I.e. these issues are security and power consumption. We considered adding the category 'environment'; however the security issue also needed to be categorized. Therefore, we propose Sustainability: sustainable development does not focus solely on environmental issues. More broadly, sustainable development policies encompass three general policy areas: economic, environmental and social. In support of this, several United Nations texts, most recently the 2005 World Summit Outcome Document, refer to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection. (http://en.wikipedia.org/wiki/Sustainable_development). We covered the economic development in the 'value chain and business model' category, we covered the social development in the 'services' category. In this category we cover the issue of power consumption and the issue of security. The power consumption relates to the environmental protection. In was found at the discussions that the security issue covers all three aspects of sustainable development. Therefore we moved it from technology to sustainability.

Issues	Questions	Prio Europe	Prio China
Security	What improvements on security are needed? How to avoid compromising on ease-of-use?	2	2
Electricity production	Battery problems. Electricity for hosting. What is the combined (infrastructure & devices) CO2 footprint?	3	2
Overall power consumption	Battery problems. Electricity for hosting. What is the combined (infrastructure & devices) CO2 footprint?	3	2

4.4.1 Security

Gap Storyline Brief: Security is needed to instill confidence of the user in the service but also to protect the device and the content. Undoubtedly security threats will increase, making strong, all-encompassing security technologies an important concern, providing reliable authentication, authorization, encryption processes, widely accepted digital rights management (DRM) systems and firewall and anti-virus software. To run new services on a handheld device, new applications need to be installed on it. This has security implications. There are a number of ways to control the installation of applications (see D1)

Gaps covered in Storyline:

- Safety: the safety is not only protection of the device but more safety in social terms (issue for monitoring possession and use of content). To ensure that a user does not

loose significant content when device is lost or breaks down many applications and content will be in the network or at least synchronized with it.

- How to create end-to-end security that covers all aspects of security that enhance people to have everywhere access to content? But also does not hinder the ease-of-use?

Table 21: Assessment of 'security' gaps

Europe	**China**
High: a. How to create end-to-end security that covers all aspects of security that enhance people to have everywhere access to content?	High:
Medium:	Medium:
Low:	Low:

The gap with high relevance is kept as the following research theme:

- What improvements on security are needed? How to avoid compromising on ease-of-use?

4.4.2 Overall Power consumption

Gap Storyline Brief: the power consumption within the devices has two aspects: the capacity of the batteries and the energy needed for the large screens and wireless operation. Moreover the power consumption of the current and future infrastructure will explode. The current internet (servers, routers, etc.) already takes 15% of the globally available electricity. Streaming video needs much power for hosting as well as wireless transmission. What is the combined (infrastructure & devices) CO_2 footprint?

Gaps covered in Storyline:

- Battery problem of devices is huge. Solution might be to automatically charge batteries when a device is close to an electricity source. However, this requires standardization and is therefore a regulatory issue.
- Need of innovation for battery life. Fuel cell developments could help since they rely on refill instead of recharge. Maybe kinetic energy is a (partial) solution.
- Now there are up to 17 processors in a chip for mobile phone. The problem is not about performance, but more about energy efficiency.
- Where is the border of objectives and need? User and consumer should decide it.
- Power for streaming video: how to solve power consumption problem?
- Also safety issue: high energy in small device could be potentially dangerous.

Table 22: Assessment of 'power consumption' gaps

Europe	**China**
High: a. Electricity needed for a wireless infrastructure	High:

b. Power availability for devices: need for innovation for battery life	
Medium: c. Electricity needed for accessing stored content.	Medium:
Low:	Low:

We decided to separate this issue in two issues: the battery problem and the electricity needed for the infrastructure, hosting, etc. After discussion we also decided to position the scarcity in bandwidth and frequency in this category.

Thus, the gaps relevant in the sustainable category are reformulated as the following research themes:

- How to improve the power supply and consumption devices?
- How to solve shortage of electricity needed for accessing stored content and operating a wireless infrastructure?
- How to deal with the scarcity in bandwidth?
- How to deal with the scarcity in spectrum, frequencies?

4.4.3 To summarize on Sustainability:

Table 23: Summary on sustainability

Cat.	R&D theme	R&D questions
Sustainability	Security model	• What improvements on security are needed? How to avoid compromising on ease-of-use?
	Battery problem of devices	• How to improve the method of charging power on devices and minimize power consumption?
	Power consumption	• How to solve shortage of electricity needed for accessing stored content and operating a wireless infrastructure?
	Scarcity in bandwidth	• How to deal with the scarcity in bandwidth?
	Scarcity in spectrum	• How to deal with the scarcity in spectrum, frequencies?

4.5 Regulation and Policy

Most frequently touched driving forces in regulation and policy perspective are (1) severity of regulation (self vs. heavy regulation) and (2) needed international cooperation for fostering this new industry. In Europe, self regulation is regarded as useful to encourage the emergence of the new industry. However, it is as well noted that a harmonized regulation approach is needed from the economic scale perspective. In other words, international cooperation is needed, but there are a lot of concerns of protection of local emerging industry. In the future, the implemented regulation policy will greatly impact the value chain and business services deployed, furthermore, influence the flourishing of the industry.

Table 24: Issues in the Regulation and Policy Category

Issues	Questions
Harmonization by self regulation or by law	China-Europe: how to deal with different speed of market changes due to regulation? Self regulation is the rule in Europe while in China it is more harmonization by law. Who influences whom?
Regulation to support local industry	From economic point of view: will countries protect their national industry? From societal point of view: The broadcaster model, the telco model and the Internet model: how will they evolve when the technologies merge? What values behind the models do we want to keep?
Policy on cultural heritage	Impact of global integration of DRM; should government facilitate centers of excellence, e.g. to keep content industry. This will happen: the market instead of the government decides on content aggregation? Q: how will societies keep our heritage? Cultural values?
Taxes	Taxes on content/services (digital goods) will disappear. What will be the impact on the finance of governments?
Government policy on licensing	The role of licensing should be researched to understand what the best approach is.

4.5.1 Harmonization by self regulation or by law

Gap Storyline Brief:

This point mainly concerns what should be the expected or appropriate role of regulation & policy in the emergence of a mobile digital (broadcasting) converged industry. Harmonization by self regulation seems to encourage the open innovation for the emerging industry, but takes more coordination and negotiation effort and time thus slowing down innovation. Regulation by law shows that in certain cases it can speed up the adoption rate, thereby giving early adopters benefit in a globalized world (e.g. Mobile iTV in South Korea)

Gaps covered in Storyline:

- In different cultural and political settings (e.g. Europe and China), what is the best balanced point between self-regulation and regulation by law?
- Need understanding of the role of self-regulation and regulation by law in the different stages of the mobile digital (broadcasting) convergence?
- What is the best way to combine these approaches for Europe and China?
- What about the subsidy of network operators for devices. It is forbidden in Belgium, but in the Netherlands it is happening. Despite the attempts to stop this.

Table 25: Assessment of 'Harmonization by self regulation or by law' gaps

Europe	**China**
High: a. Self-regulation can make sure does not take too long time so that miss the "windows of opportunities"	High: b. Can strong regulation by the government effectively support the local industry development? Or it incapable of supporting the industry development because of lack of industrial commitment and involvement?
Medium:	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- What is the criticalness of role of the regulation (self-regulation and harmonization by law) in different phase of a high tech innovation (mobile digital broadcasting)?
- In different political and cultural systems (EU and China), is there different effective solutions? How do these solutions work from short-term and long term perspective?

4.5.2 Regulation to support local industry

Gap Storyline Brief:

Apparently China government now is increasing their measure to protect some high tech local industry, e.g. mobile digital broadcasting. Gained lessons from the past experience, China seriously consider encourage the autonomous standards & innovation for the high techs. With the increasing recognized value of the China market, China will have more confidence to negotiate with international industrial players about the standards in China.

Europe faces the other challenges in the case of Mobile iTV: should different countries protect their own industry and use different standards? If this is the case, how then to compete with other countries in the world: e.g. USA and China? Probably, the relatively small market size in Europe resulting from the use of different standards will impede European competitiveness in the world.

Gaps covered in the storyline:

- Whether the intended protection of local industry by regulation can really achieve its expectation? In different models: broadcaster model, telecom model and internet model?
- Should there are different tactics and policy in Europe and China to facilitate the long term local industry development?

Table 26: Assessment of 'regulation to support local industry' gaps

Europe	**China**
High: a. How to keep European competitiveness of offering mobile digital broadcasting services and products, contents? b. Can it be achieved by a European standard (e.g. GSM)	High: c. Whether the adoption of China standard can protect the local industry?
Medium:	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- Can using European standard (by Europe) and Chinese standard (by China) sufficiently to protect its own local industry?
- What is the impact of the standard to the protection of local industry?

4.5.3 Policy on Cultural heritages

Gap Storyline brief:

What could a global player do in the light of local content production (a typical South Spanish performance, or a Dutch song). Local produced cultural content will most likely only be consumed locally while it is difficult for globally produced content to fulfil local cultural needs. However, there is also a possible phenomenon that imported content can gradually influence the local culture that is already happened to the young generation in some of the Asian countries, e.g. Japan. How the local content industry can be kept and not be replaced by other players from other countries? Can government and how should they facilitate centres of excellence, e.g. to keep content industry? How will societies keep our cultural heritage?

Gaps covered in the storyline:

- How can societies keep our cultural heritage? The young generation is influenced by the external culture, especially the content from USA
- What role should policy play to keep our cultural heritage? E.g. to keep content industry?
- Will the content industry be globally integrated to some extent?

Table 27: Assessment of 'policy on cultural heritage' gaps

Europe	China
High:	High: a. Local authority is now keeping the strict role of checking the imported content.
Medium: b. The young generations do not look at TV any more; rather go to Internet to search for content.	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- How can societies keep our cultural heritage?
- What role should policy play to keep our cultural heritage? E.g. to keep content industry?

4.5.4 Taxes

Gap Storyline brief:

It is difficult for government to control the source of digital content and services. Taxes on content/services (digital goods) will disappear. What will be the impact on the finance of governments?

Gaps covered in Storyline:

- What will be the impact on the finance of governments if taxes on content/services will disappear?
- How should the government react on that?

Table 28: Assessment of 'taxes' gaps

Europe	China
High: a. How should the government react if taxes on content/services will disappear?	High: b. How should the government react if taxes on content/services will disappear?
Medium:	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- How should the government react if taxes on content/services will disappear?

4.5.5 Government policy on licensing

Gap Storyline brief: The role of licensing should be researched to understand what the best approach is. In China, license for operator are controlled by the government. There is no

additional cost involved for the operators have the license. While in Europe, the operators must bid for the license but the situation also differs per country. In the Netherlands broadcasters won't need a license anymore but network providers will need the license; one multiplexer has the license for the DVB-H network and has to provide access to all service providers. In Italy three mobile operators operate a DVB-H network, in France it is not settled yet, etceteras[6]. Pan-European services are difficult because there are no frequencies for everybody in all countries; kind of digital dividend systems (like the emission system). The regulator could enforce network operators to open their networks for all service providers thereby establishing a split between the providers of an infrastructure and providers of services. Hence, from the economic and industrial perspective, research is needed to understand how the government policy on licensing should be enacted and implemented to foster the emergence of the industry.

Gaps covered:

- There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful?
- What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? This is a waste of time and money.
- Can government policy on licensing help to improve the situation?

Table 29: Assessment of 'government policy on licensing' gaps

Europe	**China**
High: a. There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful? b. What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? This is a waste of time and money	High: : c. Who will gain the license to operate the future Mobile iTV services?
Medium:	Medium:
Low:	Low:

The gaps with high risk and/or relevance are reformulated as the following research themes:

- There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful?
- What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? This is a waste of time and money.

[6] The BMCO forum intends to present February 2008 an overview of the license situations in different countries.

4.5.6 To summarize on Regulation and Policy:

Table 30: Regulation & Policy Summary

Cat.	R&D theme	R&D questions
Regulation and policy	Harmonization by self regulation or by law	• What is the criticalness of role of the regulation (self-regulation and harmonization by law) in different phase of a high tech innovation (mobile digital broadcasting)? • In different political and cultural systems (EU and China), is there different effective solutions? How do these solutions work from short-term and long term perspective?
	Regulation to support local industry	• Can using European standard (by Europe) and Chinese standard (by China) sufficiently to protect its own local industry? • What is the impact of the standard to the protection of local industry?
	Policy on cultural heritage	• How can societies keep our cultural heritage? • What role should policy play to keep our cultural heritage? E.g. to keep content industry?
	Taxes	• How should the government react if taxes on content/services will disappear?
	Government policy on licensing	• There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful? • What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? This is a waste of time and money

5 The R&D issues: themes and priorities

We assessed the research questions by discussing or these questions had high, mid or low priority. We translated this into: do we have to take research actions on a short term (2008-2010); Midterm (2010-2012); or long term (after 2012). Some short term research questions are at the moment researched in other existing research projects or by the industry itself. Currently various actors in the mobile broadcasting industry are dealing with research questions. The challenge is to find a way to capture these results, and further support the exchange of best practices and experiences to faster develop the market but without hampering competitive advantages of the industry partners. Other research questions should start on short notice because they have a high priority but the EC has to initiate this since the industry is not a problem owner yet. Other research actions have a high priority but won't be solved on a short term due to its complexity. These are research activities that have to run for a longer period. The fourth kind of research activities can start on a mid/long term.

Therefore we assess each research question by proposing one of the following actions:

- **I**: short term research activity already taken place within the **I**ndustry that needs support faster develop the market.
- **Q**: short term research activity to start that are urgent and have a **Q**uick win potential (start in 2008 and finish before 2010).
- **S**: **S**hort term research activity with high priority but will take time to investigate (start in 2008).
- **M**: research activity for the **M**id term (start between 2010 and 2012). Depending on resources and unforeseen developments some of these might even be start on the long run, after 2012.

Furthermore we distinguish general research activities that can be studied on a global scale and activities that have to be studied with a special emphasis on the European/Chinese differences and similarities. These are marked with an asterisk.

5.1 Services

'Start with the user!': this is an often expressed statement for the development of new media services. However, it is less often practiced. For Mobile iTV it is absolutely necessary to carefully involve the users in the development of the services. What are the reactions of the users regarding where they use the services, how they use them, their usability requirements, etceteras ? What are the results of users' pilots? We observe that the industry is improving their way of working regarding the user involvement. It has to remain a concern.

R&D theme	Research question	I, Q, S or M	European-/China sim&dif
Context of future use	● What will be the contexts in which Mobile iTV will be used?	● I	*
	● Which target group likes which kind of content?	● I	*
	● What is the influence of ideology on the delivered content?	● M	*
	● How to know what kinds of applications are most suitable for	● I (see also Mobiserv	*

	Mobile iTV? ● What is an acceptable service quality / price balance?	project) ● I	 *
Everybody is a reporter	● What is the impact on trust in content (information) from citizen journalism? ● How will societies change with ample new sources of information?	● Q ● M	* *
Privacy	● How to combine convenience with option for users to control privacy settings? ● European people like the possibility of watching TV on their own; in private. The Chinese people have greater emphasis on interpersonal relationships. How can Mobile iTV support these different cultural values related to personal settings?	● M ● M	* *
Quality of Service and Ease of Use	● What is a suitable design process for an optimal ease-of-use service with the required Quality of Service	● I	*

5.2 Technology

One of the remarks during workshops was that 'technology is not a problem; do not start R&D projects on technology because this will be solved by the industry'. On the other hand, companies might benefit from joint technology research and this might shorten the time to establish standards. Therefore we like to propose the following research questions.

R&D theme	**Research question**	**I, Q, S or M**	**European-/China sim&dif**
Anywhere, Anytime optimal access	● What are attainable and plausible scenarios to convert the current infrastructure to an all-IP based network infrastructure? ● How should the service portfolio of a successful access provider look like? ● What are models to shorten the payback horizon of infrastructure providers? (related to licensing)	• M • M • S	 *
Mobility and content availability	● How can the complexity of a multi-standard multi-protocol world be reduced as much as possible? ● What scenarios can be developed to allow transparency to users whether their needed content is online or offline? How can backup and synchronization be	● S ● S	

	established without the usual hassle for the user (maybe as a service level)? ● Can mobile receiving technologies support the upcoming bi-way high speed broadband services?	● Q	
Modularity supporting development	● How to develop a Service Oriented extendable Architecture with a defined interface language able to publish and process semantics on device features, abilities, and available services? ● Is the hardware (physical layer) modularity for different Mobile iTV standards available?	● I ● Q	
MyDevice: Functionality explosion and diversity	• Increased autonomy by context aware device can make user feel detached and out of control. Behaviour of context aware devices is key for their acceptance. Psychological/social studies need to reveal what is desired and what is unwanted behaviour. ● Can the functions of devices be easily defined? And the devices can be easily operated and maintained. (ease-of-use on devices; will be like computer). Are there enough new services that can be supported by the new functions of devices? ● Define architectures and protocols which are flexible yet inherently safe.	● S ● I ● ?	*

5.3 Value Chains and Business models

Services like Mobile iTV services cannot be provided by only one company itself. Companies have to cooperate and the question is how they will do this. What are their dependencies, interdependencies and relationships with other companies? What value networks ('ecosystems') of companies do appear? Who are the dominant players? What are the business models to steer those value networks? Those questions play also a big part in the mobile broadcasting world.

R&D theme	**Research question**	**I, Q, S or M**	**European-/China sim&dif**
Value chains	● What will be the future value web? What will be the role of incumbents versus new entrants? ● Money steers the value web: where will money be generated? Who pays whom?	● I ● I	* *
Business models for infrastructure	● What is the role of the government in infrastructure business models?	● Q!	*

DRM (revenue models for the media industry)	• The royalty system will not hold; Who will change the DRM system? The telecom or broadcast providers, or the media industry itself? What can/will replace this?	• S	*
Power of brands Power of new entrants	This is integrated in Value chains		

5.4 Sustainability

There is a lot of discussion going on caused by global warming. This has implications for all kind of new media services since they are based on ICT and ICT needs power. For a sustainable development of new media services like Mobile iTV the combination of good economic development, social development, and environmental protection needs to be realized.

R&D theme	**Research question**	**I, Q, S or M**	**European-/China sim&dif**
Security model	• How to create end-to-end security that covers all aspects of security that enhance people to have everywhere access to content?	• M	
Battery problem for devices	• How to improve the power supply and consumption devices?	• S	
Power consumption	• How to bear the responsibility that there will be enough electricity that is needed for accessing stored content and operating a wireless infrastructure.	• S	
Scarcity in bandwidth	• How to deal with the scarcity in bandwidth?	• M	
Scarcity in spectrum, frequencies	• How to deal with the scarcity in spectrum, frequencies?	• Seems solved?	

5.5 Policy and Regulation

Telecommunication and Broadcasting are both domains that are regulated by governments. This regulation differs per continent, country and sometimes even region. In Europe the European Commission starts to gain more influence in policy relevant for Mobile iTV services. In China both the ministry of broadcasting and telecommunication are involved. It is obvious, but it also seems a condition, that the government plays a role in the complex broadcasting/telecommunication field. Some company representatives ask a more proactive

role from the government in the battle of standardization; others claim that self-regulation within the industry is the only way to solve this.

R&D theme	Research question	I, Q, S or M	European-/China sim&dif
Harmonization by self regulation or by law	• What is the criticalness of role of the regulation (self-regulation and harmonization by law) in different phases of a high tech innovation (mobile digital broadcasting)? In different political and cultural systems (EU and China), is there different effective solutions? How do these solutions work from short-term and long term perspective?	• S	*
Regulation to support local industry	• Is it true that having own standards will protect its own local industry? Eg using European standard (by Europe) and Chinese standard (by China); what is the impact of the standard to the protection of local industry?	• M	*
Policy on cultural heritage	• How can societies keep heritage cultural heritage? And what role should policy play to keep our cultural heritage? E.g. to keep content industry?	• M	*
Taxes	• How should the government react if taxes on content/services will disappear? (impact of internet on tax system)	• General issue; for another research program;	
Government policy on licensing	• There are many different licensing policies in different countries. What is the impact on this for business development? Which policies are most fruitful? • What should be the role of the government in preventing a situation that more companies invest in networks that have over capacity? Can government policy on licensing help to improve the situation for investors?	• Q • Q (hot issue in china)	* *

6 Conclusion: a disruptive scenario

Disruption is about to happen in the eyes of the interviewees and presenters at the ROADiBROM workshops which verified the ROADiBROM vision. For example, traditional broadcasters found that they have been losing the attention from the young generation. Telecom operators realized that their profit based on voice communication is radically decreased due the emergence of VOIP. Consumer electronic manufacturers found that technology itself is not any more a key determinator, but rather users' interfaces and usability of the devices seem to play more critical roles (e.g. iPhone).

To keep European Competitiveness of mobile digital (broadcasting) convergence in the global market is a great challenge for policy makers, industry player and researchers. Our study shows that there are multi-disciplinary critical issues and gaps lying in front of us from the aspects of: technology and devices, services, value chain, policy and regulation and sustainability. Apparently, traditional strategic planning approach can not satisfying the demand of mobile digital (broadcasting) convergence because they are linear and limited in the scope of one industry. European stakeholders must find a way to build up a critical mass of the stakeholders to cross the gaps.

The discussion of mobile TV standard is Europe and China is hot and sensitive at the moment. Selection of a standard is just the first step of a successful emergence of a new converged industry, but it is not the most important issue. While standard still plays an important role for a converged business sector (e.g. mobile TV), there are a lot other critical factors should not be ignored. For example, recently China has been increasing its participation in standard enactment process of the high technologies, e.g. 3G, Wi-Fi, Mobile TV etc. It is very difficult for China policy makers to adopt external standard. Second, in the case of mobile iTV, there are more critical issues from a service and value chain perspective. The president of Shanghai Unicom told us: "The world can be divided in three parts: Europe, China (Asia) and the USA. USA is behind. Europe wants to be the leader, EC invests lot of money. But China has the market with most users and the networks with most capacity. So Europe and China must cooperate: but how?"

Hence, fostering the emergence of mobile TV is not a technological issue. China and Europe face the same problem? In China government has to decide the standard and this is difficult thus industry is waiting; the industry in Europe has to decide but they seem not capable of doing this and the EC started to step in with advice. Thus the problem is: how to agree on using what technology in order to be able to reach a mass market?

There is a not permanent window of opportunities left for mobile digital broadcasting. Internet model already shows us how radical change it potentially will be. With the powerful mobile device, the production cost of video is close to "zero". Internet portal (e.g. Youtube) helps to distribute the content freely and without capacity constraint. There is no journalist involved meaning freedom of interpretation/uncontrollable. Of course, there is less and less broadcasting station involved as showed by the video broadcasting on Internet (e.g. Youtube). What is the impact of this to traditional journalist, and to our society? How it will lead to the change of media industry and advertisement industry?

Mobile network environments are not neutral. How to derive the same innovativeness power as of the internet? At the moment it requires directives to get the mobile Internet as open as the Internet. Telco's have different model. Mobile internet might use the example of the internet: not too much regulation, not too much IPR. Innovation will be hampered by too much regulation. It needs real open innovation living labs to experiment.

There are early indicators that innovation in mobile is accelerating now. Google together with a group of more than 30 technology and mobile companies come to the Open Handset Alliance (Android), aiming to offer consumers a richer, less expensive, and better mobile

experience. Nokia as well step in the mobile service area. Hence, European stakeholders should move beyond the standard issue.

In summary, the mobile digital (broadcasting) convergence is developing in a fast speed; especially in the huge Chinese market. In order to keep (European) competitiveness in this new area, the research should not only be focused on the traditional technological R&D research, but more research on service innovation (content formats, interactivity, optimalisation for context of use), regulation and policy implication, value chain format, business models (new advertisement models, subscription, pay per use) and social impact of the new converged technologies.