



## **MODIBEC (Contract No.: 044925)**

### **D2.3.2 Action Plan**

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#### **Abstract:**

Based on the findings of D2.2.2 and close consultation to project partners this report proposes the potential research and development activities of the future cooperation between EU and China in the field of the convergence area of digital broadcasting and mobile communications.

## Control sheet

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## Abbreviations

<b>Abbreviation</b>	<b>Description</b>
BIFS	Binary Format for Scenes
BJTU	Beijing Jiao Tong University
BUPT	Beijing University of Posts and Telecommunication
BOSS	Business operate support system
CAS	Conditional Access System
CMMB	China Mobile Multimedia Broadcasting
DAB	Digital Audio Broadcasting
DTMB	Digital Terrestrial Multimedia Broadcast
DMB	Digital Multimedia Broadcasting
DRM	Digital Rights Management
DVB-H	DVB-Handhelds
IPR	Intellectual Property Rights
MBBMs	Mobile Broadcasting Business Management System
MPEG	Standard for the data compression in the video and audio sector
SARFT	State Administration of Radio, Film & Television (China)
SFN	Single Frequency Network
TMC	Traffic Message Channel
VOD	Video on demand
WiMAX	Worldwide Interoperability for Microwave Access
3G	The third generation of mobile phone standards and technology

## **Executive summary**

In document D2.2.2 we have defined the most important priority areas of digital convergence research and development between China and Europe. Further study of the trends and policies were conducted in both China and Europe and also an initial survey by the means of questionnaire, workshops and discussion with participants of different backgrounds and perspectives. This action plan will contribute to the future cooperation activities with a set of proposals outlining the results of the MODIBEC project.

This initial version of the Action Plan report describes the recommendations for activities to be launched after the completion of the project. The plan is based on the findings from the project activities, concretely with the conclusions of D2.2.2 report and further consultation and discussion with project partners. It proposes future R&D and industry cooperation strategies.

# 1 Introduction

Based on the survey results in deliverable D2.2.2 (Priority Areas for EC China Cooperation) and close consultation with project partners and experts, we have developed the following action plan, which will call for a united effort between the EU and China. The survey conducted in task 2.1 Priority Area definition was successful in attracting a number of experts from MODIBEC network of partners, who identified certain specific priority areas during task D2.2. A follow-up study was held in October and in November 2008 in Beijing and Brussels that refines the priority areas.

This action plan is designed to significantly advance the EU-China research and development cooperation activities in the convergence areas between mobile communications and digital broadcasting in the near future to guide both regions to cooperate more closely in potential areas for cooperation. This cooperation will benefit parties in both Europe and China, such as standardisation bodies, service providers, hardware/ infrastructure providers, end users and software companies, etc.

A crucial point in all discussions were the network standards existing in China. In the field of applications this means that application providers have to make a handover of applications available, support both standards or to be platform independent. Users expect continuous service and seamless handover.

On the document's side the fact that there are two main network standards and which standards they are is not critical. All proposed activities are independent from a certain technology, network etc.

The following main objectives of MODIBEC are to be achieved through cooperation among stakeholders in the EU and China and these will be proposed throughout this action plan:

- ▶ Create closer links between European and Chinese Digital Broadcasting and Mobile Communications experts from the industry, research and public sectors with focus on application projects
- ▶ Describe relevant standardisation issues and policies in the EU and China to explain the European and Chinese industry position and help the Chinese authorities to learn from the European experience when defining Chinese standards related to the convergence of digital broadcasting and mobile communications
- ▶ Leverage previous and ongoing EU-China IST projects in the same areas by organising conferences, exchange and dissemination of good practice
- ▶ Strengthen international cooperation, especially on the convergence of digital broadcasting and mobile communications sector for future joint implementation of R&D projects between China and the EU in order to facilitate the launch of successful cooperation projects.

## Key priority areas for future EU-China Cooperation

The following list of the priority areas is the result of the workshop and the questionnaire in the survey filled out by all the MODIBEC partners and other supporting organisations such as Tsinghua University as well as some other external participants such as Beijing Jiaotong University, Beijing University of Posts and Telecommunication, which highlights the most important research issues listed.

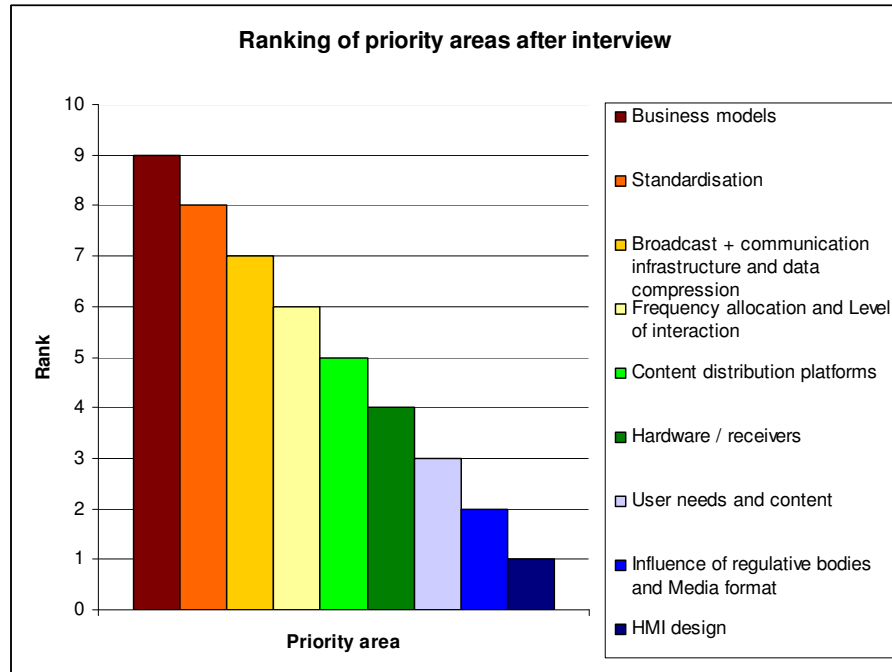
The participants' feedback represents different backgrounds, goals, impact, interest, etc. and can be divided into three main categories: research institutes, standardization organisations and service/ hardware providers.

The identified priority items have been discussed in detail in a consortium meeting in Beijing in May 2008.

Priority area	Standardi-sation group	Research Group	Operator	Rank
Business models	1	2	2	1
Standardisation	8	1	3	2
Broadcast + communication infrastructure	4	8	4	3
Data compression	7	3	6	3
Frequency allocation	5	5	7	4
Level of interaction	12	4	1	4
Content distribution platforms	2	9	8	5
Hardware / receivers	6	7	10	6
User needs and content	9	10	5	7
Influence of regulative bodies	3	12	11	8
Media format	11	6	9	8
HMI design	10	11	12	9

**Table 1: Filtered list of research priorities and ranking**

The graph below shows the priority areas that were found after the assessment of the questionnaires.



**Figure 1: Filtered list of research priorities and ranking**

During the last two workshops in Beijing and in Brussels applications as a new important field of activity for research institutes and producers were mentioned. Chinese institutions stated that there is still a huge demand on applications in the field of Digital Mobile Broadcasting and that Chinese companies need to be supported by the more experienced European application providers

Chinese institutions also pointed out that it is absolutely necessary for European companies to cooperate with Chinese companies to be able to get access to the market.

## 2 Proposed Actions for Defined Priority Areas

The Action Plan sets out a comprehensive set of priorities in areas within and also beyond the scope of the MODIBEC partners. Among these addressed priorities at the EU-China level, particular attention and opportunity should be given to the following recognized key areas and specific actions:

### 2.1 Proposed activities in Business Models

Business models usually include the defining of use cases a market entrance requires, definition of crucial points as well as cost and value analysis, distribution channels, cooperations between hard- and software providers as well as the cooperations on the network side.

Suitable ways to get the proposed stakeholders (actors) together may be conferences and fairs driven from the Chinese stakeholders. Also associations built from industry-, research- and governmental stakeholders can bring fundamental input in the field of business models in theory. In the end every concrete business model of a company or product heavily depends on the company's aims and structure as well as on its competition and the market situation.

#### Steps:

- ▶ Examine the status quo and expected future trends on the market of Mobile Digital Broadcasting and derive chances / opportunities and risks.
- ▶ Search for cooperations between application providers, hardware providers and network providers e.g. in workshops and fairs
- ▶ Enquire value chains, organisational structures and define use cases

#### Involved actors:

- ▶ Professional consultants to define key applications users require, the market's status quo and future trends
- ▶ Hard- and software providers for cooperations (e.g. Motorola, Samsung, Nokia, LG...)
- ▶ Local government, standardisation bodies, the national road operators (governmental driven) as well as Ministry of Public Security
- ▶ Cooperation between mobile-terminals vendors (Aigo, Longcheer, Lenovo, Nokia, Motorola, Samsung, LG etc.) and application providers (WorldDAB, TomTom, PTV, Geolix ...)
- ▶ Broadcasting channel providers in the main cities such as OPG, etc

### 2.2 Standardisation, regulative bodies and frequency allocation

A crucial point in all discussions were the network standards and frequency allocation existing in China:

Currently two main and general standards for Digital Broadcasting are deployed in China. The governmental driven Chinese standard CMMB – is mostly used for digital mobile video and multimedia applications on small scale screens but also for radio and partially for traffic information in some areas. The European DAB and DAB+ standard is mostly used for digital radio, video on large scale screens and other applications. Some more standards are available but may not be relevant for the Chinese total market. But as the Chinese market is 2,55 times as big (number of inhabitants) than the European market both technological standards can co-exist.

Frequency allocation and broadcasting infrastructure are other two major technical topics which are especially essential for a large country such as China, with many rural areas and few highly developed industry zones (compared to the size of the country). The combination of different broadcasting and communication networks need research in spectrum sharing and frequency allocation on the one hand, and on the other hand research on technical solutions in satellite and terrestrial broadcasting and communication systems which is described in chapter 2.7 – hardware integration.

Standardisation and regulation are horizontal sectors that influence all following actions. But apart from this fact the research partners have little influence on the activities in this field. The processes of development are mainly driven by few bodies – national Chinese and only two or three other parties.

Usually standardisations are brought forward with partners from industry, universities, administration and others in exchanging experience in dedicated associations. The associations members benefit from knowing the latest trends and socialise with important cooperation partners.

There are already existing associations in the field of digital mobile broadcasting all over the world. Most of them arose from the telecommunication sector. Prerequisite for working and efficient cooperations between Europe and China is to bring the representatives from both associations together and to agree on common structures in a way that following items in the value chain can exchange applications and data.

## **2.3 Authentication and Security**

Since authentication and security systems can provide both the needs of the end user as well as assurance of revenue for the service provider in the area of authentication and security (Conditional Access or Digital Right Management), we recommend finding a new user authentication method by combining the digital communication system with help of the following activities:

- ▶ Research on efficient Authentication and security systems such as CAS, DRM, develop the correct authentication and security method
- ▶ Exchange experience between European and China Operators
- ▶ Exchange and research on interoperability between different rights management technologies

- ▶ Cooperation with CAS provider from Europe and Mobile Communication Operator who could provide uplink for VOD
- ▶ Cooperation with Media Delivery Platform European Provider and Chinese Mobile communication operator for Digital Radio Mondiale, DTMB and CMMB applications
- ▶ Cooperation on TV Mobile service scenarios aspect between European and China R&D department of End to End system manufacturer and operator for Digital Radio Mondiale, DTMB and CMMB applications
- ▶ Discussion on IPR and royalty fees

#### **Steps:**

- ▶ Set up CAS for operation including scrambles, system manager, Pisis and link with the multiplex of wireless digital TV
- ▶ Develop BOSS in terms of different video or data services, pay mode, order mode
- ▶ System maintenance and update to meet requirement for service improvement and increase the number of subscribers
- ▶ Specify and develop End To End Control and Management system for Digital Radio Mondiale, DTMB and CMMB applications
- ▶ Specify and develop relevant TV Mobile scenarios aspect for the Chinese market taken into account their key success in Europe

#### **Involved actors:**

- ▶ Experts from areas of CAS, DRM and digital communication, DVB, Digital Radio Mondiale, DTMB, CMMB
- ▶ Support of local government
- ▶ Support of Tsinghua University, University of Electronic Science and Technology of China (Chengdu)
- ▶ Support from Digital broadcasting operators (OPG, JOLON, GTM etc.)
- ▶ Support from Mobile communication operators (CMCC, China UNICOM, China Telecom, China Netcom)
- ▶ Cooperation with CAS provider from Europe (Irdeto, NDS, Coretrust, Dream I□Nagra)
- ▶ Service providers of Mobile TV and 3G from EU and China

## **2.4 Proposed Activities in Interactivity**

In the broadcast area, consumers around the world have shown that interactivity is key to the success of any new media. In this field, we are convinced that an interactive process base on consumers needs need to be worked out. According to the European operator's experience to define which kind or how deep the interactivity will drive the best result. They are keen to promote the development of interactivity in mobile telecoms and broadcast convergence.

Cooperation with mobile communication, traditional TV programmes will obtain the capacity of interactive. According to this, we are planning to do some works below:

- ▶ Draw the standards for interactive service (e.g.: Beijing Jolon will consult BIFS technology which based on MPEG-4 and interactive service which based on the CMCC MBBMS standard)
- ▶ Technique cooperation with mobile operators (e.g.: Beijing Jolon has started the test with Beijing Mobile Communication Corporation for the interactive video service)
- ▶ Research on the methods to realize the interactivities with personalization for users and development of suitable receivers
- ▶ Encourage the discussion between Chinese and European broadcasters/ telecoms industry regarding implementation of personalized and interactive broadcasting system
- ▶ Narrow the gap between broadcasters and the telecoms industry
- ▶ Discussion on IPR and royalty fees

Most of the relevant partners in the field of interactivity are private companies. The most suitable way for governments or EU institutions to encourage private companies of different countries is to remove trade barriers and to support exchange by cooperative governmental driven institutions like chambers of commerce.

The industry usually can obtain valuable input and support in their activities from both research projects and standardisation associations.

#### **Steps:**

- ▶ Market research in EU and Chinese interactive television delivers market in terms of interactivity to understand the user needs to customise the interactive services. Chinese and European suppliers do continuously observe the market's needs, it's technological trends and business processes. Common fairs and congresses are platforms at which the results can be exchanged. In addition market research is a own branch. If relevant and measureable data can be collected, research institutes will collect and sell them.
- ▶ Encourage viewers to consume telecom services (Downloading, Voting, Merchandising, etc)
- ▶ Research on the development of interactive mobile video services and integrate mobile operators to develop user-friendly interactive mobile services
- ▶ Encourage on-going dialogue between EU and China stakeholder

#### **Involved actors:**

- ▶ Cooperation with Media Delivery Platform and End to End solution provider (Thomson)
- ▶ Content providers
- ▶ Tsinghua University, Beijing University of Posts and Telecommunications
- ▶ China Academy of Telecommunications Technology
- ▶ Communication University of China
- ▶ Thomson, Nokia, Huawei, Zhongxing
- ▶ Operator of local mobile communication (CMCC, China Unicom, China Telecom, China NETcom).
- ▶ Operator of EU mobile communication (VODAPHONE, ORANGE 3)

- ▶ Media investor (PE, VC, Investment bank)
- ▶ Support from the EU and local content delivery side
- ▶ Solution project provider in EU and China
- ▶ Market research institutions and executive consultants like McKinsey,

## 2.5 Proposed Activities in Data Compression

Data compression is concerned with reducing the amount of data required for its reproduction. It is a key component in facilitating the widespread use of digital services — in their various forms, has an essential role in the development of the digital Society and is recognized as an important contributor to freedom of information sharing. Most important issue in the field of Data Compression considered is e.g. the video/ audio codec:

- ▶ Find a proper platform for EU–China content providers to share their experience and contents
- ▶ Cooperation on the next generation data compression multi-standard of video compression and interoperable solution for the Chinese and European markets
- ▶ Develop the universal chipsets support the various standards
- ▶ Research on improvement of the performance of encoders (video decoder)

### Steps:

- ▶ Set up a video and audio encoding system,
- ▶ Cooperation with encoder vendor and set up a front-end system for digital broadcasting and TV
- ▶ Develop the data module for stock, weather forecast, traffic, exchange rate and so on
- ▶ Develop the protocol, program, software for data encode/decode

### Involved actors:

- ▶ Content providers, Data resource provider.
- ▶ Key equipment providers (e.g. Thomson), such as encoder/decoders, multiplex (Envivo, Pixtree, OTT, SVA, NSCC, Thomson)
- ▶ Support from the chipset vendors
- ▶ Digital broadcasting operators (OPG, JOLON, GTM etc.)
- ▶ Provide terminals solution for all applications (Aigo, Longcheer, Bird, Radioscape, MIO)

Data compression is usually driven by research institutions as well as by standardisation groups and the industry. Another suitable way is to create an EU-Chinese association that can trigger certain long-term activities, set and bring forward standards. A good example for such an association is the TPEG-forum TISA.

## 2.6 Proposed Activities in Broadcasting Infrastructure

Infrastructure is essential access in achieving the goal of digital inclusion, research on certain parts of Infrastructure, such as content distribution network, wireless signal coverage, etc. is also an important aspect. This is in order to reduce the cost of the overall network infrastructure and to solve the issues with in-door reception. Mobile Communication operators and Digital Broadcasting operators can share their experiences and issues with in-door reception to promote future collaboration.

But in fact the decisions about infrastructure are mainly driven by a government. Research institutions can bring essential input for these decisions.

- ▶ Develop the key equipment to improve signal coverage
- ▶ Develop and strengthen national, regional and international network infrastructure
- ▶ Exchange the experience on network optimization, system integration and performance improvement of SFN with European counterparts
- ▶ Research on interoperability of transmission infrastructure between digital broadcasting and 3G
- ▶ Research on the content production and distribution on the current digital broadcasting and digital communication networks
- ▶ Research on interoperability of transmission infrastructure between digital broadcasting and 3G

### Steps:

- ▶ Build a signal transmission system, set up outdoor digital broadcast SFN
- ▶ Estimate the effect of signal coverage and discover the weakness area
- ▶ Set up digital broadcast indoor coverage system by combining with mobile communication system based on the convergence/ interactivity of the digital broadcasting and 3G
- ▶ Analysis interference influence on signals in different frequency band
- ▶ Trial of coverage system on different scene such as building, metro, tunnel

### Involved actors:

- ▶ Current service providers, content providers and operators
- ▶ Digital broadcasting operators (OPG, JOLON, GTM, BBC, GCap Media, Radio France, Arqiva, etc.)
- ▶ Mobile communication operators (CMCC, China UNicom, China Telecom, China NETcom)
- ▶ Manufacturers of digital broadcasting transmitters (Thomson, Harris, Toshiba, NEC, Rohde-schwarz)
- ▶ Vendors of digital broadcasting Gapfillers (Thomson, MierSolid, Sunwave, UBS)

## 2.7 Proposed Activities in Integration of Hardware and Receivers in terms of multi-standard devices

As countries around the world continue to develop new broadcasting standards it is important to ensure that devices are interoperable. We would like to ensure that Chinese devices will work in Europe and vice versa:

- ▶ Undertake R&D efforts to make adequate and affordable equipment for end users
- ▶ Encourage the professionals in both regions to establish partnerships and networks
- ▶ Discussion on IPR and royalty fees

### Steps:

- ▶ Research on the development of Chinese and European manufacturers
- ▶ Encourage cooperation via workshops and information, etc.
- ▶ Encourage dialogue on interoperable devices and chips
- ▶ Look for ways to encourage/ entice more manufacturers to include European standards in Chinese devices

### Involved actors

- ▶ Cooperation with European device and equipment manufacturers (Siemens, Blaupunkt, Radioscape, Factum, VDL)
- ▶ Cooperation with European broadcasters (BBC, Radio France, RTL, GCap Media)
- ▶ Beijing Jolon, ABS
- ▶ Support from trade bodies (EICTA, WorldDMB, Chinese manufacturers trade body)
- ▶ Cooperation with Chinese device manufacturers (Longcheer, Aigo, BBEF etc.)
- ▶ Motorola, Nokia, Sony-Ericsson
- ▶ Best seller in EU of USB dangle, MP4, GPS, DMB, etc.

## 2.8 Proposed Activities in applications

A new priority area which advent during the two 2008's workshops in Beijing and Brussels is the field of applications that includes the users needs. The necessity of working together in the field of application engineering was stated from both sides – Chinese and European stakeholders. Two important issues have been pointed out: There is no successful market entrance for European stakeholders without cooperating with Chinese companies as a vehicle. And there is a reference to the action field of standardisation that becomes more and more important as two main standards are settled in the meanwhile (DAB(+) and CMMB).

As an important part of the data service, Traffic Message Channel was recognised as an important technology for delivering traffic and travel information to drivers. In order to make the delivery of high quality accurate, timely and relevant information possible a national database of TMC locations need to be created, the TMC receivers and the links to sources of real-time traffic information should be available. Whereas TMC Services are well established

across Europe it has been firstly demonstrated in China and its development is still under consideration.

**Fields of applications, that have to be examined:**

- ▶ Data services such as video, tv and videoconferencing applications are partially already utiliable
- ▶ Traffic information: increasing traffic volume in congested areas concerning both – moving people and moving goods.
- ▶ In-car applications including traffic information, geo-tagging for localised and personalised services
- ▶ Safety-oriented services like car-to-car communication
- ▶ Communication applications “everytime and everywhere”
- ▶ Complex multi-travel-mode-chains require more reliable information
- ▶ Personalised marketing applications such as sweepstakes, voice-mails etc.

**Prerequisite:**

- ▶ Platform independent applications or handover from one technology / network to another. Technologies have to be available. Already in use: GSM, UMTS, WLAN, Bluetooth, Audio, Mobile-TV, DTMB, CMMB, DAB, DAB+. Today no handover between technologies and networks is available. But users expect continuous service and seamless handover (see Ming-T presentation).
- ▶ Value chain and business models should be harmonised because users expect consistent billing systems

**Next steps**

- ▶ WorldDMB in-car seminar in Bristol 4th December & we will have discussions with car industry
- ▶ WorldDMB & Fraunhofer will develop the technical proposal, in conjunction with China partners (ABS, Beijing Jolon, SUJT)
- ▶ Aim for proposal to be ready March 2009

Content is always crucial to the end user and service provider, in order to improve the performance of video services and data services, which are primary value-added services for digital broadcasting or 3G, we propose to take the following actions:

- ▶ Set up a content aggregation and distribution platform
- ▶ Set up a digital broadcast transmission system and improve signal coverage to provide regional mobile TV and data service for local consumer
- ▶ Expand and educate the user market
- ▶ Explore & develop detail: application concepts & confirm interested participants
- ▶ Research on new attractive types of video content for the Chinese and the European markets and interactivity for video on demand

- ▶ Research on new data services such as stocks, weather forecast, exchange rate, news, traffic information, especially combine with traffic navigation system
- ▶ Research on interactive services which combine the digital broadcasting and Wimax or 3G systems

Traffic information as well as security relevant traffic systems are getting more and more attractive as the request for mobility increases tremendously.

**Steps in the field of traffic information:**

- ▶ Research on how to adjust the TMC standard to the Chinese market
- ▶ Cooperate with the European experts to set up the basic information such as location tables and event tables
- ▶ Research on distributing different data such as traffic information via Digital broadcasting
- ▶ Trial project with local broadcasting companies

**Involved actors**

- ▶ China: ABS, Beijing Jolon, Shanghai JiaTong University (SJTU), Guangdong Mobile TV Media (GTM), others (eg AutoNavi)
- ▶ EU: WorldDMB, Fraunhofer Institute, BBC, Audi, BMW, Arqiva, PTV, Tomtom

**In the field of video and data services as well as traffic information the following steps are recommended:**

- ▶ Professional consultants to provide the true information of target end users
- ▶ Service providers & mobile TV operators (OPG, Jolon, GTM, CMMC etc.)
- ▶ Cooperation with receiver manufacturers or design studios
- ▶ Support from local government
- ▶ Support from the content delivery side (SMG)
- ▶ Cooperation with mobile-terminals vendors (Aigo, Longcheer, Lenovo, Nokia, Motorola, Samsung, LG etc.)

### 3 Conclusion

This report represents concrete action lines and ideas concerning research and development priority areas regarding digital broadcasting and mobile communication convergence to develop future cooperation between EU and China.

The common vision and guiding principle of this Plan of Action is to concretise action lines to advance after the finalisation of the MODIBEC project. It takes the form of broad recommendations with specific steps and information of involved actors. It could be taken into account in future relevant Framework Programmes.

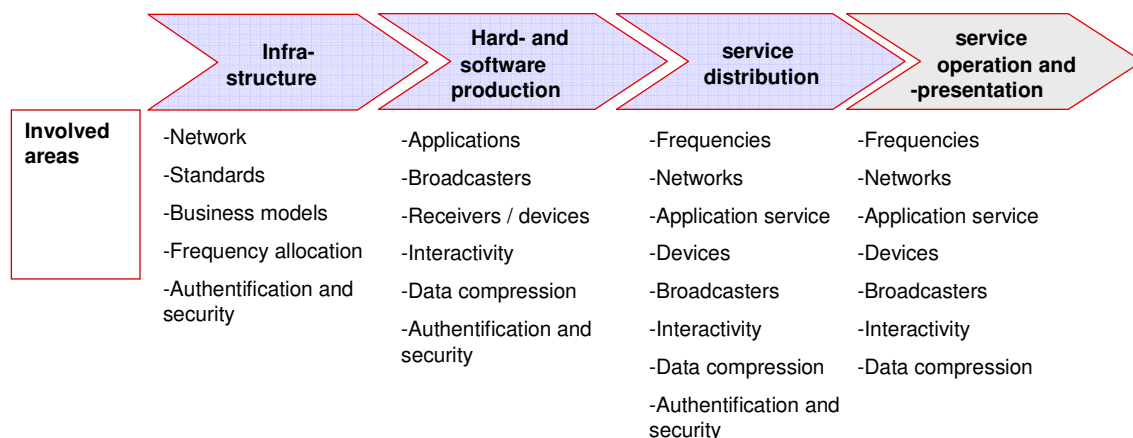
The information collected and analyzed for this Action Plan reaffirms the essential and interactive mobile services in EU and China. Our recommendations pertain to all parties involved in the standards groups, digital broadcasting operators, mobile service providers, hardware manufacturers etc.

Key actions to be taken in the EU-China cooperation are recommended for the following areas:

- ▶ Video Service and Data Service (TMC Service in China)
- ▶ Authentication and Security Systems
- ▶ Interactive Mobile Services incl. in-car services
- ▶ Data Compression (Video/ audio codec)
- ▶ Broadcasting Infrastructure
- ▶ Integration of Hardware and Receivers in terms of multi-standard devices

The last two workshops in Beijing and Brussels in 2008 showed two things very clearly: No European invest in Digital Mobile Broadcast will be successful without a Chinese partner with a valuable network. The other message was that concrete applications for Digital Mobile Broadcast are urgently needed.

The most important thing is to bring together all stakeholders involved in the complete value chain:



Digital mobile broadcasting is a new technology that prerequisites many steps and agreements of a huge number of stakeholders. In some areas mainly the private companies that are interested in earning money in new markets and innovative products are bringing things forward – with the support of research institutes, associations and information exchange on fairs and conferences. In the area of digital mobile broadcasting this affects the applications, the hardware devices and related areas like HMI design, authentication and security and interactivity and business models and content distribution. Administration can steer and support pointed out areas in fundings, in lower trade barriers and in finding mechanisms (laws) that prevent theft of intellectual property mainly. In addition EU-Chinese-driven conferences and fairs can support the exchange of know-how and business interest.

Building up the infrastructure and frequency allocation as well as regulation usually affects governmental issues and therefore has to be operated by administrative institutions. Normally there are powerful and innovative private companies that try to lobby their decisions.

Administrative (EU and Chinese) support is also needed in the field of standards. Actually there are two powerful associations in the EU and China that are pushing on the standards in their area. To come to a closer cooperation between the EU and China both regulative associations have to work together and adjust and finetune their activities. A wide range of experience and know-how can be exchanged between the both. In addition exchange between associated universities that are doing research in the field of standards can be encouraged by partnerships between EU- and Chinese universities and research institutions.

Business models can be found at each company and association that is interested in making profit. It is the essence and being of a private company to know how to earn money with new ideas. Therefore new business models are usually invented (refined and copied) by private companies themselves whereas associations can input theory and generic models.

	Research	Technical standards	Asso- ciations	Fairs and conferences	Govern- ment	Industry
Business models			○ →	○ →		●
Standards	○ →	● ←	● ←			
Infrastructure	○ →				●	
Frequency allocation					●	
Content distribution			○ ←	○ →		●
Hardware / receiver	○ →					●
Regulation			○ →		●	
application / user needs	○ →	○ ←	○ ←	○ →		●
interactivity / HMI design	● ←		○ →	○ →		●
Authentication & security	○ →	○ →	○ →			●
Data compression	● ←	● →				○

- Main actor(s)
- other actor(s) – usually collaborating with main actors and others