REPORT 2015

BY THE m-POWERING DEVELOPMENT INITIATIVE ADVISORY BOARD

m-POWERING DEVELOPMENT INITIATIVE

150 1865 2015

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m-Powering Development Initiative

A report by the m-Powering Development Initiative Advisory Board

January 2015

This report was prepared by members of the working Groups on m-Health, m-Learning, m-Commerce, Business Models and Advocacy that were formed within the framework of the m-Powering Development Initiative (http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Pages/default.aspx) launched by ITU Telecommunication Development Bureau (BDT) in 2012 to explore innovative and collaborative ways of harnessing the full potential of mobile technology for the benefit of all worldwide.

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Preface

I am very encouraged to see that most of the growth in global connectivity is now taking place in the developing world. These billions of new users are likely to focus on innovations that directly benefit and empower people locally, and these bottom-up initiatives will bring exponential benefits to communities and make a really valuable contribution to the global development agenda.

In recent years, for the first time, we are witnessing innovations flowing from South-to-North and from South-to-South particularly using mobile technologies smartly to address pressing development challenges.

While this progress is very encouraging, we must nonetheless recognize that two thirds of the global population are still not connected.

That is why we have launched the m-Powering Development Initiative to leverage the phenomenal growth of mobile and the fact that this powerful technology is available in most rural and remote areas, delivering unprecedented computing power to individuals and empowering development in areas such as healthcare, education, agriculture, commerce, banking, and so on.

I hope that this report that presents the work of the Working Groups established within the framework of this initiative will raise awareness about the opportunities to seize and highlight the systemic challenges that we need to address together if we are to see significant uptake of mobile use for development.

Mr Brahima Sanou
Director
Telecommunication Development Bureau
International Telecommunication Union

Acknowledgements

Foreword

Access to, and the use of, ICT services bring innumerable social opportunities and help to stimulate economic growth of all nations thereby benefiting the daily lives of all citizens. With such powerful technology available in most rural and remote areas, and such unprecedented computing power in the palm of our hands it is imperative that we harness this technology for use in health, education, agriculture, commerce, sport, banking, and in everything that will serve humanity and help us to achieve sustainable development.

In 2012, Mr Brahima Sanou, Director of the ITU Telecommunication Development Bureau, launched a new initiative called m-Powering Development during the ITU TELECOM World event with the objectives to:

1. Harness mobile networks in health, education, agriculture, banking, commerce, sport and other fields that foster sustainable development.

2. Increase the use of mobile services and applications in our daily lives, in order to improve economic activity, particularly in rural and remote areas.

3. Foster mobile services in areas that may not be economically profitable for operators today, but there is a social urgency to include them in the ICT society.

4. Create synergies in existing initiatives to cross-fertilize experiences and avoid duplications.

5. Optimize the use of scarce resources.

6. Forge public-private partnerships and promote large scale multi-stakeholder projects wherever possible.

An Advisory Board was created of eminent personalities from diverse backgrounds to provide a mix of expertise necessary to provide strategic guidance to the leadership of the Telecommunication Development Bureau in this area. During the first meeting of the Advisory Board on 15 October 2013, Mr Sam Pitroda and Ms Anne Bouverot were appointed as Chairman and Vice-Chairman, respectively, of the Advisory Board. Following deliberations during this meeting, the Board suggested the creation of Working Groups, as proposed by the Chairman, to survey the landscape and take stock of the activities being carried out in their respective fields of m-Health, m-Education, m-Commerce, Advocacy for Mobile, and Business Models. The Working Groups carried out their studies on a voluntary basis by electronic means and through online working. The groups presented the results of their study in the form a report at the second meeting of the Advisory Board on 23 May 2014.

This report summarizes the latest work undertaken in relation to the m-Powering Development Initiative based on the findings of Working Groups of experts on m-Health, m-Learning, m-Commerce, Business Models and Advocacy to capitalize on and promote the new opportunities afforded by the growing availability and reach of mobile technology.

I would like to express my appreciation of the work and devotion of the Working Groups members of the M-Powering Development Initiative and to all those who have contributed to the development of this report. I would like also to thank Mr Sanou for his vision to establish this Initiative that aims at identifying gaps and taking action in order to allow all stakeholders from governments, private sector, service providers, content developers and users to tap into the full potential of mobile technology for sustainable development.

The work of the Working Groups revealed that while there is an evidence that smart, innovative solutions that leverage mobile technologies can make a real difference to people around the world and can improve healthcare, education, commerce, etc., current efforts are still duplicative and fragmented. The report highlights a number of issues and challenges common to all sectors that need to be addressed appropriately. The need to embrace an integrated and holistic approach to deploy scalable, sustainable and affordable m-Powering initiatives through inter-sectoral dialogue and collaboration was stressed as a key enabler for addressing barriers to scale.

I hope that the recommendations and conclusions set forth in this report will be considered by all to make the best use of the opportunity that, for the first time in human history, the sum of human knowledge can be within reach of all the world's people – wherever they live, and whatever their circumstances are.

Mr Sam Pitroda
Chairman of the M-Powering Development Initiative Advisory Board

Executive Summary

With mobile subscriptions approaching 7 billion[1], it is clear that mobile communications could become a universal tool with benefits far beyond the voice and text communication originally envisaged. The m-Powering Development Initiative is a cross-sectoral examination of the potential and actuality of mobile communications, especially for wider development.

This report, compiled by Working Groups assigned a specific sector, evaluates progress made within that sector and the role of stakeholders involved before providing concrete recommendations for future activities. These activities necessarily involve many different kinds of stakeholders and environments. Analysis of the reports of the Working Groups on m-Health, m-Learning, m-Commerce, m-Business Models, and Advocacy for Mobile reveals a number of systemic issues that are common to all these sectors.

These issues need to be collectively addressed if we are to achieve the desired sustainability and scalability of m-Powering Development initiatives. They include:

- **A growing need to pursue advocacy** to increase awareness among governments of the potential of m-Powering initiatives and of the essential need to approach them in a holistic manner. This necessarily entails the involvement of all relevant ministries and partners, notably in the telecommunications, education, finance, infrastructure, and commerce sectors. As part of this process, attention must also be drawn to existing initiatives where interested parties can learn about best practices and access top quality advice and resources. In short, advocacy efforts need to target key influencers and actors to move the m-Powering Development Initiatives forward.

- **Supporting an enabling regulatory environment for m-Powering initiatives** wherein no citizen is excluded by affordability, accessibility or availability issues is of vital importance. ICT policymakers, regulators and stakeholders at large need to have a global overview and practical understanding of the regulatory tools required to achieve sustainable social and economic development by m-Powering citizens in a connected and globalized world. A concerted effort must be made to examine current sectoral policies and regulatory frameworks in order to identify gaps in moving towards platform markets; address the cross-sectoral nature of m-applications and services; analyse various regulatory models and the role of the different regulators and entities in charge; and to learn from the success and pitfalls of existing measures. Identifying policy and regulatory best practices in areas dealing with all aspects of modern life will foster innovation and digital inclusion for sustainable social and economic development.

- **Approaching mobile initiatives in a holistic manner** to avoid vertical "siloed" interventions and to identify where new apps can "plug-in" in an integrated and interoperable manner with already existing systems and solutions. Embracing an integrated and a *platform* approach will avoid fragmentation and duplication of effort. It will also maximize investment return on ICT infrastructure which can be considered as a "utility" to be leveraged by all sectors — e.g., health, education, agriculture, commerce and payments. This would significantly accelerate the deployment of mobile for development innovations.

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[1] See The World in 2014: ICT Facts and Figures produced by the ITU at: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf

- **A high dependency on scalability** for the success of any m-Powering initiative. To make any application sustainable and widely scalable, it should be affordable and easy to use. Possible innovative models facilitating affordable mobile-based Internet access to the unconnected, particularly in underserved areas, as well as ways to upscale them at a global level, should be further explored.

- **A clear indication for any mobile development initiative of results and outcomes.** There is still insufficient clear evidence of the benefits of m-Powering outcomes in areas such as m-Health, m-Learning, etc. The development of clear success measurements and metrics should be agreed upon at the early stages of any intervention. Further advocacy efforts are required to emphasise the fundamental importance of appropriate monitoring and evaluation of m-Powering initiatives and to agree on appropriate related frameworks.

In its following meetings, the m-Powering Development Initiative Advisory Board will adopt an action plan and kick-start activities to address some of the identified issues that are common to all sectors and where some collective and joint efforts can be conducted to benefit the wider community. The Advisory Board invites all stakeholders to take note of the findings of the Working Groups and, more importantly, to devise actions to unlock the full potential of mobile technology for the benefit of all worldwide.

1 Introduction

Along with the expansion of the Internet, the explosion of mobile telecommunications has been a remarkable feature of global socio-economic development. According to ITU statistics[2], the most authoritative available in the world of ICT, the number of mobile-cellular subscriptions worldwide is approaching the number of people on earth – estimated at approximately 7 billion, equivalent to a 96 per cent penetration rate for mobile services by the end of 2014. Further, in developing countries, mobile-cellular penetration was projected to reach 90 per cent by end 2014, compared with 121 per cent in developed countries.

Clearly, the developing world, as well as the developed world, has taken to mobile technology as a necessary everyday fact of life. Given the evident proliferation and penetration of mobile services and technologies, it is reasonable to ask if it could further leverage socio-economic development. This is the key question that this report, compiled by some of the most authoritative figures, not merely across ICT, but across key economic sectors, attempts to evaluate. The answer, in short, is that there are many possibilities.

The m-Powering Development Initiative assembled five Working Groups to identify these possibilities and lessons to learn. The Working Groups in turn have identified the key stakeholders engaged in their respective domains of activity and cite real life examples of m-Powering good practices that can be replicated. The main identified gaps and challenges are also highlighted, as are recommended steps to address them.

Broadly speaking, these gaps, challenges and recommendations relate *inter alia* to inter-sectoral collaboration; models of sustainability; evaluation frameworks; partnerships; standards and interoperability; infrastructure; funding options, incentives and innovation; and local capacity building.

Finally, the report summarises the main conclusions reached by the m-Powering Development Initiative Working Groups in their endeavour to leverage the transformative power of mobile technology for the common good, especially in the less developed and remote parts of the world.

2 Working group on m-Health

2.1 Summary

M-Health is considered as a component or subset of e-Health that brings tremendous benefits to patients, healthcare providers, healthcare payers and governments. To date, no standardized definition of m-Health has been established. WHO defines m-Health or mobile health as: "Medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices. m-Health involves the use and capitalization on a mobile phone's core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications including general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G systems), global positioning system (GPS), and Bluetooth technology."[3]

Real life examples cited in this report demonstrate that m-Health solutions not only enhance prevention, diagnosis, treatment and monitoring of diseases but also contribute to strengthen healthcare systems

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[2] See The World in 2014: ICT Facts and Figures produced by the ITU at:

http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf

[3] http://www.who.int/goe/publications/goe_mhealth_web.pdf

through improvements in emergency response, healthcare practitioner support, healthcare surveillance and administration.

Across the diversity of global health programmes, innovative ways to leverage mobile technologies including wireless communications infrastructure have emerged and been applied in a number of settings. From the most basic application of mobile telephony – namely person-to-person voice or text communication – to more sophisticated systems that provide health workers with decision-support tools, scheduling algorithms or point-of-care diagnostics, mobile phones are seen as an additional tool in the global quest to improve population and individual health, decrease pressure on healthcare systems and lower healthcare costs.

In order to realise the full potential of m-Health and to stimulate the scaling up of m-Health services across the globe, important barriers need to be addressed, in particular with respect to policy and regulation. As a guiding principle, it is essential to put the individual/person/patient at the centre of the design, development and implementation of solutions, and of the regulatory frameworks that surround these processes. The m-Powering Development Initiative can play a key role by:

- Stimulating and facilitating collaboration between health, telecommunications and finance ministries both globally and nationally;

- Promoting the development of policies, and where appropriate regulation, stimulating innovative business models allowing for funding and reimbursement of m-Health services, by means of identifying and facilitating sharing of good practices/case studies;

- Supporting initiatives/projects aiming to develop and roll out m-Health education and training programmes/campaigns for healthcare professionals and patients.

2.2 Key m-Health stakeholders

Identification and mapping of stakeholders is an important process in the development of m-Health strategies, plans and projects. Different initiatives require different partnerships to be built. Hence, understanding which stakeholders are involved and which initiative is in play, enables an assessment of the collaboration opportunities, as well as of the gaps not yet addressed. For m-Health the stakeholders are diverse, coming from different backgrounds and directions. This is simply because e/m-Health is a multidisciplinary domain which by default requires a multi-stakeholder approach. Indeed, there are a number of groups and organizations already driving best practice, developing m-Health pilots and collaboration, providing proof points and stimulating dialogue in the m-Health space between these stakeholders. Examples of these groups/organizations include the Continua Health Alliance, the Health Information and Management Systems Society, GSMA, and WHO/ITU working in collaboration.

For the purpose of this report, the authors sought to include all stakeholders with a current or potential future interest in realising m-Health objectives. It is noteworthy that most stakeholders identified in these categories can belong to either the public or private sector.

2.2.1 Patients

In people-centred healthcare, the person/patient is the single most important stakeholder: universal health coverage puts the patient at the centre of everything. Improving the health and quality of life of patients is the ultimate goal of health systems as it is for the patient who requires medical attention or information related to health. The rights of the patient must be respected and services should meet their needs at affordable cost. It is also critical that an environment of trust and safety is created as the acceptance of m-Health interventions is essential for success. This is particularly so in the areas of data management and medical device regulation. Patients also require training and education around their health needs/conditions and should be involved in the development and implementation of m-Health solutions.

2.2.2   Healthcare professionals and associations

Healthcare is provided through cadres of professionals and semi-professionals trained to undertake tasks and functions that contribute to improving people's health. These include physicians, nurses, laboratory technicians and pharmacists, each of whom has their own motivations, attitudes, knowledge and skills that determine their respective healthcare delivery roles. Respecting their roles and engaging them in the process of m-Health implementation is a prerequisite for success.

Health leaders, managers and administrators represent another category with a major stake in m-Health. The engagement of these personnel in m-Health initiatives is essential as they manage the healthcare services alongside care providers.

Numerous health workers' categories identified above belong to professional organizations (e.g. nurses' associations) or companies (e.g. manufacturers of health technologies), many from the for-profit private sector. It is therefore important to understand the motivations of these organizations and companies in order to facilitate their engagement in m-Health in a manner which benefits people and patients.

2.2.3   Healthcare payers

This refers to entities other than the patient that finance or reimburse the cost of health services. In most cases, this term refers to insurance carriers, other third-party payers, or health plan sponsors (employers or unions). These need to understand the role of m-Health in cost recovery, reimbursement, and managing other transactions in a secure and timely manner.

2.2.4   Telecommunications operators

The role of telecommunications operators, as stakeholders, in m-Health is often portrayed as limited to providing infrastructure and platforms, connecting devices and providing services; and enabling systems to carry, store and analyse health data and move it from one point to another. Operators of course do enable connectivity, provide security and authentication, and ensure the seamlessness of workflow as an integral part of mobile health services. What is often forgotten however is that telecommunications operators' capabilities exist beyond these areas for they are also able to leverage expertise in billing and revenue mechanisms, customer care, device management and distribution networks. This means they have the additional ability to be involved in the provision of end-to-end service management as opposed to being limited to the role of connectivity providers. Their engagement and commitment to excellence is a cornerstone in the process. What is vital to the longer term success of m-Health and a prerequisite for operator investment is that services are both scalable and sustainable.

2.2.5   Regulatory authorities

With regard to regulation and m-Health there is an overlap between the telecommunications and healthcare regulatory authorities, and a need for harmonization of regulation between the two to enable the right environment for m-Health to thrive.

- *Telecommunications regulatory authorities*. The role of telecommunications regulators is to protect the interests of consumers by establishing general rules for the public delivery of telecommunications services, promoting effective and fair competition and facilitating the development of the telecommunications market. As a stakeholder in m-Health they – alongside healthcare regulatory authorities – have a responsibility to ensure safety, promote patient and healthcare professional confidence and provide industry with sufficient certainty to innovate and bring new m-Health products and services to the market.

- *Healthcare regulatory authorities*. Healthcare regulatory authorities at national level (NHR) and those above country level have the role of setting and enforcing standards for healthcare practices and services to ensure their compatibility with national laws and regulations. m-Health has not been fully integrated in healthcare service delivery which poses a major concern regarding its regulation. NHRs are key stakeholders in m-Health implementation as they set the rules for privacy, ownership and confidentiality of health data as well as funding/reimbursement

criteria. While telecommunications regulators set the standard for technical interoperability, NHRs set the interoperability information standards to ensure patient safety and rights. Exchanging patient information using mobile technology requires full engagement by NHRs to ensure that technology as a carrier and health information as content meet people's needs.

2.2.6   Hardware and software vendors

These represent an important element in the m-Health stakeholders group. They provide the tools such as mobile phones, wearable devices, sensors and applications for individuals to send and receive data and information. Manufacturers and vendors are in control of the design of these tools, their functionality, cost and sustainability. Engaging them in m-Health development as an active stakeholder will ensure that they develop and deliver solutions that meet people's needs at affordable cost. It should be noted that achieving this cost objective typically requires scale, and in order to achieve scale solutions should be interoperable and produced using common and accepted standards such as the recently adopted Continua Health Alliance Design Guidelines[4].

2.2.7   M-Health project teams

These are the people who have the vision to bring all partners and stakeholders together to develop and deploy an m-Health solution. They assess the needs, study the feasibility, develop the business plan, allocate the budget, build the team, implement, monitor and evaluate.

2.2.8   United Nations agencies and other international bodies

WHO, ITU, UNICEF, UNESCO and UNHCR are among the organizations with roles to play as stakeholders in m-Health. Many others also have m-Health development roles ranging from content development and provision, funding, standardization, monitoring and evaluation, to project management in collaboration with national stakeholders, organizations and governments. These may also include international standard development organizations that play a major role in standardization and interoperability.

2.2.9   Others

- Providers of healthcare related content such as health information on the Internet.
- Educators who provide basic or advanced knowledge on m-Health to citizens and other m-Health stakeholders.
- Funders who provide the financial resources necessary for the development and implementation of m-Health services.
- Non-government organizations (NGOs) that work with communities and provide health services at grass-root level. Many NGOs understand the needs and work closely with patients not only to provide care but also for health education and prevention purposes.
- Communication and mass media workers who provide the necessary visibility to m-Health initiatives, highlighting the value and benefits to individuals and society at large.

2.3   Real life examples and best practices

M-Health applications and services can be categorised in different ways. m-Health applications cover a wide range of health services including: data collection/disease surveillance; treatment adherence reminders; emergency medical response systems; health information systems; support to healthcare

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[4]   http://www.itu.int/net/pressoffice/press_releases/2013/75.aspx#.UzHWDfI_t9w

professionals; rural health workers; supply chain management; health financing; disease prevention; and health promotion. For the purpose of this report, these applications/services have been put into two main groups those that support solutions across the patient pathway, and those that support healthcare systems strengthening:

2.3.1   Solutions across the patient pathway

Prevention – refers to services used by government and non-government agencies to spread awareness and encourage people to adopt or avoid certain behaviours and practices to prevent or control disease. These services and applications aim to leverage the reach of the mobile platform to mobilise communities and promote healthy living.

Prevention services can include:

- Regular SMS or voice health information updates.

- Subscription services to customers who sign up.

- Games or quizzes played by mobile phone to raise awareness of diseases or health risks (Gamification).

- Health information videos distributed by mobile phone.

- Services to respond to customers' questions about health.

Example: Hello Doctor.

Launched in South Africa in December 2013, with an Indonesia launch expected in May 2014, the project aims to prevent or mitigate disease through preventative education and access to affordable medical advice. The advice line offers the general public the opportunity to talk directly to a doctor for medical information, counselling and advice on first aid, common medical problems, health conditions, risk factors and proper use of medication.

Example: m-Cessation (m-Health for Smoking Cessation).

The project, launched in Costa Rica in April 2013, aims to prevent smoking-related diseases such as cancer and other lung diseases. Tobacco smoking has been recognised as a big problem in Costa Rica and many health costs are considered preventable by getting people to quit smoking. The project includes building and maintaining a database of mobile numbers based on a registration process, creating tailor-made short messages and developing two-way communication with smokers. This will entail managing both outgoing and incoming short messages. A mechanism for feedback and reporting management has been established at the Ministry of Health.

Diagnosis – includes services and solutions that help healthcare professionals connect with patients geographically far away to provide diagnosis or triage.

Diagnosis services can include:

- Health call centre.

- Patients video-conferencing with healthcare professionals for a diagnosis.

- Apps that perform diagnoses.

- Diagnostic devices that use mobile phones.

> *Example: Mobile Baby.*
>
> Launched initially in the United Republic of Tanzania, Nigeria, UAE and Saudi Arabia, from 2012 onwards the project was rolled out across the following countries: Afghanistan, Pakistan, Sri Lanka, Ivory Coast, Benin, Togo, Niger, Central African Republic and Gabon. The project is a complete suite of services enabling birth attendants and midwives to ensure safer pregnancies, labour and delivery in remote areas. It provides ultrasound-based remote monitoring of pregnancy evolution, step-by-step protocol to identify and report danger signs during labour and delivery, money on the phone to pay for emergency transportation and communication with the referral facility indicating emergency transfer and requirements on arrival.
>
> *Example: Patient images (radiology) on Mobile.*
>
> Launched by the Jai Prakash Narayan Apex Trauma Centre (JPNATC) in New Delhi, India, in 2012, it has made Picture Archiving and Communication Systems (PACS) available on mobile phones for all doctors in the Centre. This enables doctors to view patient radiology in almost real time on their handheld devices over a secure connection, greatly improving decision-making capabilities.

Treatment – includes services that help treat patients remotely and ensure adherence to the required treatment regimen.

Treatment services can include:

- Treatment compliance solutions.
- SMS medication reminders.
- Smart pill bottles.
- Smart pills.

> *Example: Vitality GlowCaps™* are a cost-effective and scalable solution to increase medication adherence. Randomised clinical studies have demonstrated that Vitality GlowCaps™ can improve adherence from 70% to more than 95%.
>
> *Example: Cell Phone Applications for Clinical Diagnostic Therapeutic and Public Health Use by Front Line Healthcare Workers, Mozambique.*
>
> The project principals, researchers from the University of Melbourne, have created a suite of applications that can run on standard mobile phones. The applications provide Mozambican health workers with diagnostic and analytical tools including reference material in the phone's memory, a calculator for determining drug dosage, and a programme for analysing inputs from medical sensors (e.g., low-cost pulse oximeter probes or a simple electrocardiogram). The project ran from March 2008 to March 2009 and concluded with an evaluation of the impact and efficacy of the applications suite.

Monitoring – encompasses a broad set of services, applications and devices that help in periodic capture of important health parameters of chronically ill patients or those undergoing post-acute care. It includes monitoring patients to identify and confirm underlying illnesses and monitoring of the vital parameters of at-risk patients to track underlying conditions and take action in order to prevent exacerbation.

Monitoring services can include:

- Vital signs monitoring for chronic disease patients.
- Emergency alarms and independent living solutions for the elderly.

Example: WellDoc Diabetes Manager. This is an integrated patient coaching and nurse case management system to improve diabetes care. Benefits include:

> 1) Proven improvement in A1c levels (1.9%) shown through randomised control trial study vs. a control group, significant even when compared to impact from medication-based intervention.
>
> 2) Potential to deliver significant financial saving for hospitals. Further clinical studies have demonstrated a 58% reduction in hospital stays.
>
> 3) Patients empowered to take greater responsibility for their own care.
>
> 4) Ability to track and store patient data for review by healthcare professionals.

Example: SIMpill and Tellumat, South Africa. A pilot project launched in 2007 showed that with SIMpill, 90% of patients complied with their medication regime, compared to the typical 22 to 60% compliance rate without the system. Reminders to take daily medication using the mobile phone are an effective means to ensure drug regime adherence, which is critical for diseases like TB, where 99% of those infected can be cured with proper medication compliance. The solution is now available worldwide.

2.3.2   Healthcare systems strengthening

Emergency response – Wireless systems enable communication between paramedics in ambulances and physicians in the hospital, plus transmission of a patient's vital parameters whilst *en route*.

Example: Cisco's Connecting Sichuan healthcare initiative, China. Features of the initiative include an enhanced ambulance connecting major hospital senior doctors with counterparts in remote areas to respond to natural disasters and other emergencies. The benefits include ability to reach disaster-hit areas and provide emergency diagnosis and treatment on site, and significantly faster patient access to treatment.

Healthcare practitioner support – Intelligent decision-support systems for diagnosis or treatment, information lookup, and information dissemination.

Example: Health eVillages in Lwala, Kenya. Variations on the service are also running in China, Haiti and in Kijabe, Kenya. The project aims at empowering healthcare professionals in Lwala through new and refurbished mobile phone and handheld devices. It provides the latest in clinical decision-support technology and medical references for health professionals on the ground, enabling the provision of improved public health services in poor, remote and previously underserved areas. The benefits include ensuring healthcare professionals have access to up-to-date medical information and empowering healthcare professionals to make clinical judgements on evidence-based clinical information.

Example: Map of Medicine for Kijabe Hospital: Remote Data Collection, Kenya. The challenge that was identified is that doctors in rural areas of Kenya are often forced to treat individual patients with little or no information about resources in neighbouring areas, impeding them from providing optimum care. The project gives Kenyan health workers at Kijabe Hospital access to the Map of Medicine, a medical information database, a web-based tool that provides comprehensive, up-to-date information on diagnosis and treatment, presented in easy-to-use flowcharts or 'care pathways'. Doctors participating in the pilot study were given PDAs and access to data on HIV/AIDS, TB, malaria, abdominal pain, diarrhoea, and typhoid fever. Hospital staff reported that the data access and entry via the PDAs has led to greater efficiency, more time with patients, and reduced administrative costs.

Healthcare surveillance – Services and tools that help public health professionals collect health-related information about populations and track the outbreak of diseases or epidemics.

Example: Chobe Malaria Early Epidemic Detection System (MEEDS), Botswana. Smart phones were provided to healthcare workers at 16 facilities in the Chobe District of Northern Botswana, enabling the facilities to submit regular reports to the Ministry of Health and the health workers to report real-time disease outbreak data, tag the data with GPS coordinates, and send out SMS disease outbreak alerts to all other healthcare workers in the district. The benefits include testing of suspected malaria cases, which increased from 11% to 98.4%, and the ability to centrally coordinate treatment and communicate disease outbreak alerts to prevent further spread of disease/infection.

Example: Cell-PREVEN-Remote Data Collection. Cell-PREVEN was created in Peru (2009) to allow access to real-time data to members of the healthcare ecosystem in the country. This interactive voice response system enables health workers in the field to collect and transmit data via basic mobile phones. The data is aggregated in a centralised database and made available to medical professionals, and the system is designed to send SMS or e-mail alerts if certain symptoms are recorded. It was concluded that "cell phones are a feasible means of collecting and reporting data in real time in remote communities … it's not necessary to have the latest Palm Pilot or Tablet PC to create a sophisticated public health surveillance system".

Healthcare administration – Services that automate or streamline administrative or back-end processes related to healthcare provision and that positively impact the efficiency of the overall delivery system. Include services such as appointment reminders.

Example: NHSmail SMS Appointment Reminders, United Kingdom. The aim of this SMS messaging programme is to reduce the number and impact of patients failing to attend appointments. The benefits are easy to implement with improved outcomes delivered through higher attendance levels, increased healthcare staff productivity, and reduced waiting times for appointments, all factors improving access for patients to healthcare professionals.

Example: Mobile birth registration in Liberia. The Liberia Poverty Reduction Strategy identifies as one of its priorities the development of a population information system, and particularly, the improvement of birth registration. The Universal Birth Registration (UBR) system, the country's first decentralised electronic birth registration and certification system – launched in 2006 - aims to increase birth registration and certification for children under six to 90 per cent in two years, which represents an important step towards achieving the fundamental right of every child to a name and nationality at birth. An initiative under UBR promotes the use of mobile-cellular technology to collect birth registration information in rural areas, which is then transmitted via global positioning response signal (GPRS) to the main registration service. This Mobile Birth Registration (MBR) project has been implemented successfully in one county in Liberia and will be scaled up to other counties, allowing the printing of birth certificates in rural counties across the nation.

Best practices and replication – Among the challenges facing m-Health is building the knowledge and evidence base of best practices which would allow replication and/or scaling up. The above examples have common elements that could be considered for replication. These include:

- Public-private partnerships as the private sector plays a major role in supporting the public sector in implementation of m-Health initiatives.

- Addressing a healthcare challenge based on deep understanding of the health of the population that the m-Health project is attempting to assist.

- Measurable results which make monitoring and evaluation possible.

- Simple services such as SMS that build on the foundations of electronic health records and platforms are a good starting point, which can then over time be expanded into more complex solutions.

- Engagement of healthcare personnel in all phases of an m-Health solution.

- Engagement of the patient in the conception, design, development, testing and deployment of m-Health solutions.

2.4   Gap and challenge analysis

Across the diversity of global health programmes, innovative ways to leverage mobile technologies including wireless communications infrastructure have emerged and been applied in a number of settings. From the most basic application of mobile telephony – that of person-to-person communication by voice or text - to more sophisticated systems that provide health workers with decision-support tools, scheduling algorithms or point-of-care diagnostics, mobile phones are being seen as an additional tool in the global quest to improve public and individual health, as well as decrease pressure on healthcare systems and associated costs. Whether as a tool able by itself to assist in the delivery of care (as in the case of modern sensor-enabled diagnostic mobile devices) or as a vehicle through which data is exchanged and information is delivered, the ultimate goal of the device/platform/service/data storage and management solution is that the m-Health solution is a catalyst to improve patient outcomes.

An m-Health solution usually takes one of three primary approaches towards:

- **Empowering the client or patient** – supporting them with access to information about preventive or curative care, reminders about drug adherence or motivation to change behaviours.

- **Assisting the provider** – helping with workflow management, activity tracking and record-keeping, clinical decision support, or clinical documentation; or

- **Strengthening the health system** – improving supply chain reporting, aggregate performance monitoring, or ensuring service delivery quality.

Increasingly, m-Health strategies maturing into larger implementation or mainstream integration target multiple levels of the system, bridging patient, provider and health system layers.

There is widespread recognition across development agencies, national governments, the telecommunications sector, the healthcare sector and private industry, of the potential inherent in leveraging ICTs for improvement of public health systems and individual patient outcomes. Despite the global proliferation of pilot projects numbering in the hundreds, if not thousands, few m-Health strategies have yet scaled to national or regional deployment and fewer have been adopted as part of global standards of care. Over the past few years, there have been active debate and discourse about the barriers and obstacles that may impede the widespread adoption of m-Health strategies.

Initially, it is likely that the novelty of the field, characterised by *widespread experimentation and a lack of a shared vocabulary to* describe m-Health innovation, contributed to some of this confusion. The inclusion of actors new to the discourse of health from the public and private sectors (e.g. telecommunications national authorities, ministries, regulators, mobile phone and telecommunications companies), brought together two communities/ecosystems each with their own strengths and approaches. This, combined with the inherently interdisciplinary nature of m-Health (spanning engineering, health sciences, communication, legislation, education and systems or implementation science), has contributed to the complexity of this emergent ecosystem.

Several additional mechanisms have been called for to strengthen the field of m-Health and improve the scalability of solutions. First, the importance of leveraging existing evidence-based practices and scientific principles in designing m-Health strategies has been stressed as a universal 'best practice'. A key shortcoming shared by many early m-Health projects was a concern that implementers were developing solutions in search of problems. This has been partially addressed with renewed emphasis by sponsors of m-Health innovation on clear articulation of the underlying health challenge or constraint which is being targeted by the technical solution.

Second, a systems approach to m-Health intervention design has been noted by many as critical, to allow incorporation of the up- and down-stream elements which could influence the relative success of a health

programme. Engagement of the end user has been noted as important, to ensure that the design of systems integrates functionality and usability as key characteristics of long-term m-Health sustainability. Systems should be grounded in scientific principles, whether behaviour-change theory or tested economic precedent regarding performance-based incentives, etc. In short, the solution will not achieve scale, nor become commercially viable and therefore sustainable, unless it is adopted by end users.

Third, with regards to the solid foundation for m-Health innovation, recognition of the need for an enabling technical, regulatory and commercial environment has emerged. Governments, globally, are formulating national guidelines, standards and regulation to guide m-Health innovation, to prevent the proliferation of non-interoperable, siloed innovation. A lack of coherent strategies because of new grass roots innovations led to disconnected, duplicative innovation that was inherently unscalable. Where appropriate, common, open-source, or shared architecture has been identified as a possible means to encourage interoperability, while national level policies, regulation (N.B. Regulation can also be at individual country level and above country, e.g. EU regulatory and policy initiatives) and standards governing issues such as common data elements (e.g. unique personal identifiers, facility codes, clinical conditions) allow for data exchange between programmes. These considerations also serve to facilitate integration into existing health systems, allowing for new digital information streams to be merged into national datasets, such as District Health Information Systems (DHIS).

It is reassuring to see that empirical evidence supporting the added-value of certain m-Health strategies is increasing rapidly. Certain strategies based on text-message support of drug adherence, or for stock-out prevention in low-resource settings, are being scaled up and mainstreamed. Increasingly, as more rigorous evaluations of these approaches become available and as the impact of m-Health strategies on health system processes or on health outcomes is repeatedly demonstrated, strategies will increasingly move from pilot to deployment at scale. The most challenging remaining unanswered questions seem to be around the value proposition to health systems and private payers to invest in m-Health; demonstrations at small scale are only beginning to translate into larger implementation at national or regional levels. Providing insight into the financial returns on investment for the public sector (e.g. improved efficiency and resource allocation, accountability, and population health) or the private sector (e.g. economic benefits, client engagement or customer base expansion, etc.) will be an important priority to address in the future. It should also be acknowledged here that to reach a sustainable m-Health level of scale, certainly within established markets, would require fundamental changes in traditional healthcare systems, with changes to patient treatment pathways and a move toward rewarding outcomes rather than just the act of a medical intervention.

2.5   Good practices

2.5.1   *Building sustainable public-private partnerships*

Public Private Partnerships (PPPs) in m-Health operationalize a commitment by the public and the private sectors to work together for the purpose of designing, planning, financing, constructing and/or operating m-Health projects. Numerous PPPs in health have been in existence for many years. PPPs in m-Health take advantage of a technology developed for other purposes than health, and use it as a crucial vector for healthcare delivery services and other activities. Without public-private development, achieving scale and sustainability is incredibly difficult.

It is fair to say that no single m-Health PPP model fits all sizes/countries/communities. Partnerships are formed depending on the motives of the private sector and the government, the size of the market, the level of penetration of mobile technology, the literacy level of the population, the health needs as well as specific legal and ethical frameworks.

The public sector engages in PPPs for a variety of reasons, including to achieve greater value for money, to share or transfer risk to the private sector, to search for better performance through the intervention of private-sector parties, political attractiveness, and in response to budgetary constraints. It is important to ensure that none of these reasons or motives becomes the sole grounds for building partnerships in m-Health.

M-Health PPPs have become a common mechanism for implementation of projects in countries and in communities. Some of these PPPs are concluded with little consideration for either the expected benefits to the community or sustainability, despite the general consensus that the interests of people should always be placed at the centre of any PPP. Losing sight of this imperative or shifting the balance in favour of private over public interests will most likely compromise the sustainability of the partnership. A further point for consideration should be whether the specific technology used for the projects can evolve over time. Indeed, experience has demonstrated that a pilot project supported or sponsored by a vendor using a specific proprietary technology has no prospect for scaling up and achieving sustainability.

Technologies develop very fast and in a diversified manner, which makes them short-lived and most often not interoperable. Entering into a partnership with a technology vendor and/or mobile service provider should therefore not be at the expense of another, and public sector partners should insist on operability for all technologies used by the PPP. Deploying a technological solution is not the end of a project as sustainability requires maintenance and support all the way including through evolution to newer technologies as they become available and cost-effective. As the hardware and software manufacturers and vendors have technological expertise, PPPs would benefit if they could systematically address interoperability and standards issues.

In addition to the technology component, a number of considerations need to be taken into account when assessing the future sustainability and benefit to the people of m-Health PPPs. The latter face legal complexities as they often are trans-border and are multinational in many cases. Although mobile companies work under national jurisdictions, they belong to multinational companies. The potential conflicts from a legal standpoint between national and international interests - and between the private and public domains -   thus need to be addressed.

Like other PPPs, m-Health PPPs require a clear level of transparency and accountability on the part of all participants. Clarity on objectives and end goals are also required, and it is only logical and legal that private sector partners will seek to make a profit, but this should be balanced with the need to deliver cost-effective solutions for the patient.

The objective of an m-Health project may dictate the type of partnership as from the public sector point of view the "content is king", while from the perspective of hardware and software manufacturers and vendors the technology is the master. This of course is not the case for other private stakeholders, such as health service providers who concentrate on content. Reconciling these two aspects and giving importance to both the content and the technology, while keeping the public interest in mind, is a safeguard for sustainability. As more PPPs and multi-stakeholder partnerships are in operation, reaching a common understanding of shared and distinct objectives between partners may become easier.

The lack of clarity on the financial sustainability (which should not necessarily be interpreted as profitability) of m-Health PPPs in low-income countries has so far slowed down private sector investments in this area. For this reason – despite the crucial need for increased financial investments in PPPs in order to scale up m-Health - very few large private sector groups have so far made important investments in the area of m-Health in low-income countries. The telecommunications and ICT sectors have understood the business opportunity perhaps sooner than the private health sector, simply by having witnessed the mobile revolution in their own field of operation. Nevertheless, the relatively modest investment by a few mobile operators into m-Health projects in low- and middle-income countries has not resulted in a significant scale up of these projects, nor in the creation of major or core business units around m-Health in these countries.

The traditional health private sector became aware only recently of the business opportunity provided by m-Health in low- and middle-income countries. This is exemplified by the fact that only 250 of the

existing 97 000 mobile health apps were developed by the pharmaceutical industry[5]. New developments of such PPPs may follow the participation of a pharmaceutical manufacturers' association in the ITU-WHO m-Health NCD initiative. The situation is similar for the health insurance sector.

An additional constraint to the scaling up of m-Health projects is the lack of experience of the health and ICT sectors to work together, in the public and private sectors alike. Government health and telecommunications ministries are not natural partners and the pharmaceutical industry or health insurance sector are not traditional partners of telecommunications operators and Internet service providers. These partnerships are therefore complex to put in place, which is an additional challenge and constraint for m-Health scale up.

3   Working Group on m-Learning

3.1   Summary

Mobile devices have the potential to contribute significantly to education and learning across the world. However, uncertainty persists as to their precise impact, and how best they can be used to contribute positively to education and learning. The very rapid expansion of mobile connectivity and devices makes it both timely and important to consider ways in which they can be utilized effectively for education, and how the ITU can best contribute to this process.

In providing an overview of m-Learning and m-Education initiatives that are either already successful or promising, the m-Learning Working Group notes that there is still far too little rigorous evaluation and monitoring of such initiatives, and states the urgent need for quality comparative data to enable success factors to be clearly identified. It nonetheless acknowledges the widespread recognition of the potential of m-Learning to improve the delivery of education and skills acquisition.

This Working Group report also reviews the main stakeholders participating in m-Learning initiatives and summarises existing knowledge about good practices in this field, citing real life examples. Building on these considerations, the report identifies key gaps and challenges facing those seeking to implement m-Learning initiatives and recommends specific areas of activity that warrant particular attention in the framework of ITU's m-Powering Development Initiative. These areas focus on:

- Support and advocacy for the fundamental importance of **appropriate monitoring and evaluation**.

- Support for and engagement in activities that enhance **awareness of m-Learning** by governments and their understanding of the essential need for all mobile initiatives to be approached in a holistic manner, involving all relevant ministries and partners.

- Sharing and showcasing **good practices in m-Learning** as part of the wider m-Powering Development Initiative.

- Support for the creation of an open mobile app to provide **free sharing of m-Learning content** as well as the dissemination of commercial resources.

The m-Learning Working Group suggests that the primary role of ITU's m-Powering Development Initiative should be to engage with telecommunications ministries and regulators, and that its main emphasis should be to advocate and influence, rather than to deliver physical products. It also favours an

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[5]   http://research2guidance.com/pharma-companies-far-from-realizing-their-app-market-potential/;
http://mobihealthnews.com/20814/report-1-7b-to-download-health-apps-by-2017/

approach that seeks to do a few things really well, rather than try to be over-ambitious and fail to do anything satisfactorily.

3.2   Why m-Learning and m-Education?

It is widely argued that the future of education is through the Internet, and that the Internet is increasingly being accessed through mobile devices. If these propositions are accepted, it follows that learning through mobile devices connected to the Internet will have a very significant role to play in the future. Mobile devices are also generally cheaper, more ubiquitous, frequently personal, and above all usable in parts of the world that would otherwise have limited access to formal learning environments. Whilst learning and teaching with and through mobile devices is a subset of the wider field of ICT in education, it nevertheless has distinct characteristics, such as greater affordability, greater ubiquity, and smaller size, which require a reconsideration of some, although by no means all, of the findings gained from more traditional computer based learning.

Even though much is already known about m-Learning/Education, and many associated initiatives currently exist in the field, there is still a need for greater understanding of its impact on and potential for learning and teaching. It is necessary to know more about why m-Learning is important, who it is important for, what countries and companies are seeking to achieve and deliver through m-Learning, and the progress achieved so far.

3.3   Key principles

In responding to these issues, the Working Group adopted six main principles:

- It should not seek to replicate or duplicate existing initiatives, but should rather identify *relevant gaps* where the ITU has a competitive advantage.

- It recognises a diversity of views and opinions.

- It should promote *good practices*, which can then be localised and adapted in particular contexts, rather than advocating a single best practice.

- M-Learning is but one aspect of a wider field of e-Learning/Education, and many of the principles of good practice in the latter are relevant to m-Learning.[6]

- There are many definitions of the mobile "m-" in m-Learning/Education. For the purpose of this exercise the term is being used to refer to *all kinds of education and learning undertaken through*

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[6]   The concepts of m-Education and m-Learning are subtly different, with the former often being used for top-down institutional structures (to facilitate learning within educational systems) and the latter more usually for bottom-up and less formal processes (to facilitate self-learning within and beyond the formal school environment). The Working Group believes that the term m-Learning is more appropriate for this title, reflecting an approach where the learner is at the heart of the learning process, and is therefore recommending a change in the Group's name to the m-Learning Working Group. We recognise that organizations such as the m-Education Alliance prefer the use of the term m-Education, since they see this as referring to the Education sector, whereas "learning" can refer to any type of learning. The distinction made in this report, and that is widely used elsewhere, is that "learning" is a process that primarily focuses on the experience of the learner, whereas "education" is more focused on the system and structures within which that learning takes place. Using "learning" suggests more of a user/learner-centred approach. This does not in any way, though, negate the importance of teachers as facilitators in the learning process. Indeed, teachers are crucial in m-Learning.

the use of mobile devices, most commonly mobile 'phones and tablets, but also including laptops and other devices where appropriate.[7]

- The Working Group aimed to be as inclusive as possible in its recommendations, recognising that many different types of m-Learning/Education initiatives have been developed and funded by a diversity of actors including governments, development agencies, the private sector (both as commercial services offered, and also as corporate social responsibility or other activities funded by the private sector), social enterprises and civil society.

3.4   Successful and promising m-Learning initiatives

The Working Group recognised that there are many existing m-Learning and m-Education initiatives, developed in a range of contexts. However, there is insufficient rigorous monitoring and evaluation of such initiatives to be able to reach firm conclusions as to what makes them successful.

Moreover, there are many different criteria for success, with members of the Working Group often having markedly different views on this issue. From a commercial private sector perspective, success is sometimes initially measured primarily in terms of the number of devices sold, or the profits generated, whereas from a teachers' perspective it is more usually measured in terms of learning outcomes in particular fields of study. Within the context of what some see as a global learning crisis, many governments place particular emphasis on key indicators such as numeracy and literacy.

Some of the more important success criteria include measures such as:

- Enhanced learning outcomes, differentiated by study subject.

- Value for money with respect to alternative modes of learning.

- Scale and number of users.

- Increases in the quantity and quality of learning materials/educational software available for mobile platforms.

- Attainment of relevant skills for employment, focusing especially on collaborative learning and assessment[8].

- Numbers of devices sold or rolled out to learners[9].

- Enhanced levels of Internet use, and thus revenue for ISPs and mobile operators[10].

- Enhanced use of education-based value-added services.

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[7]   Whether or not to include initiatives specifically focusing on laptops was debated at some length, but the dominant view in the Working Group was that the important attribute was the physical sense of mobility rather than any specific technological preferences. It is therefore important to be 'device agnostic' in discussing m-Learning.

[8]   These skills are sometimes termed 21st Century skills, but the term is not used here because not all members of the Working Group endorse this particular concept.

[9]   Although not all Working Group members accepted this criterion, it is included because it is indeed the fundamental underlying criterion of success for many companies, although not necessarily those represented on the Working Group. The fundamental rationale of all private sector companies is to make profit for their shareholders, and ultimately the number of devices sold is important. Moreover, for many governments, the number of devices given to learners is also often used as a criterion of success, even if there is no measurable impact on learning.

[10]   Again, this criterion was questioned by some members of the Group, whereas others recognized that although companies might not wish to be so blatant in their marketing, this is indeed an important criterion for them in terms of their rationale for encouraging m-Learning along with other mobile initiatives. Profitability would ensure sustainability of any m-Learning solution and encourage high quality and further innovation.

- Enhanced literacy and numeracy skills.

- Increase in employability of learners.

- Sustainability and funding mechanisms.

Overall, the Working Group strongly believes that there is a need to undertake further high quality assessments of the impact of mobile initiatives on learning outcomes, so that these can be shared more widely amongst all stakeholders.

Most such initiatives by definition have focused on the use of one specific technology, such as a particular brand of laptop, a particular mobile 'phone, or specific mobile game or piece of software. We strongly recommend that this approach be replaced by one in which mobile devices are instead integrated into a holistic systematic approach to learning that utilizes a range of technologies (e.g. books, desktop computers, tablets, mobile devices, the Internet) and activities or experiences to enhance learning. It should also be an approach that involves several different partners, each of which brings their own particular expertise to the initiative.

Another complexity in recommending m-Learning or m-Education initiatives that currently appear to be particularly successful, is that many such initiatives are not specifically designed for schools, but are instead focused on providing training for health workers or farmers, and therefore reflect overlap with these sectors. The approach adopted here has therefore been to focus primarily on initiatives specifically for formal education, although also including a small number that are for vocational and wider purposes.

Members of the Working Group identified many examples of initiatives that they believed were worthy of mentioning, some specific and some generic. Annex A3.2 provides a short list of such initiatives and gives an indication of the richness of this field. The following initiatives were seen as being particularly successful:

- *Agastya Mobile Labs (http://www.agastya.org/how/how-we-do-it/mobile-labs)* - Tapping the valuable resource of bright but underprivileged children and teachers in rural India, Agastya provides an environment in which they can create, tinker, seek solutions and find them. Agastya encourages enquiry from children, who are inquisitive by nature.

- *BBC Janala – Mobile phones for adult literacy (Bangladesh) (http://www.bbcjanala.com/)* - On TV, online, in print and accessible through even the most basic mobile phone handset, the multi-platform English language service also works through approximately 6,000 English clubs across the country.

- Dr Math (*http://mathforum.org/dr.math/*) - A question and answer service for maths students and teachers.

- *Mobiles for Education Alliance (www.meducationalliance.org)* - Consortium of international organizations focused on mobile technologies for education, primarily in developing countries.

- *Nokia Life Tools (http://www.nokia.com/in-en/support/faq/?action=singleTopic&topic=FA132357;* This is reportedly no longer operational, despite having 80 million subscribers*) - An* SMS-based subscription information service designed for emerging markets offering a wide range of information services covering healthcare, agriculture, education and entertainment.

- *Tangerine technology, RTI (http://www.tangerinecentral.org/)* - Electronic data collection software for use on mobile devices to enable recording of student responses.

- *Text2Teach, Philippines (http://www.text2teach.org.ph/)* - Aims to contribute to the quality of teaching and learning in underserved schools and communities in the Philippines

- *UNESCO's Mobile Learning work (http://www.unesco.org/new/en/unesco/themes/icts/m4ed/)* - UNESCO's programme of activities is based on growing partnerships geared towards exploring how mobile technologies can enable the achievement of Education For All.

- *Urban Planet Mobile (http://www.urbanplanetmobile.com/what-we-do)* - With products ranging from basic word and phrase lessons to TOEFL & SAT preparation, to a new online writing tool with assessment and tutorials, Urban Planet specialises in forward-thinking educational tools.

- Worldreader (*http://www.worldreader.org/*) - Using e-books to advance early grade reading.

- *Yoza (http://yozaproject.com/)* - originally known as M4Lit, providing m-novels in a funky youth-zone with engaging stories that include more Kontax episodes as well as stories from other genres, e.g. soccer, issues and teen romance.

Above all else, this survey indicates that there are not only many existing m-Learning initiatives, but also that there are already several global coalitions working in this field, notably the work led by UNESCO, the Mobiles for Education Alliance and the GSMA. This re-emphasises that whatever recommendations are made under the m-Powering Development Initiative recognise such ongoing work, and identify specifically the areas where the ITU and its partners are best placed to have an impact that is complementary to these existing activities.

3.5   Key m-Learning stakeholders

One of the specific remits of the working group is to identify the main stakeholders involved in m-Learning and m-Education initiatives.   The following provides a list of the generic and specific stakeholders identified the Working Group:

Generic

Many groups of stakeholders are involved in developing m-Learning solutions. Among the most important are:[11]

3.5.1   International organizations

- UN bodies (UNESCO, ITU, UNDP, UNICEF).

- Regional organizations.

- La Francophonie.

- Commonwealth organizations.

- Multilateral donors.

- Standards organizations.

3.5.2   National governments and public sector organizations

- Ministries

    o   Education.

    o   Communications/ICT.

    o   Finance/Commerce.

    o   Employment.

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[11] It is by no means easy to cluster these diverse stakeholders into mutually exclusive groups, but this classification is intended to emphasize the complexity involved, and to go beyond just a simple division into the public sector, the private sector and civil society.

- Education regulators and standards authorities.
- National curriculum authorities.
- Examination boards.
- Bilateral donor agencies.

3.5.3   Private sector companies

- Commercial publishers.
- Companies as employers.
- ICT industry (e.g. Apple, LG, Microsoft, Samsung).
    - o   Mobile 'phone producers.
    - o   PC and tablet suppliers.
    - o   Telecommunications equipment producers.
- Network operators.
- ICT solutions enablers[12] (e.g. Intel, Microsoft, Google).
- Telecommunications companies.
    - o   Infrastructure providers (e.g. Alcatel-Lucent, Cisco, Ericsson, Huawei).
    - o   Mobile operators (e.g. Orange, Vodafone, Mobilink and many others).
- Private Sector examination bodies.
- Software developers.
- Gaming industry.

3.5.4   Civil society organizations

- NGOs
- Think tanks
- Trade unions
- End-user associations

3.5.5   Educational and research institutions and staff

- Educationalists/teachers.
- Institutional leaders.
- Administrators.
- Universities (research and teaching).
- Schools.

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[12]   This term was not preferred by all Working Group members.

3.5.6   Citizens

- Learners.

- Parents.

- Open content providers.

- Groups of end-users.

3.5.7   Partnership organizations

- Alliances and networks.

This framework emphasises above all that many different types of organization have significant interests in m-Learning and m-Education, and therefore that it is important to adopt a holistic, inclusive approach to any such initiatives.

3.5.8   Specific stakeholders engaged in m-Learning and m-Education

Many specific organizations were also identified as having particular interests in m-Learning and m-Education, and these are listed in Annex A3.2. Among these, four stood out as being of particular prominence:

- *BBC Media (see for example http://downloads.bbc.co.uk/mediaaction/policybriefing/bbc_media_action_health_on_the_move.pdf)*

- *GSMA (http://www.gsma.com/connectedliving/meducation/; http://www.gsma.com/mobilefordevelopment/programmes/mobile-for-employment)*

- mEducation Alliance (*http://www.meducationalliance.org*)

- *UNESCO (http://www.unesco.org/new/en/unesco/themes/icts/m4ed/)*

3.7   Gap and challenge analysis

A key role of the Working Group is to identify existing gaps and the challenges that need to be addressed to ensure effective use of mobile devices for development.

Annex A3.2 provides an initial working list of such gaps and challenges, with the following identified by the Working Group as most significant:

- *The imperative need to ensure joined-up approaches across all Government ministries involved and to encourage cross-sector work*. It is important that Ministries of Education work jointly with telecommunication or ICT ministries within the context of their national ICT and broadband strategies.

- Open *Platforms for sharing mobile-learning content.* Not many yet exist, but such platforms could be valuable and effective resources for users to share content and to reduce duplication of effort.

- *Effective and rigorous monitoring and evaluation.* Not enough is yet known about what really works; there is a need for more direct evidence of success of m-Learning within the school system (K-12).

- *Sharing contextualised examples of good practices.* This is essential in order to reduce duplication of effort, and to avoid reinventing the wheel.

- *Affordability.* In many countries access to broadband either does not exist or is far too expensive for most people to use for learning. There is a need to work closely with other initiatives such as the work of the ITU Broadband Commission for Digital Development, and the Alliance for Affordable Internet to enable widespread access at affordable cost.

- *Connectivity.* There is a need to ensure universal access to the Internet, both spatially and also socially, as well as access at effective speeds.

- *Creation of effective multi-stakeholder partnerships* with the ability to implement; many people talk about partnerships, but not all have real expertise in crafting and implementing true multi-stakeholder partnerships.

- *Lack of relevant content,* especially in local languages, and differentiated according to the learning needs of students.

It should also focus especially on the core agenda of the Telecommunication Development Sector (ITU-D) and its Secretariat, the Telecommunication Development Bureau, whose main mission is "to foster international cooperation and solidarity in the delivery of technical assistance and in the creation, development and improvement of telecommunication/ICT equipment and networks in developing countries".

3.8 Good practices

Although there remain insufficient rigorous evaluations of m-Learning and m-Education initiatives, especially from a user perspective, there is widespread agreement amongst practitioners on good practices that can help to ensure success. Many of these build on the substantial literature on good practices in the wider field of e-Learning, as well as the experience acquired from existing m-Learning projects and initiatives.

Annex A3.2 provides references for some recent literature on effective m-Learning, and could provide the initial basis for a more extensive review of resources that could be used by stakeholders interested in developing m-Learning initiatives.

Annex A3.2 lists all of the good practices identified by Working Group members. Of these, the following were the most frequently cited as being of most significance:

- *Focus on learning outcomes not technology*; Mobile devices should be seen as a tool to implement pedagogy and as one of many such technologies available to teachers.

- *Involve teachers and users at all stages from design to implementation and review*; ensure that effective in-service and pre-service training, as well as on-going peer support, is available.

- Consider sustainability, maintenance and financing right at the beginning.

- Think holistically and systemically.

- Ensure that all relevant government ministries and departments are involved.

- Ensure equality of access to all learners, especially those who are marginalized (particularly those with disabilities and those without access to existing education systems).

- *Appropriate and rigorous monitoring and evaluation must be in place*; independent peer reviewed evaluations should be disseminated widely.

- Involve participatory approaches in design so as to ensure that adopted technology is user-centric.

In identifying these good practices, it is important to stress that they should not be seen as "best" practices that will always lead to success. Indeed, an important overall aspect of this report is that it has very explicitly avoided the notion of "best practices" in favour of an approach that encourages those engaged in developing m-Learning initiatives to draw on a range of good practices that are relevant to their own geographically diverse national or local contexts.

4   Working Group on m-Commerce

4.1   Summary

Mobile solutions facilitate easy access to new markets and lead to sustainable development with their potential to reach masses in the developing world. Mobile connectivity and increased use of mobile devices therefore offer tremendous opportunities for companies, businesses and governments to propose a wide range of services at practically any time and in any place.

As the uptake of mobile devices and mobile connectivity gained momentum, many businesses and governments recognized the possibility to conduct commercial transactions using mobile technology. This has led to the development of modern m-Commerce systems, including an m-payment component, without which no service can claim to be mobile.

M-Commerce systems have naturally emerged as a result of e-Commerce systems. During this process they evolved from simply transferring e-Commerce principles to mobile devices and to special applications stored and operated in a protected environment, to provide strong multi-factor authentication, data encryption and menu usability. The success of mobile technology, the growing popularity of smartphones, and the development of cryptography all contribute to prospects for mobile devices to perform secure wireless payment, banking, and other remote transactions requiring a high protection level. Due to its central role, m-Commerce is perceived as a tool to leverage all other mobile services.

This report focuses on the main characteristics of m-Commerce systems and also provides an overview of various best practices.

4.2   Mobile-based services

The attractiveness of mobile devices for the delivery of m-Commerce, m-Health, m-Education, m-Government and other services can be explained by many factors. First, mobile devices are the most widespread form of ICTs in use today. Due to technological progress, modern mobile devices now have powerful core processors and operate over high-speed communication channels, using 3G and 4G broadband networks. Thus, the costs of mobile devices and the communication channels they use have become more affordable and continue to show a downward trend. Today, there are nearly as many mobile devices as people in the world.

Secondly, mobile devices are "always on", allowing users connectivity practically anytime, anywhere, even in moving transport. The great potential of mobile devices is evidenced by the particular attention paid to them by numerous organizations, including the ITU, which has elaborated standards for the security of mobile financial transactions, while actively sharing experience in this area. During the period 2010-2014, Study Group 2 of the ITU Telecommunication Development Sector (ITU-D) developed a "Toolkit for creating ICT-based services using mobile communications for e-government services" to explain how to use these standards and to demonstrate how mobile-based systems are built in various countries.

Mobile technology progress, the growing popularity of smartphones, and the development of cryptography all contribute to the prospect of mobile devices offering secure wireless payment, banking, and other remote transactions requiring a high level of protection.

Mobile devices offer a wide range of communication options, which can be used to provide remote services:

- Voice-based services are available through voice communication with the operator of a call centre or IVR system. These services are convenient for the elderly and visually impaired persons but lack a high security level: information is openly transferred while authentication is carried out using the phone number and code words.

- Web-based platforms using Internet services developed for desktop computers. Authentication is mainly carried out using a password – sometimes a one-time password. Encryption is available using the SSL protocol, but these services are not entirely suitable for use on mobile devices owing to the particular characteristics of the latter (small screen and degraded keypad).

- SMS or USSD-based services are specific features of mobile devices. They lack a high level of security and are not very user friendly. Authentication is carried out via MSISDN; encryption is not available. Due to their low security level, SMS or USSD-based formats offer only a limited range of services and have restricted payment limits.

- Services based on special applications in mobile devices or Secure Element are the most appropriate for users. Depending on implementation, they can provide maximum security for multi-factor authentication and data encryption, operating within a Trusted Execution Environment.

4.3   Classification of m-Commerce services

Mobile commerce consists of Mobile Financial Services (MFS) and m-Marketing (see Figure 1 and Table 1). According to Figure 1, MFS consist of m-Banking, m-Payment and m-Money transfer. M-Marketing consists of mobile informing, mobile loyalty and mobile remote capture.

Figure 1: M-Commerce structure

Table 1: Definitions

Mobile device	A mobile device is a device with mobile communication capabilities such as a telecommunications network connection, Wi-Fi and Bluetooth that offer a connection to the internet or other communications networks. Examples of mobile devices include mobile phones, smart phones and tablets.
m-Commerce	Mobile Commerce is the delivery of electronic commerce capabilities directly into the consumer´s mobile device, anywhere, anytime via cellular and wireless networks.
Mobile Financial Services	Mobile Financial Services is an umbrella term used to describe any financial service that is provided using a mobile device.
m-Marketing	Mobile Marketing is the marketing process, using mobile devices for communication with customers, for the purpose of selling products or services.
m-Banking	Mobile banking in its simplest form lets a user retrieve the balance of an account, a small number of recent transactions, and transfer funds between accounts held by the user. In its widest application mobile banking is advanced enough to replace the entire suite of services offered through a bank branch and Internet banking services.

m-Payments	Mobile Payments are payments for which the data and instruction are initiated, transmitted or confirmed via a mobile device. This can apply to online or offline purchases of services and digital or physical goods as well as P2P payments, including fund transfers. Mobile payments are often divided into two main categories: proximity payments and remote payments. However, the two are converging as neither is tied to a specific technology.
Mobile Money Transfer (MMT)	A Mobile Money Transfer is the exchange of funds from one party to another, using a mobile device to either initiate and/or complete the transaction.
Mobile Informing	Mobile Informing is an information service, using mobile devices. The advantage of this service is that information comes directly into the consumer´s device, anywhere, anytime via cellular networks. Examples of such services include bank informing and advertising.
Mobile Loyalty	Mobile Loyalty is a loyalty system, using mobile devices.
MRC	The availability of cameras in smartphones has given rise to the ability to capture cheques, bills and other payment-related documents remotely instead of having to bring them to a bank. Using a mobile application, the user takes a picture of a document that is analysed by the MRC software to read out the payment instructions. The instructions are then submitted to the bank for processing. Alternative names for this type of feature are remote deposit capture, or mobile remote deposit.
MPS	Mobile Payment System

More terms and definitions used in mobile commerce are defined in "Mobile Financial Terms" Whitepaper (http://www.mobeyforum.org/whitepaper/mobile-financial-terms-explained-2/), issued by Mobey Forum. This document can be found in Annex A4.2 as extracted from the "Mobey Forum Definitions Whitepaper".

4.4   M-Commerce key drivers and key issues

Table 2: Key drivers and key issues

Key drivers	m-Commerce
	High penetration of mobile devices
	Always "on-line"
	Fast growing capabilities of mobile devices
	Trust
	Easy to use: comfort
	Cost savings
	Previous experience of Internet shopping
	Business opportunities
Key issues	
	Security
	Convenience and availability
	Regulation/Legislation
	International Standards
	Affordability

Key drivers

While talking about *"high penetration of mobile devices"* and being *"always on-line"* as key drivers, it is essential to distinguish between mobile phones and those mobile devices, like tablets, that need not

always be connected to a network. Mobile phones need to be continuously connected to the mobile network. Other mobile devices such as tablets may only be connected sometimes to the Internet. For a developing country, the mobile phone may be of greater relevance due to their ubiquitous presence and continuous connectivity to the mobile network. Devices such as tablets may be less significant due to low levels of penetration of Internet and broadband, at present. Hence, drawing a distinction between mobile phones and other mobile devices and between mobile phone networks and the Internet will help to focus attention on the relevant key drivers in different countries.

"Fast growing capabilities" of mobile phones, with more varied modes of making transactions, applications or programs in local languages that could remove the language barrier to entry and use of mobiles for banking etc. are key drivers to growth of m-Banking and m-Commerce.

"Trust", *"ease of use"* and *"cost-effectiveness"* are crucial drivers for the establishment and growth of m-Commerce services. To engender trust in m-Banking, it is important to not only ensure the security of money in the mobile or bank account but also the security of underlying mobile transactions. This can be a key driver for increase in the banked population in rural and remote regions of developing countries where the use of traditional forms of banking is seen as a complex and cumbersome process, further restricted by the limitations of transportation and social structure. A person could be giving up an entire day's wages just in order to make a trip to the bank to undertake a financial transaction.

Use of ATMs and carrying cash from one place to the other is also extremely unsafe. M-banking as a safer alternative would bring this large hitherto-unbanked population into the ambit of banking services. As the target population may largely be neither highly literate nor tech-savvy, it is essential to make the transaction process simple and easy to comprehend, with the language of communication not acting as a barrier. A well-established customer complaints redressal system in case of failed transactions would further establish trust in the system. Mobile banking would also be so much cheaper for the banking organization which would otherwise have had to set up bricks and mortar outlets to reach such populations.

"Previous experience of Internet shopping" may aid in building familiarity with the system among customers for m-Commerce. However, Internet penetration in developing countries is very limited, especially among the poor in remote regions; therefore such previous experience is likely to be limited. This would not stand in the way of growth of services such as m-Banking using simple interfaces over mobile phone devices. Experience of Internet shopping may be useful for system enablers and system providers.

As regards *"business opportunities"*, establishment of new business entities like aggregation platform providers that provide a common platform to connect several banks and telecom service providers (TSPs) has eased the transaction process and proved to be a key driver for growth of m-banking. Such platforms, by improving efficiency and merchant-buyer interactions also encourage the entry of more merchants into doing business, thus further facilitating opportunities for business.

Key issues

Security is most essential as it engenders trust and faith. Regulations in this area should include protection of transaction data privacy. *"Convenience"* is tied to ease of use and device capabilities; *availability* relates to the spread of devices amongst traders and enhanced network systems. Though *regulation* by telecommunications and banking regulators is vital, greater clarity will be required on *"legislation"* as a key issue in the present context – i.e. what exactly are the areas in which legislation will be required? *"International standards"* are good for setting interoperable platforms across countries and also to set technological standards for various modes of transactions such as IVRS, SMS or USSD-based mobile transactions. The role of international standards is also very important in terms of security.

Affordability is another key issue which needs to be considered: Should the customer or the bank pay the telecommunication service providers for the m-Banking services rendered? The bank, though saving costs by increasing the customer base without incurring the usual costs of opening a branch, ATMs etc., is not able to make profits out of the zero balance accounts maintained by the targeted population that is largely poor.

4.5   Key m-Commerce stakeholders

Table 3: Main stakeholders

Main stakeholders	m-Commerce
Customers	+++
Professionals in technology and services	+++
Governments/Regulatory bodies	++
Banks	+++
Telco operators	+++
Services & App providers	+++
IT Technology vendors	++
Content providers	+
International organizations	++
Funding/Sponsors	+

In the view of the Working Group, the average customer, who has no alternate means of access to banking and financial services, is the central stakeholder and the m-Banking framework must essentially target this category.

Inclusion of banks as stakeholders is important because they perform key functions in m-Banking both in a bank-led and telco-led framework, as transactions from the bank account will require connectivity between the telco and the bank, possibly through a banking platform. It is also essential to include the relationship between the banking and telecommunications regulators and their responsibilities in the m-Banking framework. The eco-system around m-Commerce transactions needs a reliable communication carriage system and a stable payment settlement mechanism governed by regulations of the telecommunications and the banking sectors respectively (Table 3).

4.6   Requirements for m-Payment systems

Many existing payment systems are called mobile payment systems (MPS). Below is a description of current MPS models.

Two operation types should be available in MPS:

- Operations initiated by Clients (including P2P transactions).
- Operations initiated by Merchants.

In order to implement these operation types a unique identifier (ID) should be assigned to their users. A Mobile Station International Subscriber Directory Number (MSISDN) – a number used for the international identification of mobile phone numbers (International Standard E.164 ITU-T) – seems to be the most convenient User ID, as users generally remember their phone numbers and therefore will not have to memorise a different one for identification purposes. Besides, the ID may be digitally entered into devices which may, for example, only have an ATM number pad. At the same time, users may bind their digital ID to any unique pseudonym they define. In certain cases, pseudonyms allow users not to disclose their telephone number when conducting transactions.

The user can have several means of payment (numerous bank accounts, payment cards, mobile network operator accounts, operators of e-money payment systems, etc.). Thus, each means of payment is provided an alias during its registration. The user, after receiving a payment request from the seller, may select any one of them.

As an example: a user decides to make a payment in a restaurant and gives his pseudonym or telephone number to the waiter, who initiates the payment processing request on the restaurant payment system.

This request is forwarded by the system to the payer according to his ID. After agreeing to pay on demand, the payer selects an available means of payment from among those previously registered in the payment system and returns the response to request, providing an alias for the selected means of payment. The payment system uses the alias to identify the holder of the means of payment and the appropriate account.

The following means of payment may be used as sources for Mobile Payment Systems:

- Bank accounts.
- Bank cards issued by local or global payment systems, including virtual cards.
- Personal accounts of a mobile network operator subscriber.
- Other cash deposit and withdrawal accounts.
- E-money.

It is customary and often mandatory, that a maximal share of payments in the financial system of a given State be ultimately cashless. Cashless payments are carried out by banks and as such cannot be anonymous, thus enabling the State to monitor citizens' income and expenses and to counteract illegal business. Moreover, non-cash money is not kept in a piggy bank, but is actively used by the financial system, increasing the velocity of money circulation through the economy as people transact. This also appears to be a positive factor for the State. In some jurisdictions, the central bank may be reluctant to permit non-banking entities to function as banks - i.e. they may favour a bank-led means of payment including bank accounts and payment cards. However, it should be noted that the use of cards issued by international payment systems draws additional contributions to the latter, and also allows them to manipulate payment services. Consequently, non-bank means of payment may not be favoured by the State but may be attractive to users because they are easy to subscribe to and allow payments to be anonymous in some cases.

The inconsistency of these two tendencies can be resolved by limiting non-bank payment amounts and by the following measures:

- Licensing and registration processes.
- Customer identification.
- Record keeping.
- Internal controls and monitoring.
- Guidelines.
- Reporting obligations.
- Supervision and oversight.
- Preventive framework for cross-border transactions.
- Staff training.

4.7   System architecture

As mentioned earlier, the most convenient system for users has applications pre-loaded onto mobile phones. These applications provide multi-factor user authentication, encryption and decryption of transferable data; they also offer the user menu facilitating transactions. The entire application or that part of the application containing sensitive data should be stored in the Secure Element, which can be a SIM/UICC card, built-in storage, or a special tamper-proof SD card. Usage of SIM/UICC cards as a Secure Element seems very attractive, but makes the provider of m-Commerce services dependent on the mobile network operator which owns the cards. As noted by GSMA, which has been involved in discussions with the European Commission since 2001 on the various approaches mobile operators may use to enter the financial services sector:

- Mobile operator as a provider of telecommunications services only.

- Mobile operator as a provider of financial services.

Some opportunities presented by industry from both the mobile operator and consumer perspectives are listed below:

- **Complementary capabilities.** Mobile operators and financial institutions have different strengths and histories in these areas and significant work is necessary to deliver a good mix of capabilities combining financial services offered by financial institutions and the broad reach of consumers offered by mobile networks.

- **Ease of use**. As financial services and telecommunication services converge, it becomes possible for the mobile handset to perform a new array of digital services. The ease of use offered to both mobile subscribers and users of financial services is driving both industries towards a more inter-connected world.

- **Transparency and traceability.** All digital activities can be traced and the same is true of digital financial services. Using a mobile handset to pay for goods can allow both the payer and the payee to have access to transaction logs, adding more transparency and traceability to the activity compared to cash transactions.

- **Servicing unserved markets**. Many mobile money operators will look to capitalise on the ubiquity of mobile networks where financial services lack reach, as is the case in many developing nations. The value to the mobile subscriber is financial inclusion. For the mobile operator and a range of other service delivery agents, new revenue opportunities arise. The nation as a whole can benefit from the general uplift in commerce and the alleviation of poverty.

- **Servicing under-served markets.** Financial institutions incur additional costs when they maintain both cash-based and card-based payment systems, while the results of traditional banks are affected when they do not extend their services to low-value customers. Mobile money operators take advantage of the ubiquity of mobile handsets and networks to deliver low-cost financial services to capture high volume, low value transactions in a cost-effective manner.

In line with the context described above, the GSMA, for example, is committed to supporting the development of interoperable services in this area, in order to lower costs, increase choice and help the market grow in a sustainable way. However, in some countries only banks are authorised to offer financial services, meaning that mobile operators may not offer mobile payment services there. Some experience suggest that, mobile network operators may reluctantly cooperate with banks and that slows down the development process. So, tamper-proof microSD cards appear as an alternative to SIM/UICC cards, which allows banks to be independent from mobile operators as mobile payment service providers.

It is well known that reliability of authentication is reached by multi-factor authentication, which is the combination of three factors:

- Something you have (mobile device with the special application).

- Something you know (password or PIN code).

- Something you are (biometric).

Normally, two-factor authentication is used in regards to the first two factors while a password or PIN code known only to the user is used in the mobile device to protect against unauthorised application launch by an intruder. However, mobile technology is developing very rapidly, and new solutions and opportunities are emerging constantly. The most recent and interesting developments - from a financial services perspective - seem to be occurring in biometrics, with some of the most prominent companies (e.g., PayPal, Samsung, Apple TouchID) taking first steps in implementing biometric authentication solutions. There is a constant demand to know and learn more, and to keep abreast of both the most promising technologies available and their developers. Lately, due to the efforts of the Natural Security Alliance association, a standard biometric authentication method using fingerprints has come to the fore.

Biometric authentication can replace the PIN method. Otherwise, two-factor authentication may become three-factor authentication with the use of biometric authentication.

To ensure a higher security level, mobile devices will be able to provide a so-called Trusted Execution Environment (TEE), which protects from the interception of data transferred between units within the mobile device, such as between the keypad or the display and the Secure Element where the application is stored. An application should contain a minimum amount of sensitive information and store only the data required for user authentication and encryption keys. All remaining information, including credit card or accounts data, should be securely stored within the server by the payment system operator. Such allocation not only provides a higher security level, but also facilitates creation of new services and modification of existing ones with minimum interference in the mobile device.

The following factors define successful practical implementation of the system:

- Costs of system creation and maintenance.

- Financial losses due to fraud.

- Usability for customers.

Obviously, these factors may often contradict one another. Usually, a higher security level results in less convenience for users and higher costs in the creation and maintenance of the system, which means that customers will pay more for its use. These factors may prove dissuasive to clients. As mentioned above, security risks may be decreased by reducing the functionality of a system, making it less attractive to customers. According to stated user preferences, the system of their choice should be simple, convenient and elegant. This can be achieved by pre-loading special applications onto mobile phones.

The importance of certain parameters such as functionality and security is perceived differently in different regions. For example, the m-Pesa system, despite its relatively low levels of functionality and security, has gained huge popularity in several African and Asian countries. However, it is difficult to imagine that such a system could become popular in Europe or North America, where user security and protection requirements are considerably higher. The success of the m-Pesa system in these other parts of the world is due to its accessibility, low cost, the poor development of the local banking sector, and the high local demand for financial services traditionally provided by banks. Initiatives utilising mobile technologies to facilitate payments have successfully brought financial services to the doorstep of billions of unbanked poor people. One may conclude that the most attractive factor for developing countries with their under-banked populations is service availability, including the relatively low cost of service use, while in developed countries security and service functionality are considered the most important criteria. This brings into sharp focus the fact that developed and developing countries currently have different requirements for m-Commerce systems. Nevertheless, the future undoubtedly belongs to multifunctional and secure systems that become available at affordable cost.

4.8   Security of m-Payment systems

Prior to the era of smartphones, the management of mobile applications by operators on mobile phones was relatively easy. Basically, operators simply had to control the application that could be downloaded onto the device and its security characteristics. Management of mobile applications became more complex with the advent of smart phones and the ability to freely download third party applications. Nowadays, it is almost impossible to be completely certain that every application executing on a mobile device originates from a trusted source.

As a result, mobile users are subject to additional threats such as identity theft, phishing, and loss of personal data. Against this backdrop, it is evident that security is one of the most important requirements for payment systems, as well as for e-Government and e-Health systems, including their mobile variations. Security may be provided by meeting the Recommendations of the ITU Telecommunication Standardization Sector embodied in its manual entitled "Security in telecommunications and information technologies". These Recommendations are standards that define how telecommunication networks operate and interwork. Despite being non-binding, they are generally complied with due to their high

quality and because they guarantee the interconnectivity and consistency of networks and systems in and between different countries and enable telecommunication services to be provided on a worldwide scale. While some Recommendations relate to telecommunication networks in general, others refer specifically to mobile networks or to mobile payment systems.

Since mobile commerce systems involve many players, security considerations can be divided into multiple categories that include:

- End-point security.

- Mobile application security.

- Mobile network security.

- Identification of the requesting party that includes proper identification of the individual that is requesting the financial transaction.

The term "security" is used in the sense of minimizing vulnerabilities of assets and resources. An asset is anything of value. Vulnerability is any weakness that could be exploited to violate a system or information it contains. A threat is a potential violation of security. The ITU-T Recommendation X.805 "Security Architecture for Systems Providing End-to-End Communications" (Figure 2) defines a set of eight so-called "Security dimensions" designed to protect against all major security threats, described in the ITU-T Recommendation X.800 "Security architecture for Open Systems Interconnection for CCITT applications".

These security threats involve:

- Destruction of information and/or other resources.

- Corruption or modification of information.

- Theft, removal or loss of information and/or other resources.

- Information disclosure.

- Service interruption.

Security dimensions are not limited to the network, but extend to applications and end user information as well. In addition, security dimensions apply to service providers or enterprises offering security services to their customers. These security dimensions involve:

- Access control.

- Authentication.

- Non-repudiation.

- Data confidentiality.

- Communication security.

- Data integrity.

- Availability.

- Privacy.

Figure 2: Recommendation X.805 – Security architecture for end-to-end network security
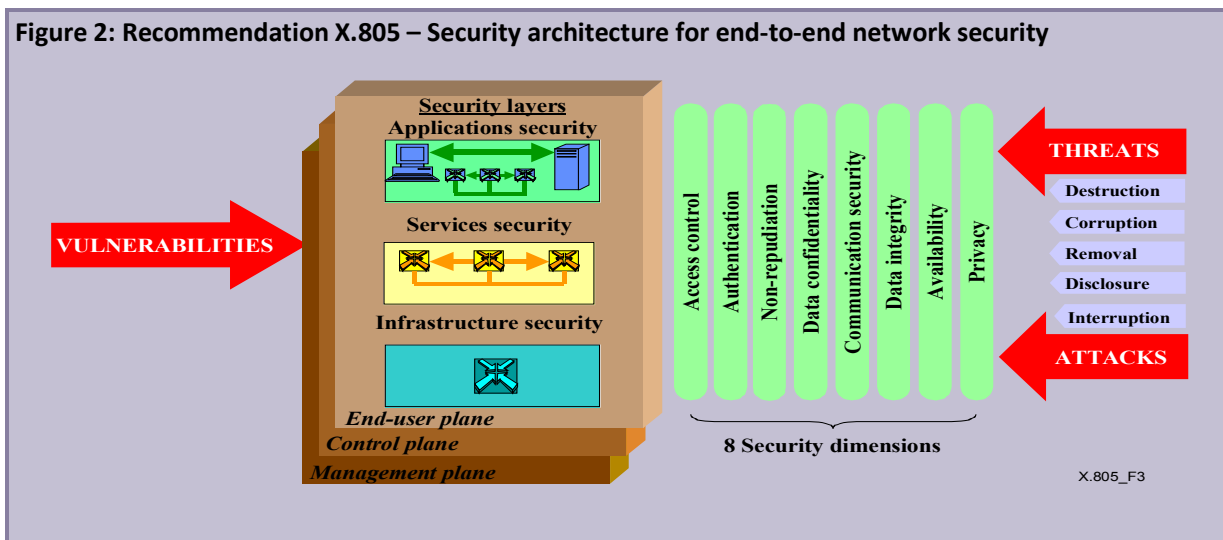
The ITU-T Recommendation X.1122 applies when using asymmetric cryptography, and provides guidelines for creation of secure mobile systems based on Public Key Infrastructure (PKI). This standard describes the generation of public and private keys, certificate applications, as well as issuance, activation, use, revocation and certificate renewal.

The ITU-T Recommendations Y.2740 and Y.2741 describe the security requirements and architecture of secured mobile financial transactions. These Recommendations, though made for mobile remote financial transactions in NGN, are fully applicable to ensure security for m-Payment systems in 2G, 3G and 4G mobile networks. The Recommendation Y.2741 "Architecture of secure mobile financial transactions in next generation networks" describes the system architecture and possible interaction scenarios. This 3-domain architecture of the m-Commerce system, compliant with the "3-D Secure" protocol with multi-factor authentication, is illustrated below (Figure 3).

Figure 3: 3-D architecture of m-Commerce system
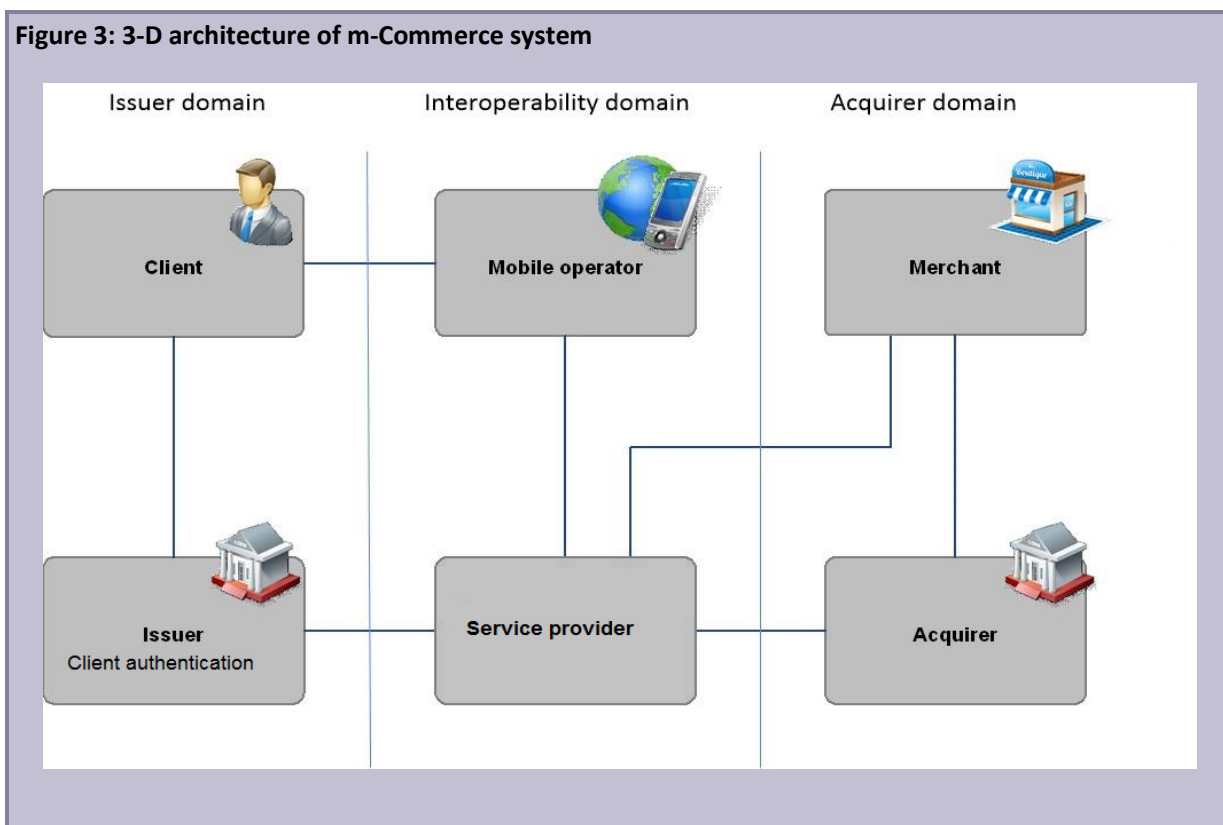
In this architecture, authorization of the financial transaction is carried out by the Issuer as a result of final authentication made by the Issuer's authentication system. Preliminary authentication, as well as the provision of security for the transmission and storage of sensitive data should be performed by the Service provider. In some cases roles can be combined. For example: Issuer and Service provider (bank-owned system) or Issuer and Acquirer (P2P money transfer within one bank), or even all roles, except Client (mobile operator top-up system). The scenario for Merchant-initiated payment is shown in Figure 4.

Figure 4: Scenario for Merchant-initiated payment (ITU-T Recommendation Y.2741)

NOTE – Security provider, client authentication provider, service provider.

ITU-T Y.2741(11)_F04
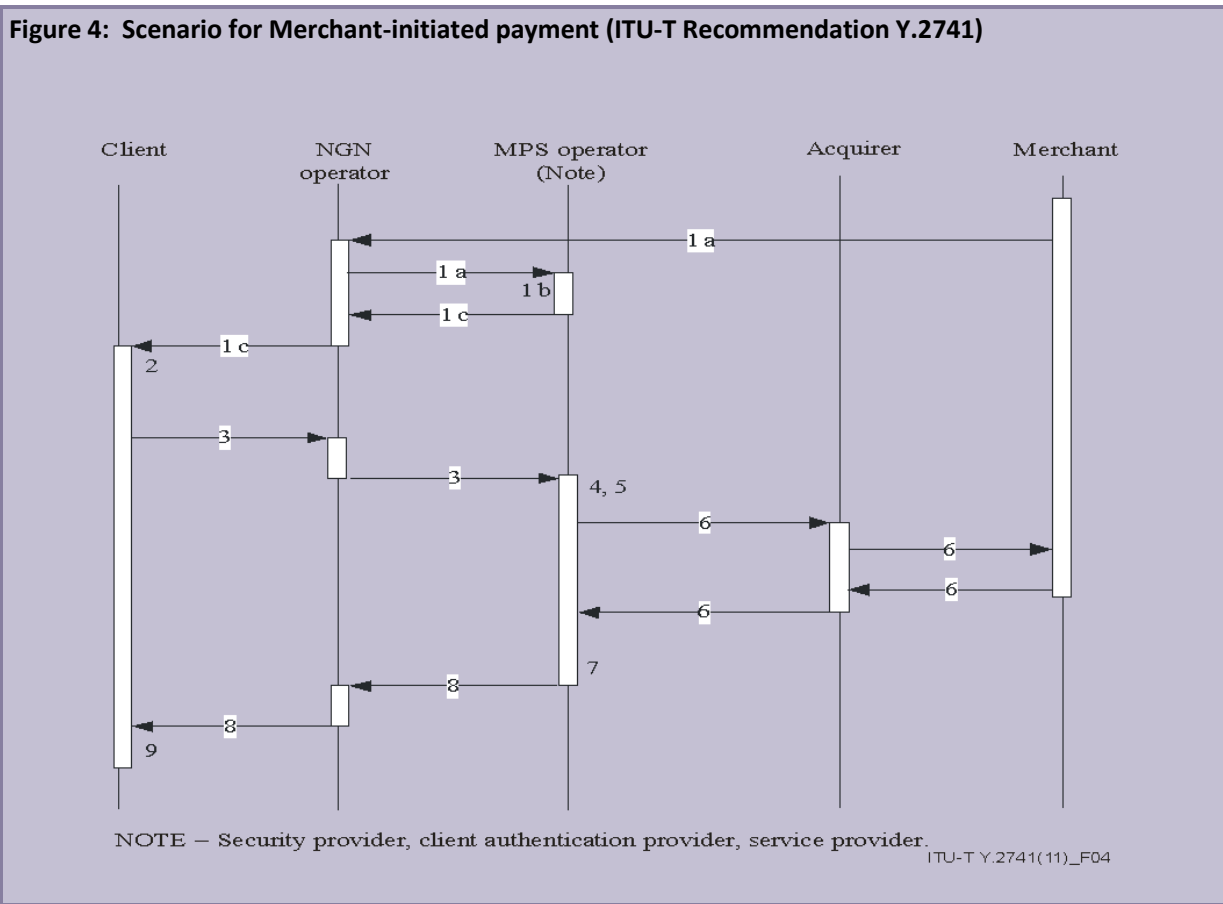
Recommendation Y.2740 "Security requirements for mobile financial transactions in Next Generation Networks" defines four security levels of mobile financial transaction systems (see Table 4). The fourth (highest) security level must have the strongest implementation of security dimensions.

Security Level 4 requires a Trusted Execution Environment (TEE), a secure area that resides in the application processor of an electronic device (see Figure 5). To help visualise a TEE think of a bank vault; a strong door protects the vault itself (hardware isolation) and within the vault, safety deposit boxes with individual locks and keys (software and cryptographic isolation) provide further protection.

Separated by hardware from the main operating system, a TEE ensures the secure storage and processing of sensitive data and trusted applications. It protects the integrity and confidentiality of key resources, such as the user interface and service provider assets. A TEE manages and executes trusted applications built in by device makers as well as trusted applications installed as people demand them. Trusted applications running in a TEE have access to the full power of a device's main processor and memory, while hardware isolation protects these from user installed apps running in a main operating system. Software and cryptographic isolation inside the TEE protect the trusted applications contained within from each other.

Device and chip makers use TEEs to build platforms that have trust built in from the start, while service and content providers rely on integral trust to start launching innovative services and new business opportunities.

Figure 5: User verification in Trusted Execution Environment
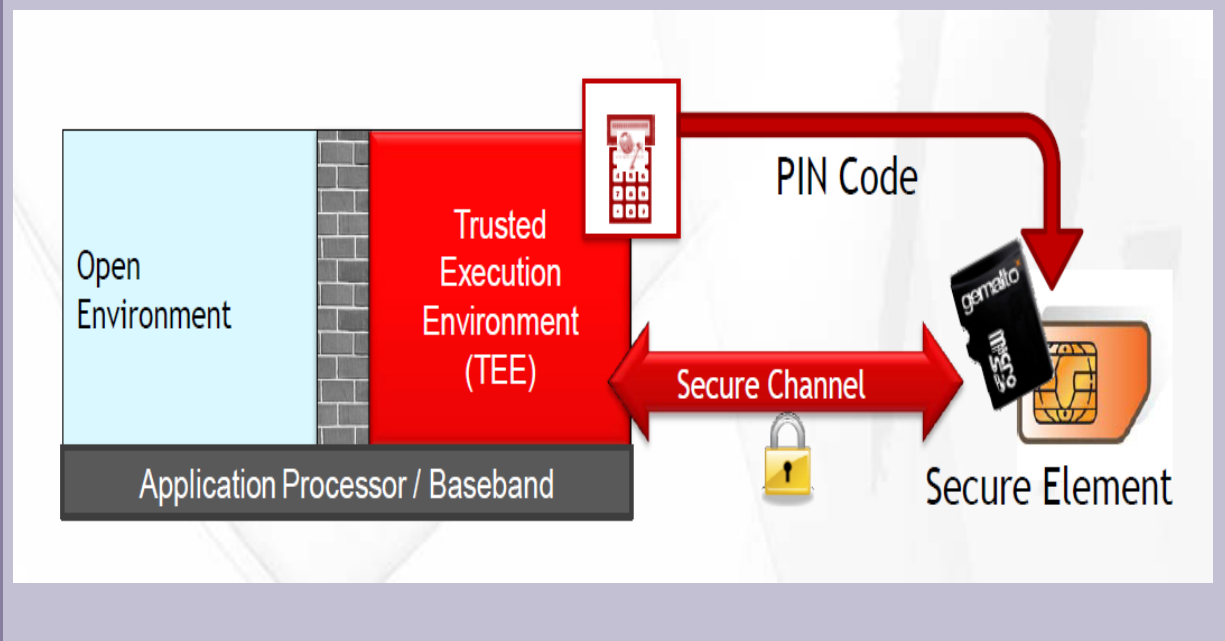
The era of mobile devices with the TEE has just started, but in the near future this technology will protect the Achilles heel of current mobile payment systems.

Table 4: Four Security Levels of MPS (ITU-T Recommendation Y.2740)

Security Dimension	Security Level			
	Level 1	Level 2	Level 3	Level 4
Access Control	Access to each System component shall be granted only as provided by the system personnel or end-user access level.			
Authentication	Authentication in the System is ensured by mobile network data transfer environment	Single-factor authentication for System services usage	Multi-factor authentication for System services usage	In-person connection to services where personal data with obligatory identification is used. Multi-factor authentication for System services usage. Obligatory usage of Hardware Cryptographic Module.
Non-repudiation	The impossibility of a transaction initiator or participant to deny his or her actions upon their completion is ensured by legally stated or mutually contracted means and accepted authentication mechanisms. All system personnel and end-user actions shall be logged. Event logs shall be change-proof and hold all actions of all users.			
Data confidentiality	Data confidentiality during data transfer is ensured by the communications security environment, and by the data storage mechanism together with the means of system access control – at data storage and	Data confidentiality during data transfer is ensured by additional message encryption together with data transfer protocols that ensure the security of		The implementation of Level 3 requires use of hardware cryptographic and data security facilities on the Client's side (Hardware Cryptographic module).

Security Dimension	Security Level			
	Level 1	Level 2	Level 3	Level 4
Data integrity	processing.		the data being transferred by the interoperation participants (including data integrity verification); at data storage and processing confidentiality, integrity and privacy are ensured by additional mechanisms of encryption and masking together with well-defined distribution of access in accordance with privileges and permissions.	
Privacy	Privacy is ensured by the absence of sensitive data in the messages being transferred as well as by the implementation of the required mechanisms of data storage and the System access control facilities. The System components must not have latent possibilities of unauthorised data acquisition and transfer.			
Communication	The delivery of a message to the addressee is ensured as well as the security against unauthorised disclosure at time of transfer over the communications channels. It is ensured by the NGN communications providers.			
Availability	It ensures that there is no denial of authorised access to the System data and services. Availability is assured by the NGN communications providers as well as the service providers			

Requirements for some security dimensions are unified for all security levels. Parties using MPS should be aware of the system security level and risks inherent in the system. The acceptable security risk level of any system component is determined by the party taking the risk. The degree of risk is the function of the security level and the amount of potential losses in the event of a security violation. The parties concerned can additionally mitigate the risks of using MPS though operational measures such as limiting the frequency or monetary value of individual transactions, and restricting use of the service to their most loyal clients. As an example, mobile operators offer top-up services that are risk-free because they only allow users to top up their own accounts by limited amounts using SMS.

In addition to ITU standards on security, the Working Group recommend study of the European Central Bank's "Recommendations for the Security of Mobile Payments" (which is currently a draft document issued for public consultation).

The European Payments Council stated in a 2012 White Paper on mobile payments that the mobile terminal should represent a "digital wallet" with authentication and digital signature components to replace multiple passwords, IDs and loyalty cards of merchants (Figure 6).

Figure 6: The digital wallet is replacing the leather one

With the rapid adoption and growth in mobile technologies, mobile payment services are being taken up throughout the world, albeit in different ways in the developed and developing regions. The only way to ensure that mobile payment processing is uniform is to develop and adopt global standards.

4.9   M-Commerce initiatives in different countries

India

In India, telecommunication service providers are allowed to provide only closed and semi-closed wallets to their customers - i.e. a telecommunication service provider customer who subscribes to an m-Wallet service has access to only a limited range of payment options. Bank-led m-Banking initiatives have however been encouraged by the Reserve Bank of India (RBI) through Business Correspondents (BC), which are agents of the bank facilitating the unbanked population in remote areas in opening bank accounts. Though cash deposits and withdrawals have to be performed with the BC personally, other types of transactions such as transfers and payments can be carried out by the account holder using a mobile phone. As m-Banking transactions involve multiple banking and telecommunication interfaces, a framework involving aggregation platform providers has been established to ease the transaction process and enhance the efficiency of the m-Banking system. The RBI has also appointed a Technical Committee on Mobile Banking to examine various options for providing m-Banking services, including the feasibility of using encrypted SMS-based funds transfer.

The objectives of the m-Banking project in India are:

- Low-cost/cost-free access to financial services (anytime access and low transaction costs).

- Quick and easy operability (transaction in most basic of sense, minimum paper work).

- Security and safety of public money (trust and reliability).

- Less obtrusive operational requirements (minimum balance requirement, daily transaction limit, minimum activity requirement etc.).

- Possibility of making frequent deposits and remittances.

In India, Unstructured Supplementary Services Data (USSD) has been identified as an appropriate communication channel for m-Banking services for financial inclusion, as it is available in almost all handsets and requires no additional application or accessories, which makes it attractive for use by someone with a basic mobile phone model. Hence, it is convenient, easily available, accessible and inexpensive.

The Telecom Regulatory Authority of India (TRAI) has taken steps to regulate tariffs for use of communication channels of telcos for m-Banking transactions as well as the quality of services. TRAI has prescribed an affordable ceiling tariff of Rs 1.501 per outgoing session for the customer for the use of USSD communication channels and has established a framework to facilitate banks and platform service providers to interface with telcos for use of not only USSD, but also SMS and IVR (Interactive Voice Response) channels to provide m-Banking services.

The following is a hierarchy of the various banking and financial services that can be used on a mobile phone:

Rudimentary banking services – deposit, information and transfer facilities

- Advanced banking services – payments between accounts to settle bills – including for utilities, payments for credit cards, merchant payment settlements.

- Payments for day-to-day transactions – e.g. payments at grocery stores, MPoS solutions

- Large transactions that are presently carried out on the Internet.

Russia

Various mobile payment systems have become popular in the Russian Federation. Some payment systems have minimum functionality limited to topping up the balance of a previously registered mobile phone and neither require nor provide security. Other mobile payment systems such as "Easy payment" and "MasterCard Mobile" have wide functionality and meet high security level requirements in line with ITU standards. Importantly, a high level of security does not entail any additional inconvenience for users. The transport environment integrates the full range of modern mobile communication standards. SMS and USSD have become quite widespread due to the growing number of smartphones in circulation and the development of standards for mobile telecommunication systems, and increased use of GPRS, UMTS and LTE.

Interestingly, equally present on the market are applications with "sensitive information" stored on tamper-resistance devices, and applications with data stored in the phone's memory. Despite being potentially less secure, the latter have become more popular with customers since they benefit from not having to change their SIM/UICC card. Yet, these applications carry the potential risk of enabling intruders to read confidential data from the phone's memory.

According to statistics, fraud usually takes place, not when applications on stolen phones are hacked, but because intruders or virus programmes penetrate clients' phones. This is the least protected system area, one that calls for a further increase in the security of mobile applications, especially in cases of very high risks of being hacked, for example to steal an official digital signature recognised by State entities.

Conversely, risks associated with payment systems can be limited by restrictions on the maximum amount allowed per financial transaction and the maximum number of such transactions allowed over a given period of time. Hence, the most important task in securing usage of devices working in open networks is to train clients how to use them and install anti-virus programmes. At the same time, the service provider should take all available measures to protect confidential information, as defined by the ISO 27001 information security standard and other similar standards.

In particular, there is a need to minimize the number of employees operating the system who have access to "sensitive data"; to assign different access levels to the system; and to provide mandatory authentication and login registration.

5 Working Group on Business Models

5.1 Summary

Widespread use of mobile devices, increased access to wireless networks in most countries, and more mobile technology-based lifestyles are the drivers that are changing the world. This change is evident in sectors where services provided receive significant support through mobile devices, including education, management, health and entertainment. These areas are the fast growing of mobile technology applications, and their potential is developing continuously.

5.1.2 Considerations in driving m-Powering applications deployment

Three broad conclusions can be drawn from the earlier overviews of sectoral applications:

- Large numbers of different stakeholders – many well outside the traditional communications sector - now exist in the mobile communications community and enjoy different drivers and perspectives on how they approach or respond to the market and its impact. For example, along with major private sector groupings are governmental and public sector interests and, increasingly civil society actors.

- Evaluating the m-Powering initiatives in progress suggests there is an extraordinary diversity of approaches now underway, and it is clear that no one-size-fits-all, and similarly that there are many good practices, but describing best practice remains elusive and probably unnecessary because of the importance of adapting existing good practices to local contexts.

- Many initiatives are still at a funded-trial stage and currently lack evidence on true scalability. However, to ensure sustainability and expansion, developing business models to support them will be key.

5.1.3 Systematic approaches to building business models

This report highlights the diversity and richness that is seen in the emerging m-Powering Development world. Given the diversity of approaches suggested above and throughout this report, it is important to consider this section of the report in conjunction with the sectoral contributions reported earlier, especially in terms of gap and challenge analyses.

- Developing a business model approach allows an exhaustive view of the context of any project or initiative in each sector. It includes key actors and stakeholders, resources, specific issues and key success factors with the following emphases: it is the approach that matters, rather than necessarily the specific elements included in the different business models that follow;

- Cooperation between all stakeholders, for example, and motivation of all of them will be key to success and needs to take, in some domains such as m-Education and m-Health, the form of strategic partnerships between different players to ensure quality and sustainability. There are likely to be many different approaches, but in each case all of the relevant actors need to be involved, and recognize the interests and drivers experienced by other stakeholders.

- Solutions will need to be scalable and sustainable, addressing multiple applications across global markets. Business models will themselves need to be extremely creative to adjust to changing needs and markets. This is complex: arguably, a business model that works as a pilot is unlikely to be scalable. Effectively, we need to be able to design and build at scale. This is a bright area of work for the future.

- Traditional players, such as telecommunications operators, will need to understand better the regulatory frameworks and risks inherent in providing these services. Likewise, traditional regulators might need to change their approaches so that they become more like facilitators of social and economic change. In order to generate more revenue, operators will need to move

beyond connectivity to providing value-added services that might extend beyond traditional telecommunications services.

The work of the Business Models Group is summarized in the present chapter. This elaborates on some possible frameworks for more formal approaches to business model construction, developing mainly a Value Chain chart and Business Model Canvas for each selected sector. Additional data and information are presented in Annex A5.2 (which includes some specific resources), or considered by the Working Group of the associated sector. As noted above, it must be recognised that this approach may differ in places from the accounts of the specific sectoral working groups, and there remains considerable opportunity for fruitful discussion around the most appropriate kinds of business model that could be developed for each sector.

5.2   M-Commerce

Mobile commerce refers to trusted transactions using a wireless device and data connection that result in the transfer of value in exchange for information, services, or goods. Mobile commerce, facilitated generally by mobile phones, includes services such as banking, payment, and ticketing. The availability and effectiveness of m-payment solutions is seen as a key success factor of m-commerce.
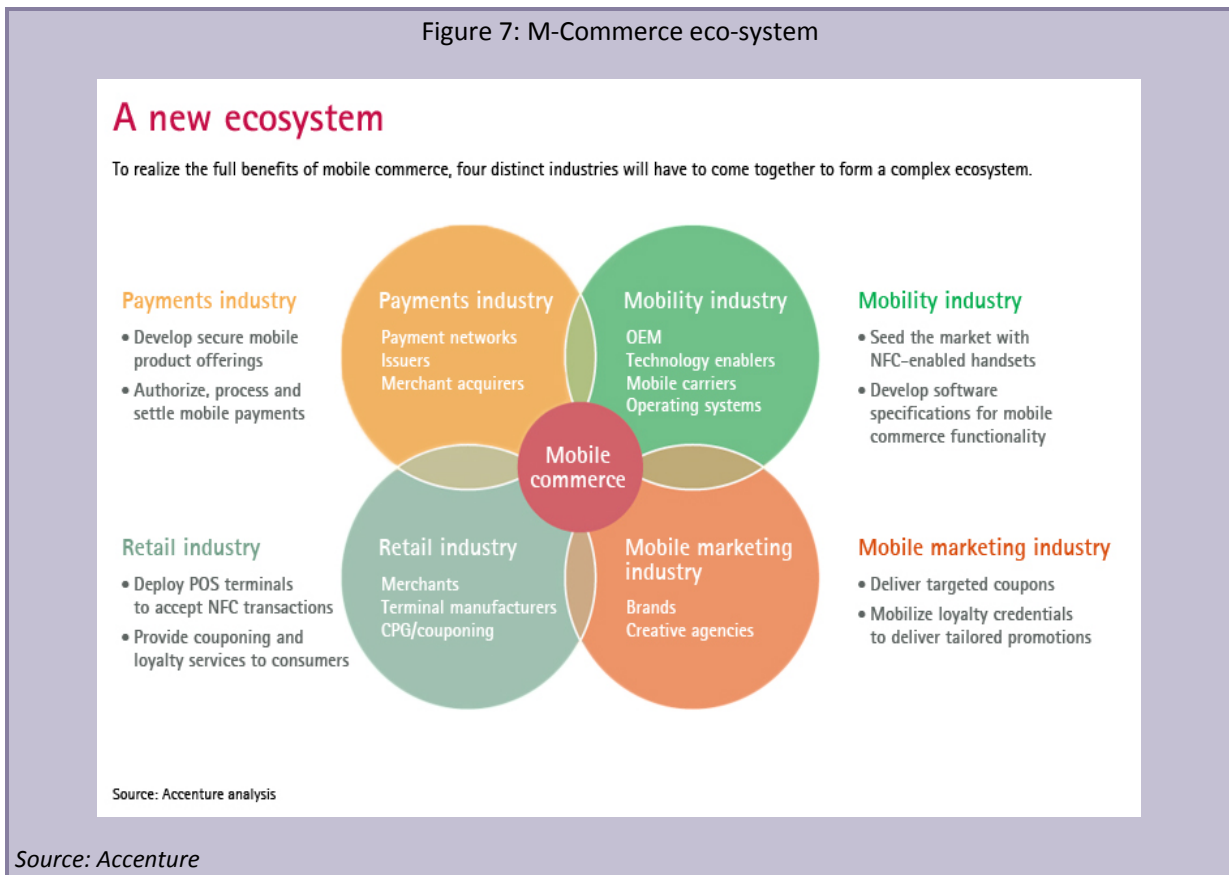
The marketplace will probably include multiple solutions for a considerable period of time. However, it appears likely that mobile NFC handsets will grow to be a dominant mobile payment solution. The ability to leverage existing payment system assets securely, in combination with enhanced mobile solutions for loyalty and offering management, will drive significant growth in NFC handset-based mobile payments.

A huge variety of companies jostle for position in this eco-system (Figure 7): Internet giants including Amazon, Apple and Google; mobile operators; financial institutions such as banks, credit card companies and PayPal; and others.

- Big players are present on all four segments.

- Application stores are determined by OS type.

- Mobile wallet segment is dominated by Internet giants.

- Mobile operators lead the SMS and the NFC segments.

5.2.1   M-Commerce ecosystem

Figure 7: M-Commerce eco-system

A new ecosystem

To realize the full benefits of mobile commerce, four distinct industries will have to come together to form a complex ecosystem.

Payments industry
• Develop secure mobile product offerings
• Authorize, process and settle mobile payments

Payments industry
Payment networks
Issuers
Merchant acquirers

Mobility industry
OEM
Technology enablers
Mobile carriers
Operating systems

Mobility industry
• Seed the market with NFC–enabled handsets
• Develop software specifications for mobile commerce functionality

Mobile commerce

Retail industry
• Deploy POS terminals to accept NFC transactions
• Provide couponing and loyalty services to consumers

Retail industry
Merchants
Terminal manufacturers
CPG/couponing

Mobile marketing industry
Brands
Creative agencies

Mobile marketing industry
• Deliver targeted coupons
• Mobilize loyalty credentials to deliver tailored promotions

Source: Accenture analysis

Source: Accenture

5.2.2   M-Commerce value chain

A single operator managed service offering (Figures 8 and 9)

Mobile operators could provide retailers with an end-to-end mobile commerce proposition, encompassing NFC and non NFC elements. They could deliver this either individually or by collaborating with other mobile operators.

First option: a single operator managed service offering

- This requires the development of a complex value chain involving significant costs.

- In this case, the mobile operator will have to work directly with a large number of third parties, such as application developers, loyalty programmes and digital signage providers, as well as retailers.
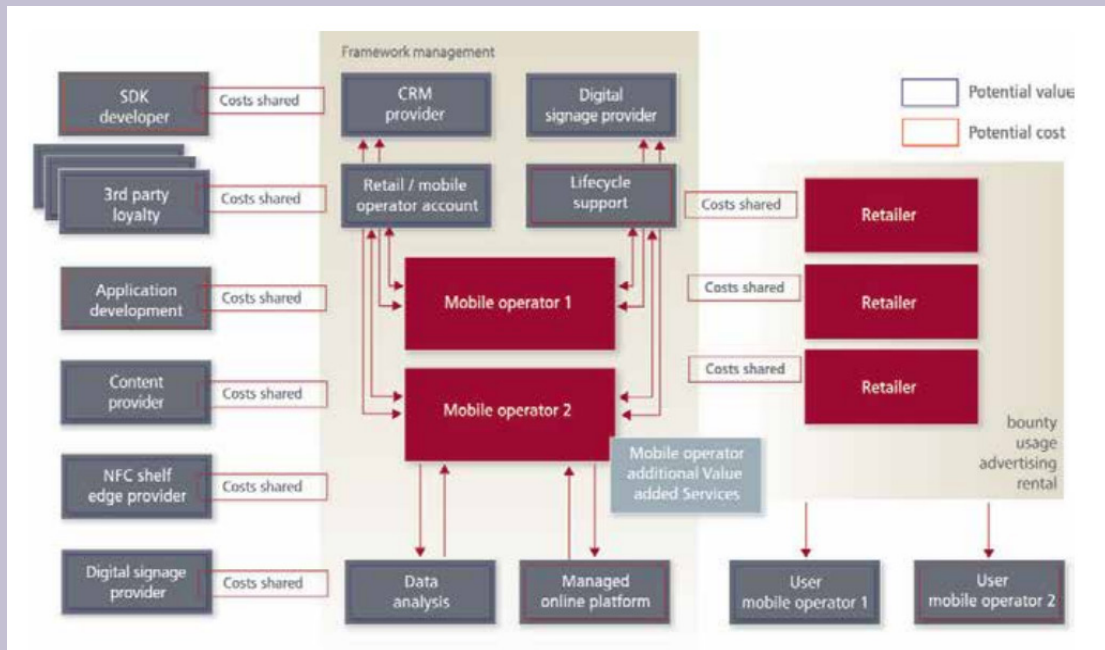
Figure 8
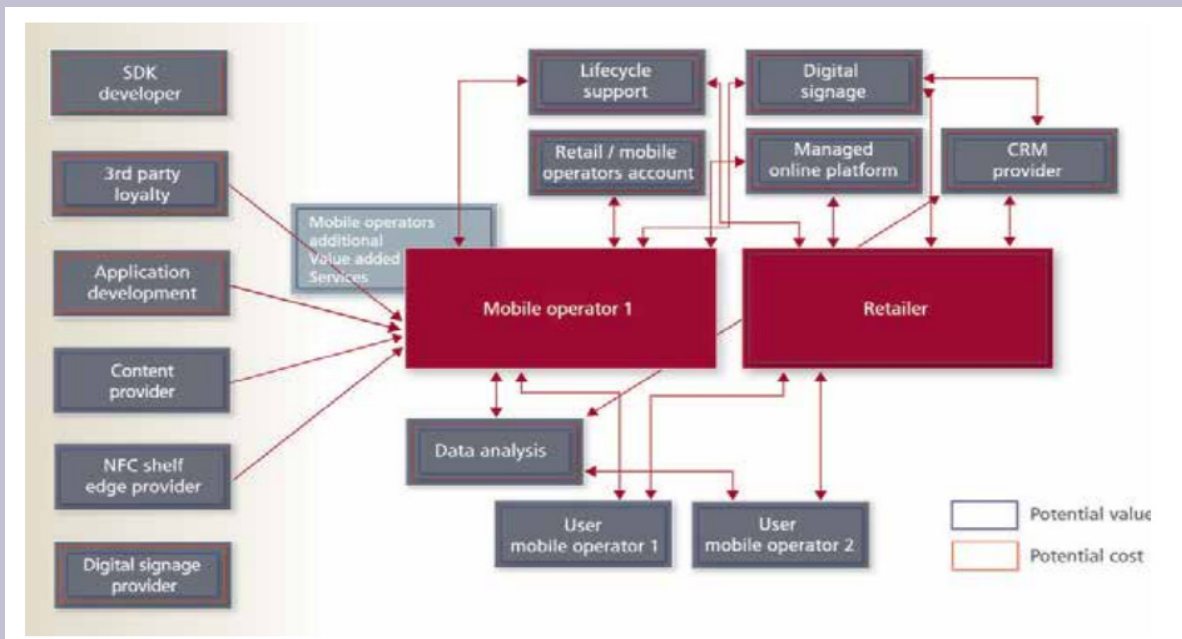
Source: GSMA

Second option: a joint operator managed service offering

- This could use framework architecture to generate economies of scale, and reduce costs and complexity.

- The use of common framework architecture across operators would remove the need for a direct relationship between each specialist supplier and individual operators.

- An application developer, for example, would then be able to create an application that is compatible with the framework, knowing it will work across multiple mobile networks. This means that individual mobile operators will share many of the costs with other operators and their suppliers will gain economies of scale.
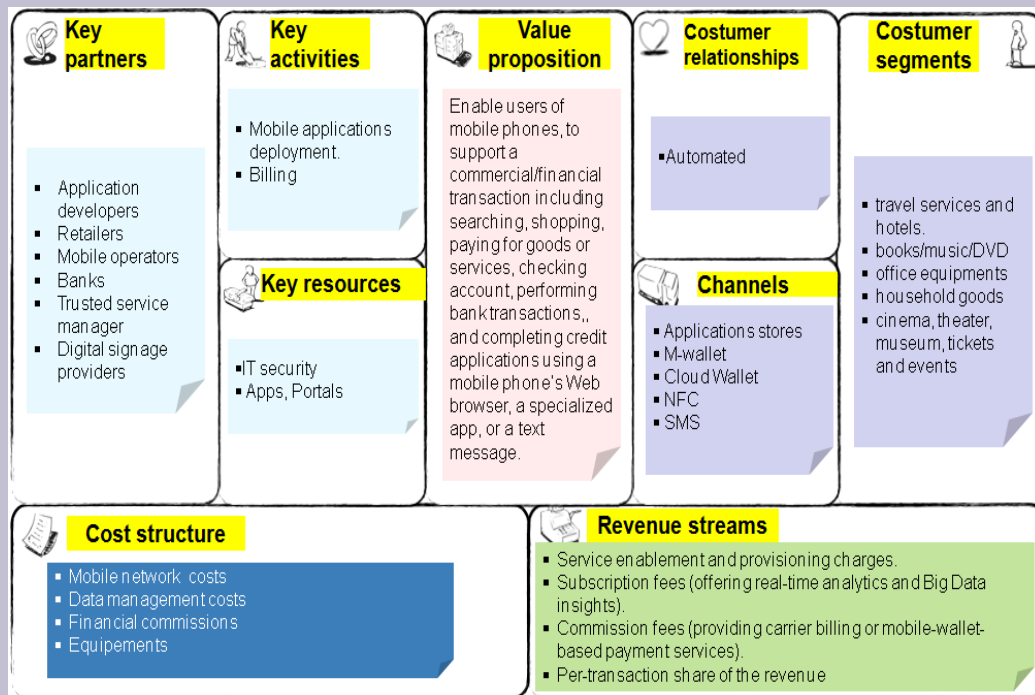
Figure 9

Source: GSMA

5.2.3   M-Commerce business model

**Figure 10: M-Commerce business model**

5.3   M-Education

5.3.1   M-Education value chain

Identifying the key players involved, as shown in Figure 11, is one way of illustrating the core elements of the moblile education value chain:

- **Enablers**: These initiate and drive change, facilitate collaboration and test and solve problems. They often develop pilots and projects bringing together suppliers, users and research organizations.

- **Device manufacturers:** These manufacture and distribute mobile devices for general use. They may target education settings or devices may be adapted for education.

- **Connectivity providers (mobile operators):** These enable devices to be connected to learning materials, other students and teachers, and the Internet.

- **Content providers:** These provide digital content to devices related to learning outcomes.

- **Distributors (service providers):** These distribute content and services to end users. They may also sell mobile devices.

- **Policy makers:** These influence and shape policy at a micro level. They may also set policy objectives, influencing curriculum, assessment and teaching standards. They are the main source of funding for m-education.

- **Education authorities:** These exert a certain level of control or influence over education providers. Likely to distribute some level of funding.

- **Educators:** These eliver education and learning, mostly in institutional settings.

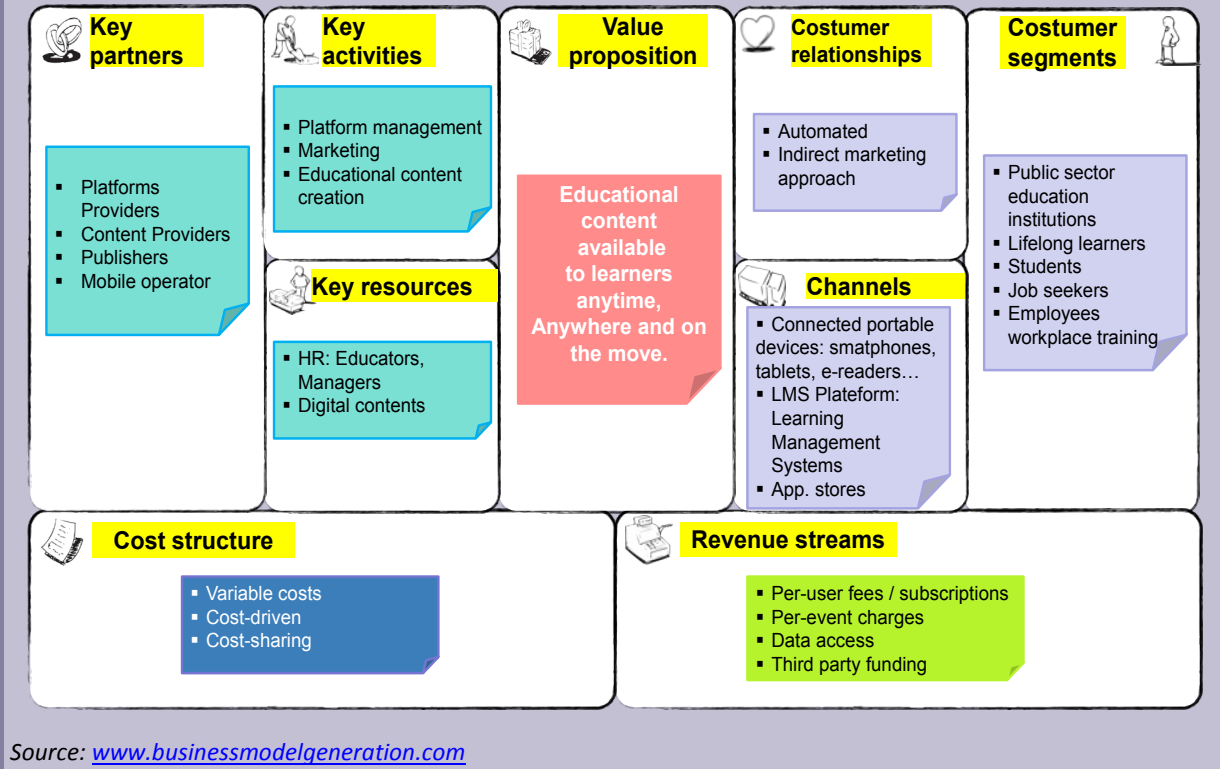- **End-users:** Students and teachers using mobile education and other informal users.

Figure 11: M-Education value chain
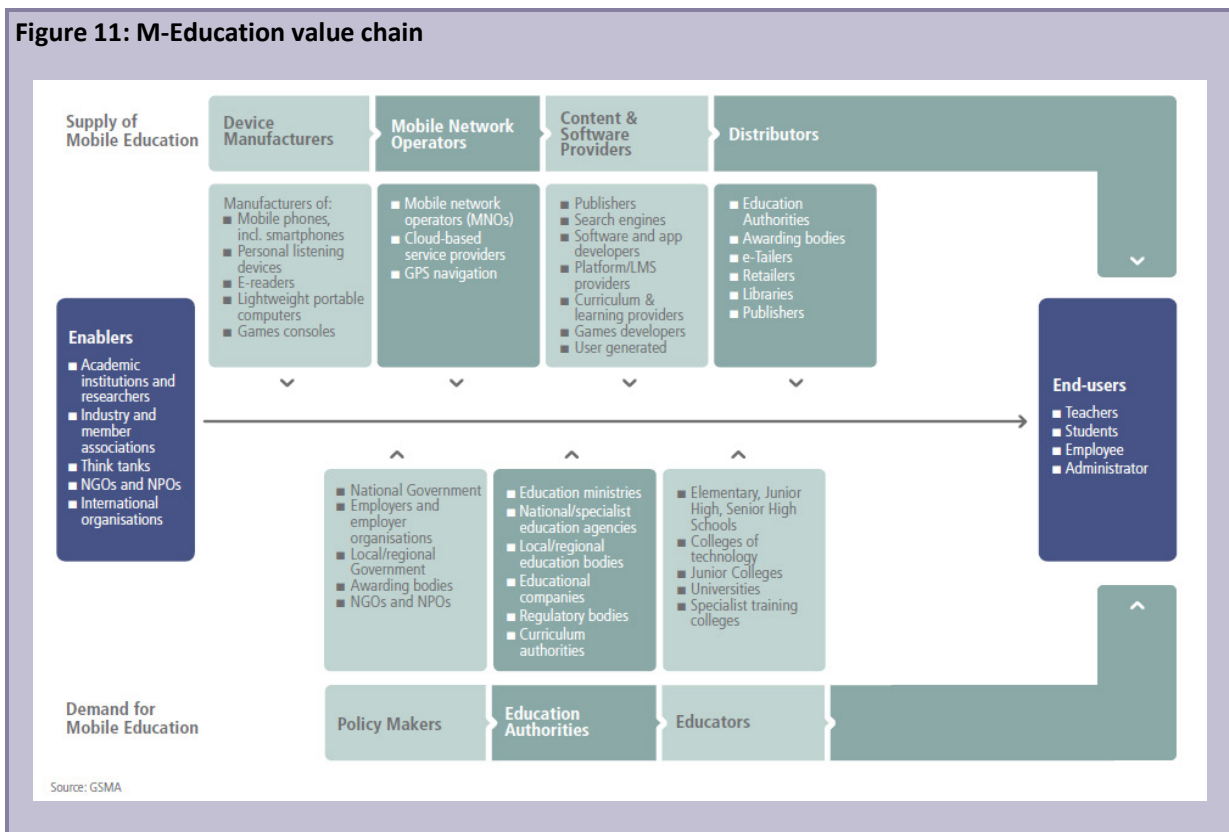
5.3.2 M-Education business model

Below is an illustration of the business model canvas for m-Education (Figure 12):


Figure 12: M-Education business model

Key partners
- Platforms Providers
- Content Providers
- Publishers
- Mobile operator

Key activities
- Platform management
- Marketing
- Educational content creation

Key resources
- HR: Educators, Managers
- Digital contents

Value proposition

Educational content available to learners anytime, Anywhere and on the move.

Costumer relationships
- Automated
- Indirect marketing approach

Channels
- Connected portable devices: smartphones, tablets, e-readers…
- LMS Plateform: Learning Management Systems
- App. stores

Costumer segments
- Public sector education institutions
- Lifelong learners
- Students
- Job seekers
- Employees workplace training

Cost structure
- Variable costs
- Cost-driven
- Cost-sharing

Revenue streams
- Per-user fees / subscriptions
- Per-event charges
- Data access
- Third party funding

Source: www.businessmodelgeneration.com

5.4 M-Health

5.4.1 M-Health value chain

Mobile healthcare services and applications demonstrate a clear benefit to all players in the value chain, ranging from MNOs and device manufacturers to patients. The m-Health value chain (Figure 13) is formed by several players:

- **Software vendors:** They develop applications and platforms to serve healthcare to patients and health workers.

- **Hardware vendors:** They manufacture and distribute mobile devices for patients and health workers (e.g.: smartphone, tablet, and healthcare devices such as the wireless Telcare blood glucose meter).

- **Connectivity providers (mobile operators):** They provide access to data through the mobile network and connected m-Health devices.

- **Content providers:** They provide healthcare-related content.

- **Funders (donors or investors):** They provide the necessary financial resources.
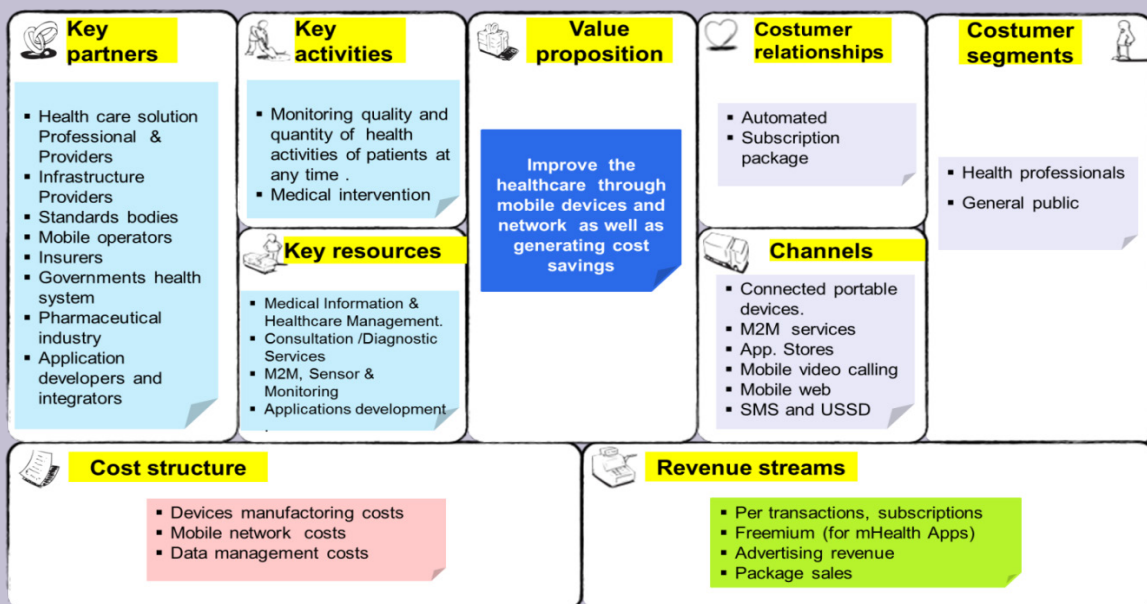
Figure 13: M-Health value chain
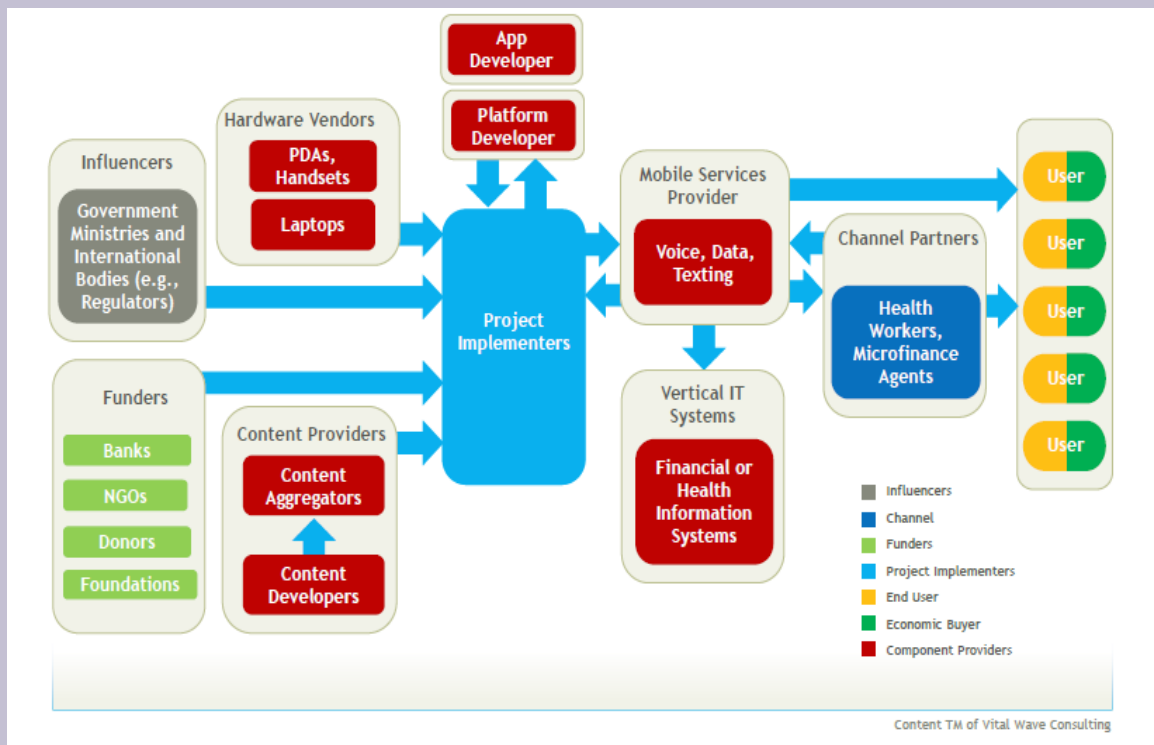
Source: Sustainable Financing for mHealth, Vital Wave Consulting, mHealth Alliance (2013)

5.4.2   M-Health business model

A prospective m-Health business model canvas is depicted in Figure 14.

Figure 14: Business model canvas for m-Health

Source: www.businessmodelgeneration.com

5.5   M-Governance

Mobile Governance can be defined as the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to citizens, businesses and all government units.

5.5.1   Market overview

The main uses may be classified in four categories of services:

- Alert services (information services, birth and death registration, emergency alerts).

- Interactive services (learning services, graduation results, interaction between agencies, between governments and employees, between governments and businesses).

- Management services (call centre, data update, daily grievance statistics).

- Utility services (SMS-based transaction).

5.5.1.1   Key benefits

The main beneficiaries of m-Governance are citizens, government units/organizations, and businesses (G2C, G2G and G2B). The main benefits are:

- Reduction of service processing time.

- Reduction of operating costs and less paper work.

- Early detection of problems and crisis.

- Enlarged accessibility (fast and easy access).

- Transparency: citizen becomes more loyal to the government.

- Increased participation of citizen. (empowerment).

- Satisfaction of citizen and private users: reduction of human error due to the automated process, elimination of queues, etc.).

5.5.1.2   Objectives

The main objectives of m-Governance are:

- To extend services where wire line Internet access is limited.

- To reach the masses through the use of simplest technology.

- To provide point to point delivery of government services in a personalized manner.

- To improve operational efficiency.

- To provide cost-effective services.

- To facilitate business interaction.

- To improve the lives of citizens.

5.5.1.3   Critical success factors

- A policy on e-Governance and m-Governance.

- The right data and clear needs for content developers.

- Available technology platforms (SMS, MMS, WAP, SMS Voice, Apps, M2M, Video).

- The existence of effective partnerships.

- The effective and real demand for m-Governance, user adoption.

- Minimized transaction costs.

- Communication and change management.

5.5.1.4   M-Governance services

M-Governance services mainly cover daily citizens' needs. Information provided may concern any of the following aspects of the daily needs of citizens, businesses and government units:

- Health information: SMS - appointments/preventive actions/alerts, etc.
- SMS birth and death registration.
- SMS for utility services (electricity, telecommunications bill payments, repairs, etc.).
- Travel information (public transport) using SMS/apps.
- Check information regarding bank accounts, transactions, property, investments, etc.
- Access to weather forecast information.
- E-Appointment advisory via SMS sent one day before appointment.
- Neighbourhood crime alert via SMS.
- Traffic information and payment of traffic fines.
- Information on current in-country trans-border wait times.
- Key economic statistical SMS service providing national economy estimates, consumer price index, wholesale trade index, etc.
- Electronic voting, political decisions.
- Economic indicators, exchange rates, currency converter.
- Key Government service phone numbers.
- Member of Parliament contact information.
- SMS graduation results.
- Prayer timing apps.
- Trade license status/ fees.
- SMS alerts for passport renewal, road tax renewal, traffic offences.
- Safety information.

5.5.2   M-Governance value chain

Main stakeholders

- **Telecommunications operators**: They provide services that are responsive to the demand of m-Governance users.
- **Government**: It develops policies and standards, coordinates between partners. Governments can also stimulate demand and create the local market.
- **Device manufacturers**: Manufacturers build mobile devices that can conduct voice or data transactions between proprietary networks and ensure updated operating systems.
- **Content providers**: they provide digital content to devices related to learning outcomes.
- **Infrastructure providers**: They manufacture and assemble switches, gateways, base station controllers, mobile switching centres, packet control unit, GPRS support node, gateways, WAP servers, PSTN interface and other circuit switches.
- **Application developers**: They create mobile applications to support m-Governance services, and support personalisation and synchronicity.

- **Content developers and enablers**: They compile content in mobile-ready formats so applications can immediately extract desired information, and package it according to users' requests.

- **End users**: Citizens, businesses and government units form the end user communities.

Figure 15 depicts a prospective m-Governance value chain.

Figure 15: M-Governance value chain

Source: Susan Cable, Public Technology Institute, 2010
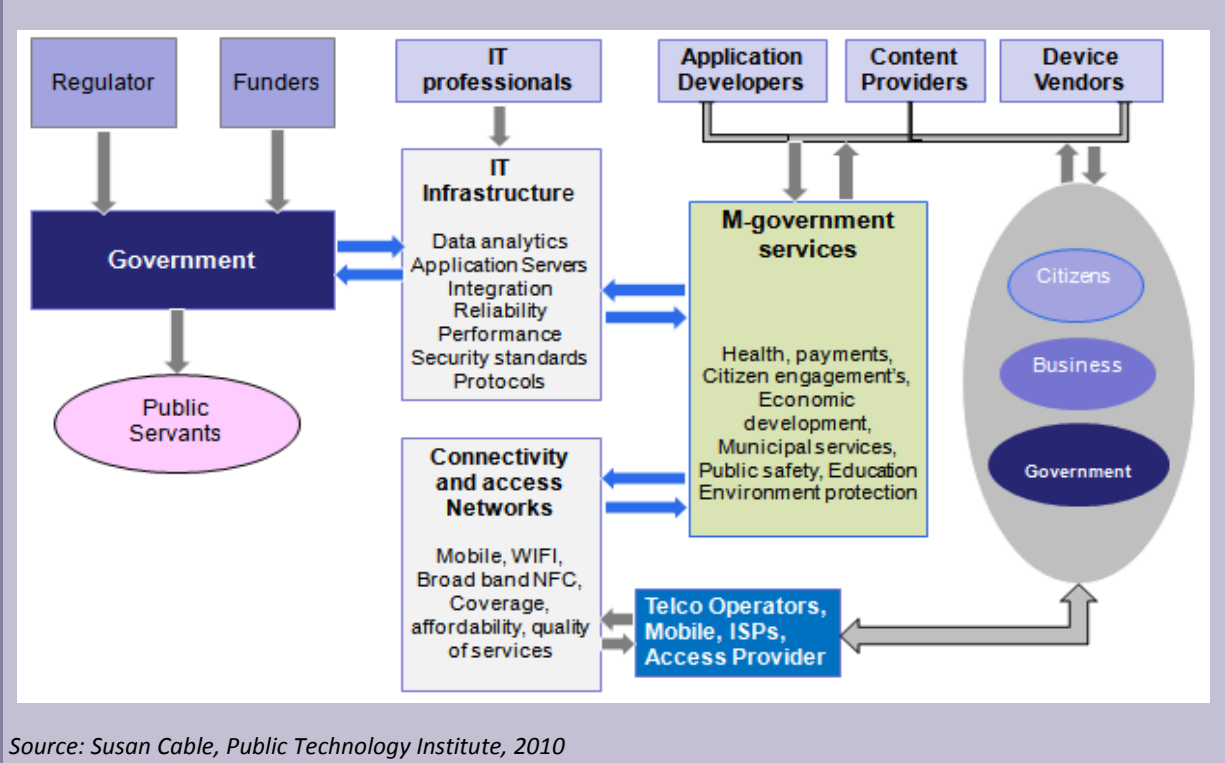
5.5.3   M-Governance business model

Figure 16 depicts a prospective m-Governance business model and Figure 17, a prospective business model canvas.
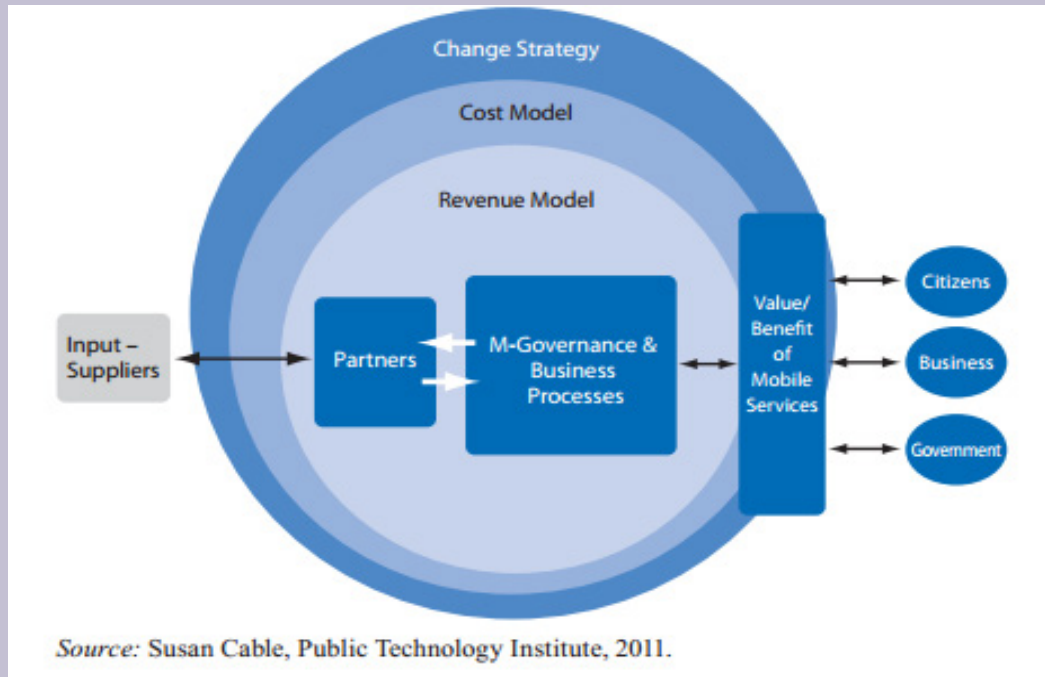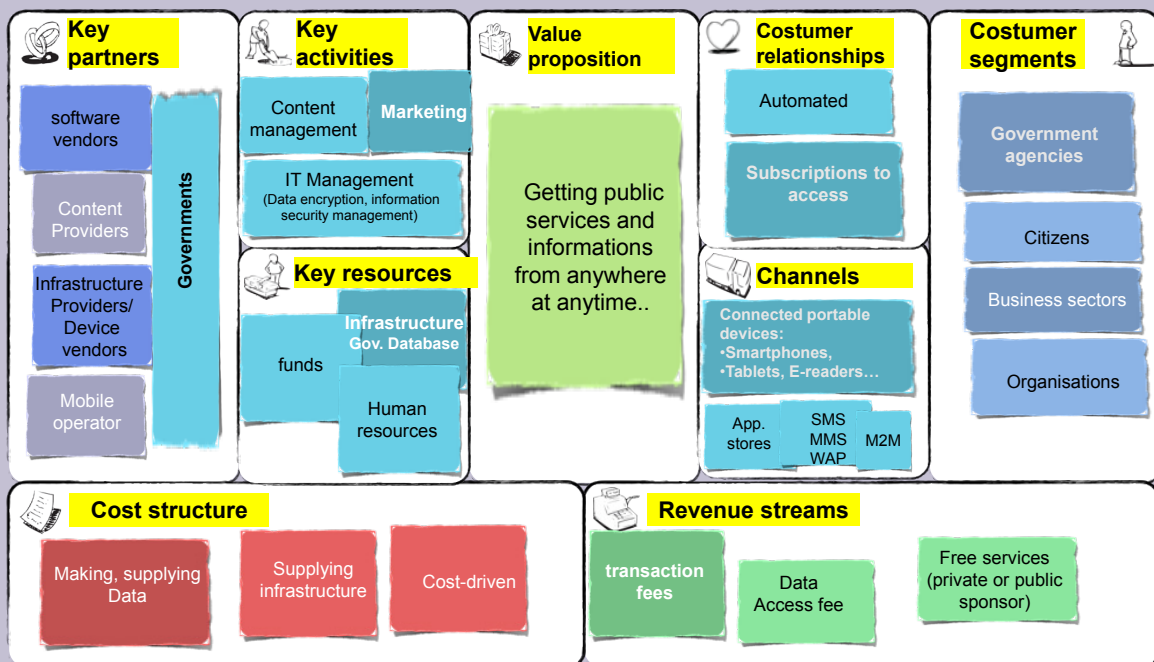
Figure 16: M-Governance business model

Source: Susan Cable, Public Technology Institute, 2011.

Figure 17: M-Governance business model canvas

Source: www.businessmodelgeneration.com

- As illustrated in Figure 18, an effective partnership (involving public and private sectors) is the key to success in any m-Government project. All stakeholders' benefits depend on synergies created and engagements of each player.

Figure 18: Benefits to the main stakeholders in m-Governance services

Source: Informa Telecoms & Media

5.6   M-Sport

Mobile sport includes services and applications for mobile phones that enable sports fans to keep track of their favorite sport, player or sports event at anytime, anywhere. It can include real-time information such as scores, rankings, news, statistics and more, or other functionalities including the integration of pictures, video of goals and other key events.

5.6.1   Market overview

Sports fans are using smartphones and tablets in growing numbers to access online sports content, according to a new report from Burst Media. Among all sports fans, 45.7 per cent use smartphones and 31.6 per cent use tablets to access online sports content and video at least occasionally, while 23.8 per cent use smartphones and 17.1 per cent use tablets to watch sports events live. These results point to the emergence of tablets and smartphones as sports content consumption platforms.

Viewers are no longer in a passive mode of consumption with user eyes riveted on the TV; rather consumers act and react in parallel on their smartphones or tablet computers.

A 2013 ON World report covers the growing market opportunities for mobile sensing solutions in sports and fitness including wearable wireless devices, MEMS sensors and mobile applications (Figure 19). According to this report:

- As profit margins continue to decline for hardware devices, paid mobile apps and subscriptions will become increasingly important. Global cumulative revenues between 2012 and 2017 for mobile sensing sports and fitness apps and subscriptions will reach $975 million.

- By 2017, there will be 500 million annual sensor shipments for mobile sensing health and fitness applications and two-thirds of these will be for activity tracking.

- By 2013, 150 million downloads of mobile sensing health and fitness apps had occurred and this number is set to increase 900 per cent to 1.4 billion over the next five years

Figure 19: Mobile sensing solutions market
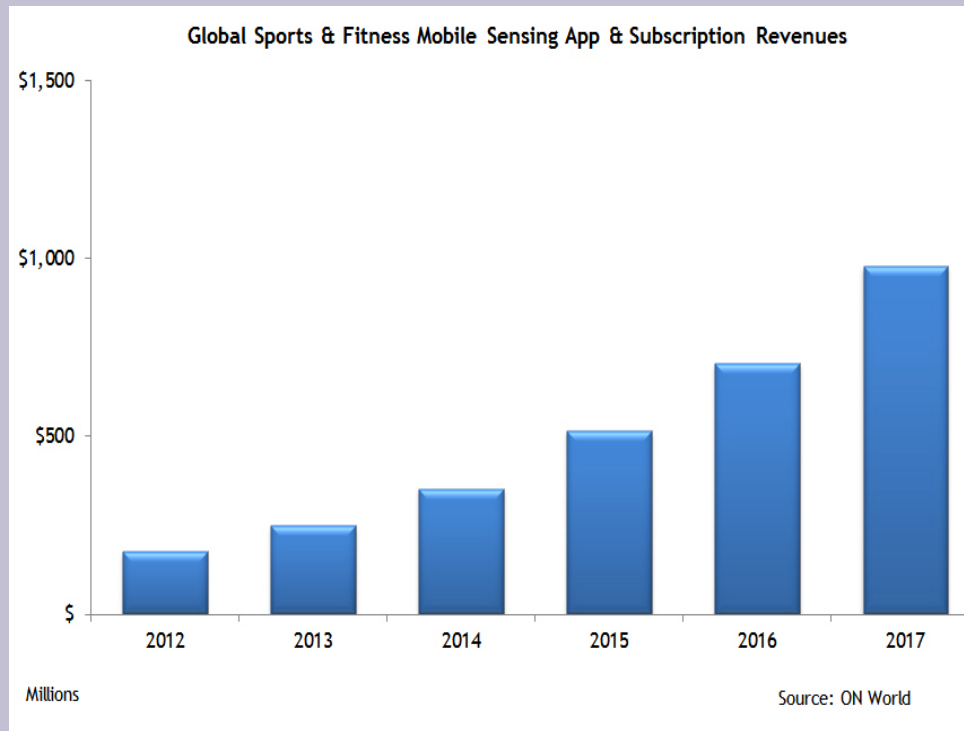
5.6.2 Advertising in sport

Mobile sport may serve as a vehicle for the promotion of elements that can be a physical product, an event or a brand name. The goal is to provide the client with strategies to promote the sport or to promote something other than sport through sports.

Advertising in sport can be divided into three sectors:

- Advertising of sports events and sports associations such as the Olympics Games, the European Football League and other types of sports competition (e.g. athletics meetings, handball, volleyball and tennis tournaments).

- The use of sports events, sports teams and individual athletes to promote various products that may - but do not have to be - directly related to sports.

- Sports event marketing to increase public audiences.

Mobile sports products can be classified in four groups:

- Sports events: player appearances, arenas/stadiums.

- Sports goods: equipment, apparel, sportswear, footwear.

- Sports training: fitness and health services, sports camps and instruction.

- Sports information: magazine, radio, TV, SMS, MMS, applications.

5.6.3   M-Sport business opportunities

Figure 20: M-Sport business opportunities
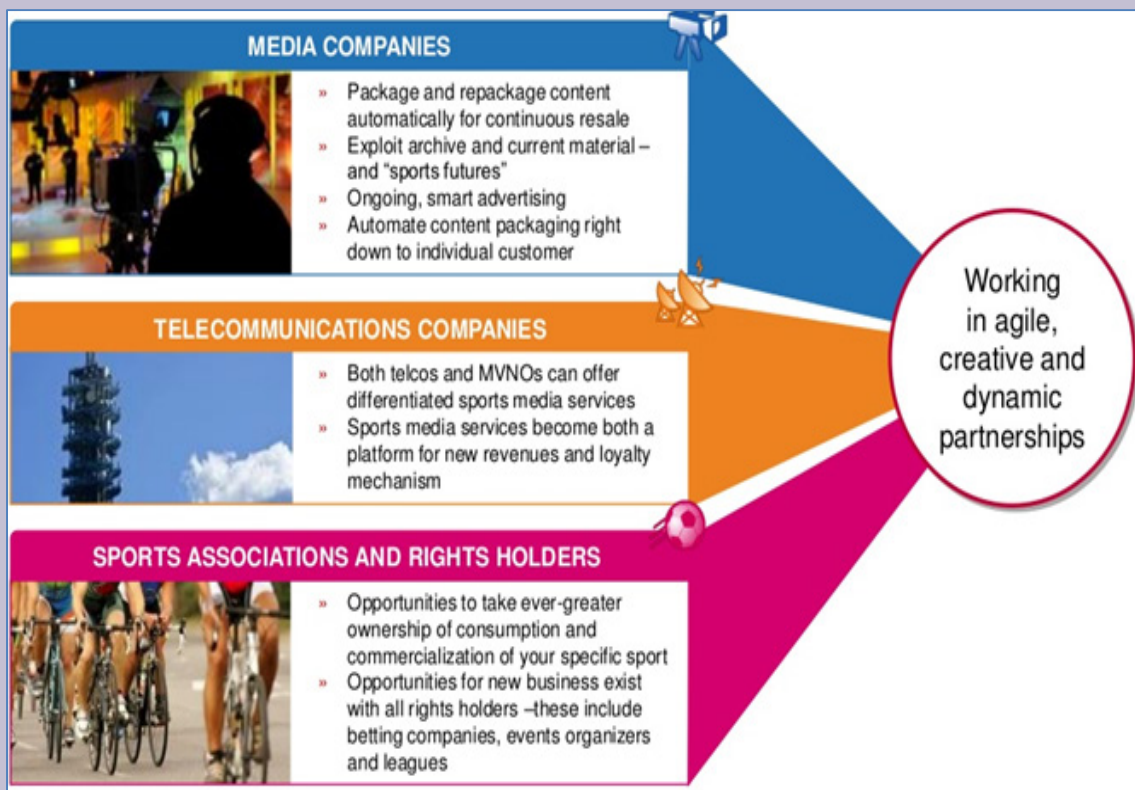
Source: New media in sport, Miguel Morcuende, 11 March 2011

5.6.4   M-Sport value chain

The m-Sport value chain (Figure 21) is composed of the following players. Partnership programmes are the main source of income for m-Sport.

- **Content owners:** These include holders of pre-owned content and information that can be bundled with a live event such as text, instant video replays, or advertising to be distributed to fans, increasing usage of content assets.

- **Event hosts:** These organize and host events on behalf of teams and other third parties; they seek to differentiate their venues and the services they offer to their customers and spectators.

- **Mobile content and service providers:** They provide aggregation and publishing of content and services in different formats such as SMS, MMS, WAP, Apps, Video, and Catch-up.

- **Media organizations:** They provide marketing and promotion of sports events, products and services.

- **Mobile network operators:** The advent of wireless broadband technologies such as Wi-Fi, 3G, WiMAX and LTE are creating new opportunities for MNOs to address the demand for content-rich applications with greater bandwidths.

- **Advertisers:** With mobile sports services and applications, advertisers can effectively target different segments, such as sports fans at an event, with a rich media interface. The publishing tool and distribution service can support promotions for delivery during specific activities during a sports event. These may feature, for example, the promotion of the jersey of a player who has just scored; the profile of a sports fan attending a football match; the time of day or time during

an event (e.g. halftime); or location (e.g. to promote a visit to a restaurant near the venue before or after the event).

- **Sports Fans:** Sports fans are the primary end users for m-Sport: a sports fan can be an enthusiast for a particular athlete, team, sport, or for organized sport in general. Fans often attend sports events or watch them on TV, and follow sports news via newspapers, Internet websites, and mobile applications.
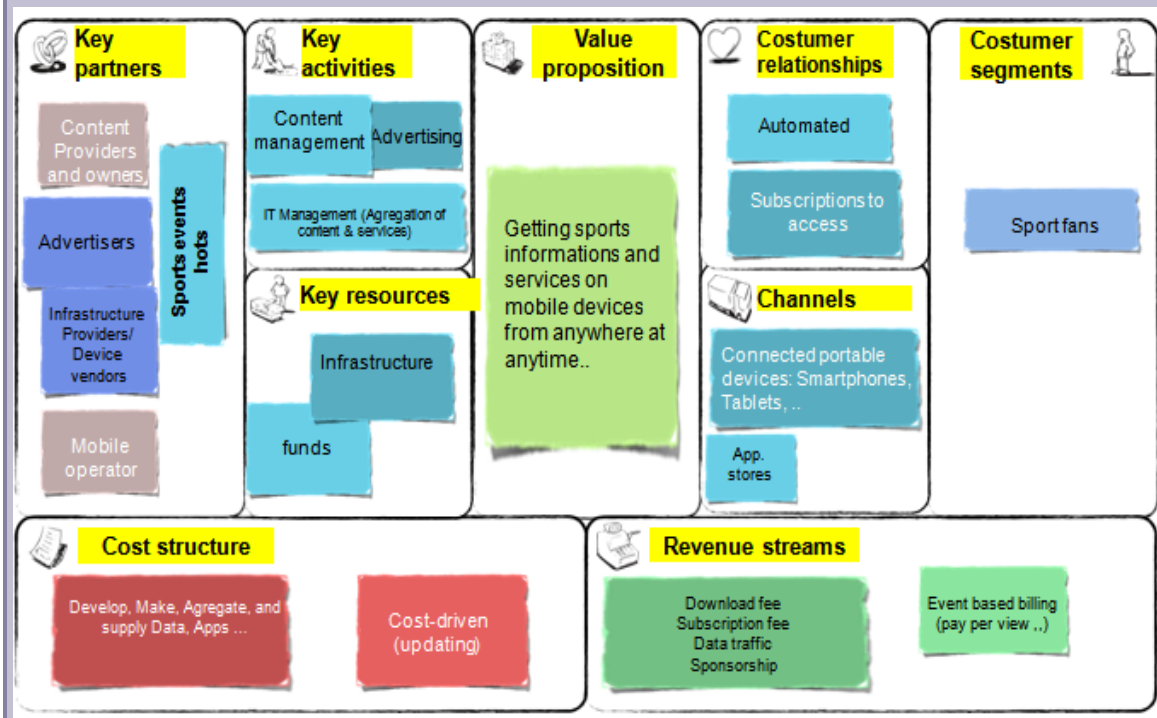
Figure 21: M-Sport value chain
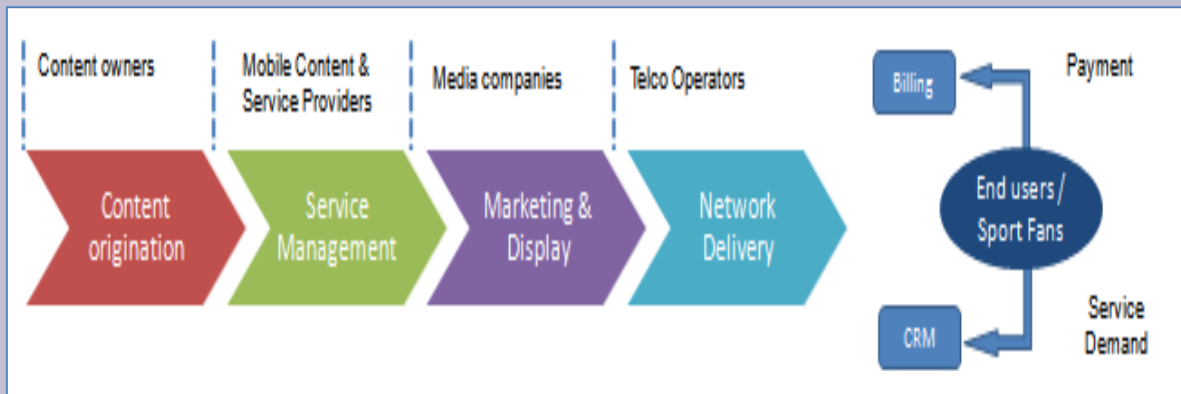
5.6.5 M-Sport business model

Figure 22 depicts a prospective business model canvas for m-Sport.

Figure 22: M-Sport business model canvas

6   Working Group on Advocacy for Mobile

6.1   Scope

The Working Group on Advocacy was set up by ITU's m-Powering Development Initiative Advisory Board to prepare the groundwork for an advocacy campaign that seeks to ensure that mobile technologies are taken into account in the development agenda.

6.2   Initial approach

The Working Group on Advocacy views its work as highly dependent on the findings of the other Working Groups set up by the Advisory Board, the outcomes of which will help identify the gap analysis that will contribute towards the formulation of advocacy priorities. In the meantime, in a desire to move forward, the Working Group is focusing on presenting to the Advisory Board advocacy proposals that aim to ensure that national governments, industry and intergovernmental organizations place issues related to mobile platforms and applications high on their respective agendas.

6.3   Advocacy objectives

Based on the premise that advocacy approaches with clearly defined and measurable objectives can expect to have a more targeted impact than others with less specific goals, the Working Group, with input from the Advisory Board, seeks to determine the following:

- The specific desired results of the m-Powering Development Initiative advocacy campaign.

- Identification of the key influencers and actors to move the m-Powering Development Initiative forward.

- Identification of high value, easily achievable, and relatively immediate ways to reach the identified key influencers and actors.

- The advocacy role of the Advisory Board and the organizations and sectors it represents in implementing chosen advocacy programmes.

6.4   Advocacy and awareness raising

The ITU has many opportunities for raising visibility about m-solutions for development and the policies and market conditions required to successfully elaborate and implement them. These include: the Global Symposium for Regulators/Global ICT Leadership Forum, ITU TELECOM, the World Radiocommunication Conference 2015, and regional and global symposia, to name just a few.

The following proposals for consideration by the Advisory Board can stand alone, but are not mutually exclusive. Indeed, there are many points for intersection where they can build upon each other. Each campaign, or portion thereof, would develop messaging aimed at key target audiences, full use of media channels, and draw on other platforms and opportunities to reach target audiences and build traction for defined results.

- Campaign to demonstrate m-powering for a better world generically and in streams, focusing on successful programmes and demonstrating societal value in the areas of health, education, employment, economic development, commerce, business and sport, taking advantage of existing business and government platforms such as the Global Mobile World Congress, ITU TELECOM, the World Economic Forum, and regional fora.

- Energize young innovators and future leaders through regional competitions, plus a global competition among regional winners, bringing together a Blue Ribbon panel of government,

business and high visibility personalities to judge and recognise awardees at the UN General Assembly

- Build traction and visibility within the UN, starting at the UN General Assembly, that would lead over time to: 1) UN establishment of a Mobile-Power for Development Day, and 2) integration of mobile solutions as an option in all UN development programmes.

Components could include:

- Establishment of an annual workshop on the impact of m-Powering adjacent to the UN General Assembly and perhaps attached to the ITU Broadband Commission for Digital Development.

- Convening by the UN and/or ITU, in partnership with industry groups and humanitarian organizations, a world conference of experts in health, education, business, sports, finance, along with ministers responsible for those sectors, to discuss and agree to means for improving public economic and social well-being employing mobile platforms and applications.

- Creating a UN mobility-for-ICT investment or grant fund whereby young entrepreneurs and other young innovators could develop their ideas and demonstrate their scalable m-solutions in subsequent UN, ITU and/or industry fora.

6.5   Next steps

The advocacy approach that the Advisory Board choses to propose to the ITU will, of course, require further analysis and expansion about feasibility, cost, identification of implementation actor(s), and the further role of Advisory Board members.

The Advocacy Working Group invites the ITU and the Advisory Board to assist it in further fleshing out the details of an advocacy campaign with the expectation of being ready for concrete action following decisions taken at the next Advisory Board meeting.

7   Conclusions

Examining the different Working Groups reports, the following conclusions can be drawn per sector.

7.1   M-Health

Numerous examples exist worldwide of m-Health projects supporting patients, healthcare professionals and healthcare systems, leading to improved patient-centred care and outcomes. The examples cited in this report clearly demonstrate that m-Health solutions not only enhance prevention, diagnosis, treatment and monitoring of diseases, but they also contribute to strengthening healthcare systems through improvements in emergency response, healthcare practitioner support, and healthcare surveillance and administration.

However, in order to realise the full potential of m-Health and to stimulate the scaling up of m-Health services across the globe, important barriers need to be addressed, in particular with respect to policy and regulation. As a guiding principle it is essential to put the patient at the centre of the design, development and implementation of solutions, as well as the regulatory frameworks that surround these processes.

Mobile phones are seen as an additional tool in the global quest to improve population health and individual health, decrease pressure on healthcare systems, and lower healthcare costs.

Several additional mechanisms have been called for to strengthen the field of m-Health and improve the scalability of solutions. First, the importance of leveraging existing evidence-based practices and scientific principles in designing m-Health strategies has been stressed as a universal 'best practice'. Second, a systems approach to m-Health intervention design has been noted by many as critical, to allow incorporation of the up- and down-stream elements which could influence the relative success of a health

programme. Third, with regards to the solid foundation for m-Health innovation, recognition of the need for an enabling technical, regulatory and commercial environment has emerged.

What is also vital to the longer term success of m-Health and a prerequisite for operator investment is that services are both scalable and sustainable. Without public-private partnership development, achieving this would be incredibly difficult. It is fair to say that no single m-Health public-private partnership model fits all sizes/countries/communities. Partnerships are formed based on the motives of the private sector and governments, the size of the market, the level of mobile technology penetration, the literacy level of the population, the health needs as well as specific legal and ethical frameworks. Technologies develop very fast and in a diversified manner, which makes them short-lived and most often not interoperable. Entering into a partnership with a technology vendor and/or mobile service provider should therefore not be at the expense of another, and public sector partners should insist on operability for all technologies used by the PPP.

With regard to regulation and m-Health there is an overlap between the telecommunications and healthcare regulatory authorities, and a need for harmonization of regulation between the two to enable the right environment for m-Health to thrive. Among other challenges facing m-Health is building the knowledge and evidence base of best practices which would allow replication and/or scaling up.

Patients' rights must be respected and m-Health services should meet their needs at affordable cost. It is also critical that an environment of trust and safety is created as the acceptance of m-Health interventions is essential for success, particularly in the areas of data management and medical device regulation. Patients also require training and education around their health needs/conditions and there is a need for patients to be involved in the development and implementation of m-Health solutions. Respecting the roles of healthcare professionals and engaging them in the process of m-Health implementation is also a prerequisite for success.

The engagement of healthcare leaders, managers and administrators in m-Health initiatives is also essential as they manage healthcare services along with care providers. It is also important to understand what motivates entities such as health technology manufacturing companies and professional healthcare organizations in order to facilitate their engagement in m-Health in a manner which benefits people and patients.

7.2   M-Learning

As a basic rule, the Working Group affirmed that in the framework of the m-Powering Development Initiative it is crucial not to duplicate or detract from the success of existing ongoing initiatives in the specific field of m-Learning and m-Education.

Based on a review of available evidence the Working Group reached four main findings:

- A very considerable amount of research and practice has already been carried out in the field of m-Learning and m-Education.

- Despite the lack of high quality and rigorous monitoring and evaluation, there is widespread recognition of the potential of m-Learning to improve the delivery of education and skills acquisition.

- There already exist major international initiatives in the field of m-Learning and m-Education.

- The use of mobile devices in learning and teaching is still at a relatively early stage and developments in this field are evolving very quickly.

In light of the above, the Working Group stressed that whatever recommendations emerge from the m-Powering Development Initiative, it is essential that in the field of m-Learning and m-Education there is very close co-operation and collaboration with existing initiatives such as the M-Education Alliance, and the activities of UNESCO and the GSMA in this domain. It also concluded that the primary role of the ITU's m-Powering Development Initiative should be to engage with telecommunication ministries and

regulators, and that its main emphasis should be to advocate and influence, rather than actually to deliver physical products.

Another priority need underlined by the Working Group is to conduct further quality assessments of the impact of mobile learning initiative outcomes, and to share the findings with all stakeholders. While acknowledging the widespread recognition of the potential of m-Learning to improve education delivery and skills acquisition, it noted that there is still far too little rigorous evaluation and monitoring of such initiatives, and stated the urgent need for quality comparative data to enable success factors to be clearly identified.

Above all else, the Working Group emphasised that the next task of the m-Powering Development initiative should be to consider focusing on the systemic issues common to all of the Working Groups, before deciding whether or not to invest further energies specifically into one or more of them. With this in mind, the Working Group noted that it is much better to deliver a few things really well, rather than be over-ambitious and fail to deliver anything satisfactorily.

Other conclusions reached by the Working Group include:

- The m-Powering Development Initiative should imperatively not replicate or duplicate the ongoing work undertaken by other m-Learning initiatives, but should instead add value to them or focus on areas that are not currently addressed sufficiently.

- The m-Powering Development Initiative should focus on the core mission of the Telecommunication Development Sector (ITU-D) "to foster international cooperation and solidarity in the delivery of technical assistance and in the creation, development and improvement of telecommunications/ICT equipment and networks in developing countries".

- Recognising that UNESCO's remit is primarily with Education Ministers and that the GSMA represents and has strong links with mobile operators, the main interlocutors engaged with under the m-Powering Development Initiative should be telecommunication ministries and regulators.

- The main emphasis of the m-Powering Development Initiative should be to advocate and influence, rather than actually to deliver physical products, such as apps. ITU does not have the capacity or the financial resources to compete with companies and groups already creating such apps, and its primarily role should be to influence and convene.

- One of the key roles that the ITU can play is in advocacy and awareness-raising of the importance of m-Learning. This can be done very cost effectively by including sessions on m-Learning in existing ITU events, such as TELECOM World and ITU's various regional meetings. One exciting suggestion could be to have a stream at TELECOM World events dedicated to the various aspects of ITU's m-Powering Development Initiative. Additionally, ITU could support existing well-established events, such as e-Learning Africa, via a stream on some of the aspects emanating from the m-Learning Working Group's recommendations.

7.2.1 Funding issues

The Working Group noted that securing the necessary funding was a pre-requisite to achieving anything substantial through the m-Powering Development Initiative. It pointed out, however, that most of the Working Group proposals would incur relatively low cost, and could readily be combined with ongoing activities and plans within the ITU and cognate bodies. If the m-Powering Development Initiative is to gain traction, and deliver valuable outputs, it underlined the urgent need to enhance its web-based presence. Moreover, it posited that it would not be difficult to combine forces with relevant organizations represented on the Advisory Board to deliver an international event, or indeed a series of regional events, to promote systemic and holistic approaches to m-Powering Development.

More generally, some members of the Working Group felt that there would also be value in creating incentive funds for multi-stakeholder partnerships to form around specific m-Learning initiatives. The track record of such funds in the field of ICTs has not been particularly successful to date, as for example

with initiatives such as the Digital Solidarity Fund, and it is extremely difficult to identify where the core funding for such initiatives might come from. Encouragement to bilateral and multilateral donors, as well as international banks, to develop incentive funds is nevertheless something that the ITU might consider taking forward as part of its wider agenda. Some members of the Working Group, for example, are already considering funding incentives to encourage aspects of m-Learning, as with USAID's championing of the need for greater evaluation of promising technology-supported interventions for advancing reading. There could be particular value with incentives designed to encourage local innovation, thereby helping to build internal capacity within poorer countries of the world. National governments might also be encouraged to consider the introduction of incentive funds should they have the means to do so.

Concluding the discussion on funding, members of the Working Group suggested the following:

- Though all Working Group practical recommendations (see *Recommendations*) for further action are to an extent already being undertaken, they nevertheless remain important, and more action is needed to ensure that they succeed. The ITU can therefore play a key role in synergising support for existing initiatives, and joining forces with them to reduce duplication of effort, and help maximise the likelihood of impact.

- The number of organizations represented on the Working Group is an indication of the considerable importance that they all place on m-Learning and m-Education. Most members of the Working Group are already providing funding and resources to support m-Learning initiatives and more generally they already contribute to the ongoing work of the ITU. They are therefore willing to consider supporting aspects of m-Learning advocated by the ITU, especially where they coincide with their own ongoing activities.

7.3   M-Commerce

Since mobile phones have achieved full market penetration and high service level, they are the ideal payment terminals and secure communication instruments.

Mobile solutions facilitate easy access to new markets and lead to sustainable development with their potential to reach masses in the developing world. Mobile connectivity and increased use of mobile devices therefore offer tremendous opportunities for companies, businesses and governments to propose a wide range of services at practically any time and in any place.

Progress in mobile technology, the growing popularity of smartphones, and the development of cryptography all contribute to the prospect of mobile devices offering secure wireless payment, banking, and other remote transactions requiring a high level of protection. As stated in a European Payments Council White Paper published in 2012, the mobile terminal should represent a "digital wallet" providing authentication and a digital signature to replace multiple passwords, IDs and merchant loyalty cards.

Keys drivers of m-Commerce include: the high penetration of and ease of use of mobile devices; the fast growing capabilities of "always-on" mobile devices; cost savings; previous experience of Internet shopping; and business opportunities.

Among the main challenges facing m-Commerce are security, without which trust in m-Commerce systems cannot take hold; determining the regulatory framework that should cover *inter alia*: the protection of transaction data privacy; the availability or lack thereof of mobile devices amongst traders; the development of enhanced network systems; the establishment of international standards for setting interoperable platforms across countries as well as technological standards for various types of mobile transaction such as IVRS, SMS or USSD-based transactions; and affordability, particularly in the developing world. In addition, the user experience remains strongly challenged by the necessarily-small form factor. For example, the mobile phone form factor effectively limits the amount of information that can be displayed at any given time as well as the ability of the user to enter complex text.

The most realistic vision is one of a market where multiple mobile applications co-exist, combining services on a single mobile device, and the most convenient system for users has applications pre-loaded

onto mobile phones, providing multi-factor user authentication, encryption and decryption of transferable data and a user menu to facilitate transactions.

Other conclusions reached by the Working Group on m-Commerce include:

- As financial services and telecommunication services converge, it is becoming possible for the mobile handset to perform a new array of digital services.

- The ease of use offered to both mobile subscribers and users of financial services is driving both the financial services and telecommunication industries towards a more inter-connected world.

- Significant work remains to be done to deliver a good mix of capabilities combining financial services offered by financial institutions and the broad reach of consumers offered by mobile networks.

- Many mobile money operators will look to capitalise on the ubiquity of mobile networks where financial services lack reach, as is the case in many developing nations. The value to the mobile subscriber is financial inclusion. For the mobile operator and a range of other service delivery agents, new revenue opportunities arise and whole nations can benefit from the general uplift in commerce and the resulting potential for poverty alleviation.

- Financial institutions incur additional costs when they maintain both cash-based and card-based payment systems, while the results of traditional banks are affected when they do not extend their services to low-value customers. Mobile money operators can take advantage of the ubiquity of mobile handsets and networks to deliver low-cost financial services to capture high volume, low value transactions in a cost-effective manner.

- Since all digital activities – including digital financial transactions – can be traced, using a mobile handset to pay for goods can allow both the payer and the payee to have access to transaction logs, adding more transparency and traceability to the activity compared to cash transactions.

- The eco-system around m-Commerce transactions needs a reliable communication carriage system and a stable payment settlement mechanism governed by regulations of the telecommunications and the banking sectors, respectively.

8 Recommendations

Following are the main findings and recommendations of the Working Groups established by the Advisory Board (AB) of the M-Powering Development Initiative to identify ways to move forward towards the fulfilment of the Initiative's objectives taking into consideration the outcomes of the latest Working Group deliberations.

8.1 M-Health

- Stimulate and facilitate collaboration between health, telecommunications and finance ministries both globally and nationally in order to:

  - Build a common understanding and agreement on the role and socio-economic value of mobile technologies and services in addressing current healthcare challenges in the developing world.

  - Promote regulatory and policy frameworks enabling the development and implementation of safe, effective, trusted and accessible m-Health solutions. Key focus areas are: medical device regulation, data protection and privacy regulation (and funding and reimbursement policies and schemes – see below).

  - Promote interoperability and standards that enable scalability and a plug-and-play experience.

- Promote the development of policies, and where appropriate regulation, stimulating innovative business models allowing for funding and reimbursement of m-Health services, by means of identifying and facilitating sharing of good practices/case studies.

- Support initiatives/projects aiming to develop and roll-out m-Health education and training programmes/campaigns for healthcare professionals and patients

8.2   M-Learning

- Support and advocacy for the fundamental importance of appropriate monitoring and evaluation of m-Learning and m-Education initiatives.

  - There is as yet insufficient clear evidence of the benefits of m-Learning and m-Education for learning outcomes. The m-Powering Development initiative should work together with existing major global m-Learning programmes and organizations to help develop a clear framework for effective monitoring and evaluation, that would enable the educational community to assess how and why m-Learning delivers different, and possibly better, learning outcomes from those achieved by other methods. The most important priority should be for the ITU to use its good services to advocate resolutely for evidence upon which future funding decisions can be made. This approach would be strongly supported by many members of the Working Group, including bilateral donors such as USAID and DFID, who would be willing to work collaboratively in this endeavour.

- Enhanced understanding by governments of the essential need for all mobile initiatives to be approached in a holistic manner, involving all relevant ministries and partners.

  - In the case of m-Learning, this would involve at least the telecommunications, education, finance, infrastructure and commerce ministries, but the Working Group on m-Learning considers that this should be a major output of the m-Powering Development Initiative as a whole. Specific activities involved in this deliverable could include short guidance and briefing documents for governments, and the holding of a major conference on the importance of holistic approaches to mobile development initiatives, preferably jointly with other cognate bodies.

  - A central element of this recommendation is also for activities to be undertaken that would help increase awareness among governments of the potential of m-Learning. If the Internet is going to play a key role in education in the future, and the future of the Internet is mobile, then it follows that the future of education is mobile. Several members of the Working Group expressed willingness to convene and develop workshops and training resources to deliver this potential output. It is also critically important to ensure that any such initiative is undertaken in collaboration with other major international bodies and partnerships, such as UNESCO and the m-Education Alliance.

  - Rather than developing its own specific initiative in this area, the ITU should work with and support its members and cognate bodies, by convening joint activities that benefit all of their members. Additionally, it would be particularly appropriate to focus attention on the least-developed countries that have the greatest needs, so as to work diligently to reduce the inequalities caused by differential access to social and physical infrastructure.

- Support for an environment for sharing and showcasing good practices in m-Learning as part of a wider m-Powering Development online resource**.**

  - Numerous initiatives exist with platforms for information-sharing on good m-Learning practices. Likewise, there are international awards for m-Learning content. However, if the ITU wishes to have a visible output from the m-Powering Development Initiative it could create, or support, a digital environment to enable users easily to access information across all of the fields in which it is engaged (e.g., health, education, rural development). This could provide real value for the Initiative's presence on the ITU site (http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Pages/default.aspx). The Working Group does not however recommend duplicating the work of existing initiatives by specifically creating an m-Learning or m-Education portal. Rather, it recommends using the ITU's distinctive position to draw attention to existing initiatives where

interested parties can find high quality advice and resources. Several members of the Working Group offered to expedite the sharing of good practices.

- Support for the creation of an open mobile app to provide for free sharing of m-Learning content, as well as the dissemination of commercial resources.

    - Several initiatives are underway in this field, but nothing has yet been developed that would enable all kinds of mobile users, including commercial and OER developers, as well as teachers and learners, to access and upload m-Learning content in a variety of languages and contexts. Interestingly, since the first meeting of the Advisory Board, several initiatives, mainly by private sector companies, have already moved towards delivering the sort of product that was initially identified by the Working Group as being a gap. This shows that commercial interests are likely to be best positioned to deliver on this recommendation. It is important for the ITU to advocate that any such apps should be platform agnostic, and that they should pay specific attention to accessibility issues, for example being readily usable by people with disabilities. There is a definite need for such a resource, but the Working Group recommends that this is not something that the ITU itself should embark on. The ITU's role might therefore be to develop and advocate appropriate standards through which such apps could be created.

8.3   M-Commerce

- User experience of interfaces, services and networks should be seamless.

    - Users should have easy-to-use mobile phone interfaces with consistent user experience across all supported mobile phone implementations.

    - Customers should not be bound to a specific mobile network operator or bank, and should retain their current ability to choose service providers.

- Security is a primary consideration.

    - Two-factor authentication should be required for electronic dialog.

    - For mobile remote financial transactions use Security Level 3 or 4, in accordance with ITU-T Recommendation Y.2740.

    - Customers should be aware of the security level of the e-Commerce system they use, which should be stipulated in the participants' agreement; user authentication may be performed by a unified authentication centre.

    - To ensure its security and to be user-friendly, the mobile device must have a special mobile application, which provides authentication and encryption; it is recommended to use mobile applications with several independent blocks and different sets of keys.

    - Data transfer should be executed in a secure mode using cryptography.

    - To reach the highest security level, the mobile application should be located on the hardware security element.

    - The registration and provisioning of a mobile application needs to be executed in a secure environment; access to a mobile application would be easier for customers if they could benefit from an existing trusted relationship with a service provider(s).

    - All identification and authentication centres should comply with the same allocation rules and regulations for mobile identifiers of mobile clients, registered in a central system directory to ensure message delivery to customers.

    - The client may have multiple customer mobile identities bound to his/her MSISDN. Unified rules to issue mIDs, registered within the System Central Directory, should be introduced to ensure proper routing of messages to clients.

- Favourable market and deployment economics should be facilitated

  - Mobile systems should, to the extent possible, use technologies and infrastructure which have already been widely deployed.

  - The service enabler should provide the technology support and integration of various access means, as well as interoperability with service providers and authentication centre.

  - We should foster a dynamic market with an environment that favours innovation and a diversity of stakeholders and respect for the rights and privacy of m-Commerce consumers.

  - We should advocate for an approach where building an interoperable standards-based eco-system for mobile commerce is central so that all players can benefit from the system created.

  - Service providers should support interoperability and openness, rather than develop and use exclusive proprietary models; business models should reflect this approach.

  - Retailers and manufacturers should embrace a service-based approach that will strengthen core business.

  - Mobile network operators should explore ways to integrate m-Commerce with existing tools for revenue generation such as SMS, Premium SMS and MMS.

  - Mobile phone manufacturers should deliver mobile devices adapted to the market and that drive the latter in new directions, with open architecture and tools allowing for development of appropriate new applications.

  - M-Commerce players should tailor their strategies to the conditions of each market.

  - Expand the number of integrated NFC handsets and the availability of NFC equipment.

8.4   M-Governance

- Governments should be encouraged to adopt 'digital technology and solution' policies that can drive demand for m-Governance.

- M-Governance services should be viewed as a strategic project and planned carefully to reduce the chances of emergence of the islands of information systems dilemma.

- Introducing mobile government technology means that the work conditions are changed and the environment is modified. Therefore existing policies, practices, and regulations may need to be updated or even created: Revisiting current policies to make certain that they are still valid and appropriate for the new environment and ensuring privacy and security of government data may be necessary.

- Governments should compile databases about their staff activities, citizen needs and types of devices that could be used to help them do their jobs better or make their lives easier: Developing apps for multiple platforms is more expensive, but can allow people to use Governance-apps with their existing mobile devices.

- Governments should try to integrate mobile within their existing digital platforms as much as possible. It should be an incremental change, not a giant and costly. The capability to reuse existing applications in other domains is a good example.

- Governments can learn from other governments and organizations around the world that use mobile technology to take payments, help citizens find embassies and track court case schedules.

- Establishing technical infrastructure must be reviewed to identify if and how it can support a more mobile workforce. Maintaining devices and infrastructure that remain on site is different from maintaining ones that are in constant movement.

- Mobile government implementation consists of 3 steps: mobile access, mobile content, mobile services and applications. Partners in each of those steps are necessary and the private sector and organizations can play a crucial role.

- Governments should set-up a Mobile Governance Innovation Fund to support the development of suitable Governance-applications by developers including start-ups. The objective of this fund was to accelerate the development and deployment of the mobile applications across the entire spectrum of public services.

8.5   M-Sport

- Mobile sport can be used potentially an ideal channel for the development of sportsmanship among fan sports. Sports organizations, as well as local and international leagues may be able to connect and bring about positive influence on fans as they enjoy outstanding events.

- Mobile sports face issues of intellectual property considerations including addressing licensing for sports video delivered to mobile devices. Protection for rights holders from illegal copying, hackers, spyware, and viruses. Rights managers must work on these issues to avoid serious market difficulties.

- Interactive sport mobile TV allows for further opportunities for operators to stimulate incremental spending from viewers of mobile TV, through browsing sessions initiated by a call to action on services or information (video clips, mobile games, ringtones). These will represent a small but important component towards achieving return on investment for network operators.

- Mobile sports players must expand their partnerships and business models to involve other areas. In some cases, they must move beyond advertising as a business model. With expansion, m-Sports could catalyse very significant developments around other areas such as m-Banking, m-Commerce, m-Advertising, and m-Health.

8.6   Advocacy for mobile

- Campaign to demonstrate m-Powering for a better world generally and in streams, focusing on successful programmes and societal value.

- Energize young innovators and future leaders through regional competitions, plus a global competition among regional winners, bringing together Blue Ribbon panel of government, business and high visibility personalities to judge and recognize awardees at the UN General Assembly.

- Build traction and visibility within the UN. Components could include:

  - Establishment of an annual workshop on the impact of m-Powering adjacent to the UN General Assembly and perhaps attached to the ITU Broadband Commission for Digital Development.

  - Convening by the UN and/or ITU, in partnership with industry groups and humanitarian organizations, of a world conference of experts in health, education, business, sports, finance, along with ministers responsible for those sectors, to discuss and agree to means for improving public economic and social well-being employing mobile platforms and applications.

  - Creating a UN mobility-for-ICT investment or grant fund whereby young entrepreneurs could develop their ideas and demonstrate their scalable m-solutions.

Annex 1: Advisory Board Members

(by surname in English alphabetical order[13])

Mr David Atchoarena, Director, Division for Teacher Development and Higher Education, United Nations Educational, Scientific and Cultural Organization (UNESCO), France

Mr Housseynou Ba, Former Minister of Health, Mauritania

Mr Anthony Bloome, Senior Education Technology Specialist, Founder of m-Education Alliance, USAID, United States

Mr Evgeny Bondarenko, Vice Chairman ITU-D SG 2, Deputy General Director, Intervale, CJSC, Russia

Ms Anne Bouverot, Director General, GSMA Ltd., United Kingdom (Vice Chairman)*

Ms. Kathryn C. Brown, President and CEO, Internet Society, United States

Mr Robert Collymore, Chief Executive Officer, Safaricom Ltd., Kenya

Mr John Davies, General Manager, Vice President, Intel World Ahead Program, Intel Corporation, United States*

Ms Gabrielle Gauthey, Executive Vice President for Global Government and Public Affairs, Alcatel-Lucent, France

Ms Lindsay Glassco, Director of International Cooperation and Development, International Olympic Committee, Switzerland

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H.E. Dr (Mrs.) Omobola Johnson, Minister, Federal Ministry of Communication Technology, Nigeria

Mr Navin Kapila, Independent Consultant, India

Mr Rahul Khullar, Chairman, Telecom Regulatory Authority, India

Dr Marie-Paule Kieny, Assistant Director-General, World Health Organization (WHO), Switzerland

Mr Sipho Maseko, Group Chief Executive Officer, Telekom SA, South Africa

Mr Mokhtar Mnakri, Chairman and Chief Executive Officer, Groupe Tunisie Telecom, Tunisia

H.E. Mr Diego Molano Vega, Minister, Ministry of Information, Technologies and Communications, Colombia

Dr Sam Pitroda, Advisor to the Prime Minister of Indiar, C-SAM, United States (Chairman)*

Dr Veena Rawat, (Former) Vice President, Advanced Technology Team, Research in Motion (RIM) Ltd., Canada

Mr Mohamed Sharil Mohamed Tarmizi, Chairman, Malaysian Communications and Multimedia Commission, Malaysia

Prof. Tim Unwin, Secretary General, Commonwealth Telecommunications Organization, United Kingdom

H.E. Mr Binali Yıldırım, (Former) Minister, Ministry of Transport, Maritime Affairs and Communications, Turkey

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[13] Asterisk indicates Member of the Broadband Commission for Digital Development.

Annex 2: M-Health

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- **Dr Marie-Paule Kieny** (Chairman)

- **Mr Housseynou Ba** (Independent consultant)

- **Ms Anne Bouverot** (GSMA)

- **Dr Sayave Gnoumou** (Nazounki Global Medical Network)

- **Mr Navin Kapila** (Independent consultant)

- **Dr Veena Rawat**

Colleagues supporting members of the Advisory Board and Invited individuals with external expertise

- **Mr Robert Childs** (GSMA)

- **Ms Belinda Exelby** (GSMA)

- **Ms Florence Gaudry-Perkins** (Alcatel-Lucent)

- **Mr Yuri Grin** (Intervale)

- **Prof. Alain Labrique** (Johns Hopkins Bloomberg School of Public Health)

- **Dr Mahesh C. Misra**

- **Dr Najeeb Al Shorbaji** (WHO)

Annex 3: M-Learning

A3.1 Members of the Working Group on m-Learning

- **Prof. Tim Unwin** (Chairman)
- **Mr David Atchoarena** (UNESCO)
- **Mr Anthony Bloome** (USAID)
- **Ms Anne Bouverot** (GSMA)
- **Mr John Davies** (Intel)
- **H.E. Dr (Mrs.) Omobola Johnson** (Nigeria)
- **Dr Veena Rawat**
- **H.E. Mr Binali Yikdirim** (Turkey)

Invited members with external expertise

- **Mr Tayfun Acarer** (ICTA, Turkey)
- **Ms Rosalind Gater** (DFID)
- **Mr Simon Milner** (Facebook)
- **Mr Mike Trucano** (World Bank)

Colleagues supporting members of the Advisory Board

- **Mr Ahmet E. Cavusoglu** (Turkey)
- **Ms Belinda Exelby** (GSMA)
- **Ms Florence Gaudry-Perkins** (Alcatel-Lucent)
- **Mr Adrian Godfrey** (GSMA)
- **Mr Carlos Martinez** (Intel)

A3.2 Examples of m-Learning initiatives

The following initiatives listed in alphabetical order provide an indication of the richness of this field (those mentioned by more than one Working Group member are in italics):

A3.2.1   Specific m-Learning initiatives

- *BBC Janala – mobile phones for adult literacy (Bangladesh) (4) (http://www.bbcjanala.com/)* - On TV, online, in print and accessible through even the most basic mobile phone handset, the multiplatform English language service also works through approximately 6000 English clubs across the country.

- Nokia Life Tools (this is reportedly now no-longer being continued, despite having 80 million subscribers) (3) (*http://www.nokia.com/in-en/support/faq/?action=singleTopic&topic=FA132357* - an SMS based, subscription information service designed for emerging markets which offers a wide range of information services covering healthcare, agriculture, education and entertainment.

- *Urban Planet Mobile (3) (http://www.urbanplanetmobile.com/what-we-do)* - With products ranging from basic word and phrase lessons to TOEFL & SAT preparation, to a new online writing

tool with assessment and tutorials, Urban Planet specializes in forward-thinking educational tools.

- Worldreader (*http://www.worldreader.org/*) using e-books to advance early grade reading (3).

- *Yoza (3) (http://yozaproject.com/) - originally known as M4Lit, providing m-novels in* a funky youth-zone with engaging stories that include more Kontax episodes as well as stories from other genres, e.g. soccer, issues and teen romance.

- Dr Math (*http://mathforum.org/dr.math/*) (2) - a question and answer service for maths students and teachers.

- Tangerine technology, RTI (*http://www.tangerinecentral.org/*) (2) - electronic data collection software for use on mobile devices to enable recording of student responses.

- *Text2Teach, Philippines (www.text2teach.org.ph/) (2) -* aims to contribute to the quality of teaching and learning in underserved schools and communities in the Philippines.

- Afghan Institute of Learning Mobile Literacy Programme (www.afghaninstituteoflearning.org/vision.html)

- Airtel Classroom: www.airtel-classroom.com/AirtelPortal/Dashboard.aspx
Workforce entry exam focused learning online and mobile.

- All Children Reading Grand Challenge for Development (www.allchildrenreading.org) prizes and grant competition which in Round Two will focus on attracting tech innovations for advancing early grade reading (US$23 million initiative in collaboration with USAID, DFAT, and World Vision).

- BBC Media Action Mobile Kunji (www.bbc.co.uk/mediaaction/where_we_work/asia/india/india_sdp_ empowering_chw_ma_mk.html) – empowering community health workers in Bihar.

- Canaima Education Programme (Canaimitas, Venezuela) (http://www.canaimaeducativo.gob.ve/) – the programme promotes learning among children in the country using new technology. It reaches 2.7 million Venezuelan children.

- E-Taleem – Nokia Pakistan (www.nokia.com/global/about-nokia/people-and-planet/news/news-article-24/)
Nokia and UNESCO Pakistan - free basic Urdu literacy and basic math app for Nokia phones.

- Efiko (www.efiko.com.ng/about.html) a mobile self-testing platform designed for secondary school students in Nigeria. It inspires self-learning by engaging students in taking charge of their own learning and celebrating their successes.

- Electronic Early Grade Reading Assessment (EGRA) (www.rti.org/pubs/bk-0007-1109-wetterberg.pdf) – using electronic devices to capture EGRA scores – Research Triangle Institute (RTI – product: tangerine) and Education Development Center (EDC) – E-EGRA.

- Elimu kwa Teknolojia (Education through Technology, Tanzania) (www.iyfnet.org/bridgeit) - a dynamic public-private sector alliance led by IYF and the Tanzanian Ministry of Education and Vocational Training. Through the programme, teachers downloaded video content using cellular phones, which were connected to TVs in their classrooms, allowing remote schools and communities to access a vast range of educational content.

- Eneza Education, Kenya (enezaeducation.com/) – gives children access to information and parents to meaningful data and tips for helping their students.

- English in Action, DFID Bangladesh (www.eiabd.com/eia/) - is using mobile phones, print-materials, television, and peer-to-peer learning to help 25 million Bangladeshis improve their English.

- The FundZa Literacy Trust (www.fundza.co.za/) - FunDza aims to boost literacy among teens and young adults in South Africa by using mobile technology to connect and interact. Project K-Nect (www.projectknect.org) - is designed to create a supplemental resource for secondary at-risk students to focus on increasing their math skills through mobile smartphones.

- Learn English with the British Council – Sri Lanka (www.ft.lk/2011/08/20/british-council-english-language-programmes-on-etisalat-mobile/) - this service is delivered via SMS; customers receive English language usage tips and multiple choice questions.

- Longman Ladybird Mobile Reading - a pilot reading programme for children to access with mobile phones.

- M4Lit Shuttleworth Foundation (www.shuttleworthfoundation.org/projects/m4lit/) - the m4Lit (mobile phones for literacy) pilot project created a mobile novel and published it on social media platforms in order to explore ways of supporting teen leisure reading and writing around fictional texts in South Africa, using mobile media.

- Mobile and Immersive Learning for Literacy in Emerging Economies (MILLEE) (www.cs.cmu.edu/~mattkam/lab/millee.html) - distributes games in underdeveloped regions around the world on a cost-recovery basis. With mobile technology that can extend the reach of learning beyond formal school environments, the vision is to revolutionise educational services delivery throughout the developing world.

- Nokia Mobile Learning for Mathematics (South Africa) (www.un.org/en/ecosoc/innovfair2011/docs/nokia.pdf) - the project works to support mathematics education in schools using the web, social networking, and mobile applications to deliver learning material directly to students' cell phones. The project uses social networking tools to allow groups to collaborate.

- Mobile-based Literacy Programme - Mobilink (Pakistan) in a partnership with UNESCO (www.unesco.org.pk/education/mlp.html) – The project used mobile 'phones to address literacy retention issues among the youth population in Pakistan.

- Mother Tongue Literacy (Motoli) (www.et4d.com/work/) - MoToLi is an application to teach reading with a phonic pedagogy in local languages. It can be adapted to suit the needs of any country in terms of language and curriculum.

- Planet Read (India) (www.planetread.org/literacy.php) - Same language sub-titling of Bollywood Video.

- Project Alphabetisation de Base par Cellulaire (ABC) (https://sites.tufts.edu/projectabc/) – A collaborative initiative between Catholic Relief Services/Niger, Tufts University and the University of Oxford that uses mobile phones as a tool to promote adult literacy and numeracy in Niger.

- Shaqodoon Project Somalia (shaqodoon.org/) - Uses Somali-language audio programmes on financial literacy and entrepreneurship and links youth to opportunities through the use of cell phones and web-based technologies. The project aims to reach 8,000 youths over a three-year period.

- SNDT Women's University (India) (http://sndt.ac.in/) - Committed to women's empowerment through access to education.

- Souktel – (www.souktel.org/jobmatch.html) mobiles for CV creation & job matching.

- Najja7ni m-English (Tunisia) (m-education4all.com/Najja7ni.html) - US State Department funds English learning platform for Tunisian users.

- u-Report Uganda (ureport.ug/) - A free SMS-based system that allows young Ugandans to speak out on what's happening in communities across the country, and to work together with other community leaders for positive change.

- UNESCO Mobile Literacy Pakistan (www.unesco.org/uil/litbase/?menu=14&programme=125 - The main objective of the project is to develop a mobile-based literacy programme where the newly literates receive literacy materials as messages on a mobile phone, which they read and then respond to.

- UNESCO – Using mobile technologies to support teacher development in Mexico, Nigeria, Pakistan and Senegal (www.unesco.org/new/en/unesco/themes/icts/m4ed/teacher-support-and-development/)

- Ustad Mobile, Afghanistan (Mobile Teacher) (www.ustadmobile.com/) - literacy programme that enables Afghan women deprived of a basic education to learn to read and write using a mobile phone. It provides national curriculum courses in national languages, Dari and Pashto, as well as mathematics courses.

- UStad, specifically Paiwastoon (www.ustadmobile.com/ and svr1.paiwastoon.net/?s=Ustad)

- Verizon Collaborative & Virtual learning services: (powerfulanswers.vzwb2bsolutions.com/solutions/education.html#Page1) - Cloud based, end to end, education services for formal environments.

A3.2.2   Networks and generic initiatives

- Mobiles for Education Alliance (*www.meducationalliance.org*) Consortia of international organizations focused on technologies for education primarily in developing countries (3)

- UNESCO's m-Learning work (2) (*www.unesco.org/new/en/unesco/themes/icts/m4ed/*)

- Bring your own device initiatives and trials

- Educational television (e.g., Sesame Workshop)

- iEARN (www.iearn.org/) – international educational resource network (linking schools around the world in collaboration projects) although not focused exclusively on m-Learning

- Intel Classmate initiatives in Venezuela, Argentine, Portugal, Macedonia, Nigeria, Malaysia, Turkey (www.intel.com/content/www/us/en/education/evaluations/other-programs.html)

- OERs/MOOCs (such as Coursera), although not specifically focused on m-Learning

- Technology for Reading initiatives

A3.2.3   Organizations with particular interests in m-Learning:

- *BBC Media (*see for example downloads.bbc.co.uk/mediaaction/policybriefing/bbc_media_action_health_on_the_move.pdf)

- *mEducation Alliance* (www.meducationalliance.org)

- *UNESCO* (www.unesco.org/new/en/unesco/themes/icts/m4ed/)

- Alcatel-Lucent (www.alcatel lucent.com/sustainability/inclusion.html)

- Ayala Foundation (www.ayalafoundation.org/)

- British Council (www.britishcouncil.org/)

- Carnegie Mellon University (www.cmu.edu/index.shtml)

- Commonwealth of Learning (www.col.org/Pages/default.aspx)

- DFID (https://www.gov.uk/government/organizations/department-for-international-development)

- Facebook (www.facebook.com)

- French Development Bank/AFD (see for example:
  www.afd.fr/webdav/site/afd/shared/PORTAILS/SECTEURS/EDUCATION/pdf/TIC-table-ronde-1.pdf and www.afd.fr/webdav/site/afd/shared/PORTAILS/SECTEURS/EDUCATION/pdf/TIC-table-ronde-2.pdf)

- GESCI – (www.gesci.org/)

- GIZ – (www.giz.de/en/html/index.html)

- Global Business Coalition for Education – (gbc-education.org/)

- Google – (www.google.com)

- GSMA (www.gsma.com/connectedliving/meducation/;
  www.gsma.com/mobilefordevelopment/programmes/mobile-for-employment)

- Harvard University – (www.harvard.edu/)

- Hewlett Foundation – (www.hewlett.org/)

- IGNOU – (www.ignou.ac.in/)

- Institute of Education, University of London – (www.ioe.ac.uk/)

- Intel – (www.intel.com)

- ISTE – (https://www.iste.org/)

- ITU – (www.itu.int)

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- MIT – (web.mit.edu/)

- Nokia[14] (www.nokia.com)

- Open University UK – (http://www.open.ac.uk/)

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- Pearson – (www.pearson.com/)

- Sesame Street – (www.sesamestreet.org/)

- Stanford University – (www.stanford.edu/)

- Telefonica – (www.telefonica.com)

- USAID – (www.usaid.gov/)

- World Bank – (www.worldbank.org/)

A3.2.4   Useful references on good practices in m-Learning

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[14] Life Tools is reportedly being dismantled

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Kukulska-Hulme, A. and Traxler, M. (eds) (2005) *Mobile Learning: a Handbook for Educators and Trainers*, London: Routledge

McKinsey & Company and GSMA (2012) *Transforming learning through mEducation* (mckinseyonsociety.com/downloads/reports/Education/mEducation_whitepaper_April%201_vFINAL.pdf), Mumbai and London: McKinsey & Company and GSMA.

UNESCO (2012) *Mobile Learning for Teachers: Global Themes*, Paris: UNESCO (unesdoc.unesco.org/images/0021/002164/216452E.pdf) and note regional publications as well, with details at www.unesco.org/new/en/unesco/themes/icts/m4ed/mobile-learning-resources/unescomobilelearningseries/

UNESCO (2013) *Policy Guidelines for Mobile Learning*, Paris: UNESCO (unesdoc.unesco.org/images/0021/002196/219641E.pdf)

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World Economic Forum Global Agenda Council on ICT (2012) *Accelerating the adoption of mLearning: a call for collective and collaborative action*, Cologny: World Economic Forum (http://www.weforum.org/reports/accelerating-adoption-mlearning-call-collective-and-collaborative-action)

Notes:

1. GSMA have commissioned a research report on mobile education policy. The research informed the development of a Mobile Education Policy Handbook which was launched at the GSMA Mobile World Congress in February 2014. See www.gsma.com/connectedliving/mobile-learning-policy-handbook/

2. There are numerous websites with relevant m-Learning information and resources, including

   - www.unesco.org/new/en/unesco/themes/icts/m4ed/mobile-learning-resources/unescomobilelearningseries/

   - www.meducationalliance.org/

   - www.gsma.com/mobilefordevelopment/lifestories/mlearning

   - www.gsma.com/connectedliving/resources/?project=mEducation

3. ITU recently commissioned John Traxler to write a new book on m-Learning

A3.2.5   *Good practices*

The following are among the key principles of good practice in m-Learning and m-Education cited by Working Group members:

- Focus on learning outcomes, not technology; mobile devices should be seen as just one of many such technologies available to teachers to implement pedagogy.

- Involve teachers and users at all stages from design to implementation and review; ensure that effective in-service and pre-service training, as well as on-going peer support, is available.

- Consider sustainability, maintenance and financing from the onset.

- Think holistically and systemically.

- Ensure that all relevant government departments are involved.

- Ensure equality of access to all learners, especially the marginalised with a particular focus on people with disabilities and those without access to existing education system.

- Monitor and evaluate appropriately and rigorously; independent peer-reviewed evaluations should be disseminated widely.

- Adopt participatory approaches in technology design to ensure that it is user-centric.

- Establish effective multi-stakeholder partnerships (MSPs) that go beyond just the public and private sectors (PPPs) and involve civil society and other relevant stakeholders.

- Ensure supporting infrastructure must be in place.

- Maintain technology appropriately.

- Use equipment for as long as possible each day; ensure that it remains used outside normal classroom hours.

- If the initiative is at classroom level it should be implemented within the formal education system.

- For school-level work, ensure close collaboration with curriculum and examining authorities so that resources deliver on curriculum requirements.

- Ensure transparency and accountability in all practices.

- Involve parents, and encourage them also to use mobile learning for their own skills development.

- Ensure that all learners have the same quality device, especially if 'bring your own device' policies are in place,

- When online resources are used through the Internet, ensure that a digital citizenship element is in place as a precaution against potential technology misuse and abuse, including online threats that endanger child online protection.

- Focus explicitly on developing resources specifically for mobiles, rather than porting content from elsewhere; focus specifically on what can be done with mobiles, rather than on what they are not good for.

- Think about developing mobile solutions that complement and extend existing products and services.

- Keep interfaces as simple as possible.

- Consider using Universal Service/Access funds for education.

- Extend utilisation of Open Educational Resources.

- Consider using educational games that seem to be effective in particular learning contexts.

- Encourage use of mobiles to support peer learning.

- Ensure appropriate change management plans are in place to enhance rapid adoption.

A3.2.6   Gaps and challenges

Significant gaps and challenges in implementing m-Learning and m-Education initiatives; those in italics were mentioned by more than one member of the Working Group:

- *The imperative of ensuring joined up approaches across Governments*; bringing together all of the different Ministries involved, and encouraging cross-sector work. It is important that Ministries of Education work jointly with Telecommunication or ICT Ministries within the context of their national ICT and broadband strategies.

- *Open platforms for sharing mobile-learning content* – not many yet exist, but such platforms could be valuable and effective resources for users to share content and to reduce duplication of effort.

- *Effective and rigorous monitoring and evaluation* – since not enough is yet known about what really works the need exists for more direct evidence of success of m-Learning within the school system (K-12)

- *Sharing contextualised examples of good practices* - this is essential in order to reduce duplication of effort and to avoid reinventing the wheel.

- *Affordability* – in many countries, access to broadband either does not exist or is far too expensive for most people to use for learning. There is a need to work closely with other initiatives such as the work of the Broadband Commission for Digital Development, and the Alliance for Affordable Internet to enable widespread access at affordable cost.

- *Connectivity* – ensuring universal access to the Internet, both spatially and socially, as well as access at effective speeds.

- Creation of really effective multi-stakeholder partnerships with the ability to implement.

- *Lack of relevant content,* especially in local languages, and differentiated according to the learning needs of students.

- Really understanding user needs, practices and experiences of educational programmes that integrate technologies.

- Standards – ensuring compatibility between solutions for Android, iOS, Windows phone, etc.

- Effective teacher training policies integrating the appropriate use of ICTs (including m-Learning) should be put in place by Governments.

- Turnkey low-cost complete solution (Millennium Foundation is one attempt to address this)

- Funding in general is a challenge. Ministries of Education have tight budgets; so one option may be to use USF or licence fees to connect schools, subsidise devices, and support m-Learning initiatives.

- Integrating m-Learning within existing e-Learning policies and practices, rather than advocating for its existence as a separate field.

- Gap in imagination – need for creative thinking about what can be achieved through m-Learning.

- Ensuring future-proof implementation from technology innovation – e.g. by creating 'bring-your-own-device' environments and cloud-based systems.

- Lack of awareness of m-Learning potential in multiple contexts (formal, non-formal and informal).

- Linkages between the learning and tangible outcomes, such as employment or self-employment.

- Mobile assessment.

- Sustainable business models – including functioning partnerships and systems that would support delivery at scale.

Annex 4: M-Commerce

A4.1 Members of Working Group on m-Commerce

- **Mr Evgeny Bondarenko** (Chairman)
- **Ms Anne Bouverot** (GSMA)
- **Mr Yury Grin** (Intervale)
- **Mr Rahul Khullar** (TRAI)
- **Mr Sipho Maseko** (Telekom SA)

Colleagues supporting members of the Advisory Board:

- **Ms Belinda Exelby** (GSMA)
- **Mr Andreas Schauer** (Giesecke & Devrient GmbH/ Mobey Forum)
- **Ms Marina Solin** (GSMA)

A4.2 Definitions

Mobey Forum Definitions Whitepaper

Mobile Device	A mobile device is a device with mobile communication capabilities such as a telecom network connection, Wi-Fi and Bluetooth that offer a connection to the internet or other communications networks. Examples of mobile devices include mobile phones, smart phones and tablets.
Mobile (Virtual) Network Operator (MNO/MVNO)	A mobile network operator (MNO) or carrier owns its equipment and offers mobile communication services to its customers. While an MNO often owns its network infrastructure and licensed radio spectrum, a mobile virtual network operator (MVNO) usually does not. An MVNO typically has a business relationship with a larger MNO. An MVNO pays wholesale fees for communication services and then sells the minutes at retail prices under its own brand.
Mobile Application (Mobile App)	Native applications are those that are developed to be downloaded and run on a specific range of mobile devices, while mobile web applications use the device's browser. Native applications can interface with most relevant hardware features of the mobile device, but mobile web applications have very limited ability to do so.
Mobile Identification Number (MIN)	The mobile identification number is the unique number that a mobile network operator uses to identify a SIM. While a subscriber's phone number can change over time with number portability, the MIN always stays the same.
MSISDN	Commonly called MSISDN, the Mobile Station Integrated Services Digital Network is the mobile phone number allocated to a subscriber, commonly known as the phone number. It is used for routing calls to the subscriber. The MSISDN can change over time with number portability (while the MIN identifying the SIM does not change). Further information: GSMA
SIM Card	Commonly called SIM Card, the Subscriber Identity Module Card is a smart card chip used in GSM devices to provide access to the services provided by a mobile network. Access to a SIM card is protected with a PIN and can offer SIM Toolkit services. The SIM Card has a unique fixed number, and a mobile phone number assigned to it by the network operator. Since the introduction of 3G (UMTS) services, the SIM Card is often referred to as USIM (Universal SIM) or UICC (Universal Integrated Circuit Card).
	In the context of NFC-based services, the SIM card can act as the Secure Element (SE), although other SE options are available.
SIM Toolkit (STK)	The SIM Toolkit is a development environment for applications on the SIM Card/UICC. Thus applications are subject to control by the Mobile Network Operator. SIM Toolkit

	applications can take many forms. Many such applications include text-based menus to make certain functions, such as querying the remaining prepaid balance available, simpler for the user. In Mobile Financial Services SIM Toolkit applications are often used for the menus of mobile money services that communicate with the service via SMS or USSD.
Short Message Service (SMS)	Commonly called SMS, the Short Messages Service was originally only meant for communication between GSM network engineers and only later its potential for mobile subscribers was realised. SMS messages are always sent through the SMSC (the Short Message Service Center) of the subscriber's mobile network operator. SMS was not a feature of CDMA networks originally but was later added. In some cases interoperability between GSM and CDMA networks is still not flawless, resulting in delayed or double delivery of messages.
UICC Universal SIM (USIM)	Please see the definitions for 'SIM Card' and 'Secure Element'.
Unstructured Supplementary Service Data (USSD)	Unstructured Supplementary Service Data (USSD) is generally associated with real-time or instant messaging type mobile services. It has no store or forward capability that is typical of normal short messages (SMS). This increases the level of security it offers compared to SMS based financial services. USSD does not have roaming capabilities, so it is not suitable for international money transfers. USSD is used via codes that aren't very user-friendly (e.g. *06# to show the mobile device's serial number), so USSD services are often coupled with a text-based menu in a SIM Toolkit application. Further information: GSMA.
Mobile Banking (mBanking, m-Banking)	Mobile banking in its simplest form lets a user retrieve the balance of an account, a small number of the recent transactions, and transfer funds in-between accounts that the user holds. In the widest of senses mobile banking is advanced enough to replace the entire suite of service offered through a bank's branch and internet banking services.
Mobile Commerce (mCommerce, m-Commerce)	Mobile Commerce is the delivery of electronic commerce capabilities directly into the consumer´s device, anywhere, anytime via cellular and wireless networks. Source: Global Mobile Commerce Forum.
Mobile Financial Services (MFS)	Mobile financial services is an umbrella term used to describe any financial service that is provided using a mobile device.
Mobile Payments (mPayments, m-Payments)	Mobile Payments are payments for which the data and instruction are initiated, transmitted or confirmed via a mobile device. This can apply to online or offline purchases of services and digital or physical goods as well as P2P payments, including transfer of funds. Mobile payments are often divided into two main categories; proximity payments and remote payments. However, the two are converging as neither is tied to a specific technology.
Mobile POS (mPOS)	A mobile point-of-sale (mPOS) refers to using a consumer mobile device (i.e. smartphones, tablets) to facilitate payments and enable acceptance of payment instruments such as credit cards, debit cards and/or cash. mPOS devices leverage both hardware and software components to allow a merchant or individual to accept payments. To support the various card reading modalities (magnetic stripe, Chip and NFC/Contactless) some form of add-on physical hardware such as a sleeve, dongle or card reader is typically required.
Mobile Wallet (mWallet, m-Wallet)	Mobile wallet refers to the functionality on a mobile device that can interact securely with digitised valuables. It includes the ability to use a mobile device to conduct commercial transactions in the physical world. A mobile wallet may reside on a mobile device or on a remote network/secure server. Alongside the ability to undertake payments, the Mobile Wallet may contain other content, such as identity, commerce and banking services, transport and other tickets, retail vouchers and loyalty programmes. Further information: Mobey Forum, GSMA.
Social location services	Social location services combine social network traits with real-world locations. Users can "check-in" to locations and users following them will get a notification about this. Some services assign points for different actions and show leader boards amongst friends. Businesses are encouraged to claim their venues and use these social location services to track, build and reward loyalty with their customers. Rewards take different forms and could be discounts on purchases or giving the nth product for free.

Mobile proximity payment	Mobile proximity payments (in contrast to remote payments) are transactions that require that the payment device (contactless card, token, phone) is in close proximity to a payment terminal. For example, in NFC payments a consumer waves, taps or touches their mobile payment device to communicate with a merchant's point of sale terminal to pay for goods or services. These types of contactless transactions use short-range wireless frequencies and do not use the cellular network of a mobile network operator. Currently the most strongly emerging technology standard for proximity payments is near field communication (NFC). This technology brings the feature of contactless cards to mobile devices. Other technologies like Bluetooth, QR, barcodes, infrared or voice recognition can also be used and have the advantage of not requiring an NFC enabled device.
Near Field Communication (NFC)	NFC Forum proposed definition. NFC complements many popular consumer level wireless technologies, by utilizing the key elements in existing standards for contactless card technology (ISO/IEC 14443 A&B and JIS-X 6319-4). NFC can be compatible with existing contactless card infrastructure and enables a consumer to utilise one device across different systems. Extending the ability of the contactless card technology, NFC also enables devices to share information at a distance less than 4 centimeters with a maximum communication speed of 424kbps. Users can share business cards, make transactions, access information from smart posters or provide credentials for access control systems with a simple touch. NFC's bidirectional communication ability is ideal for establishing connections with other technologies by the simplicity of touch. For example if the user wants to connect their mobile device to their stereo to play media, they can simply touch the device to the stereo's NFC touch point and the devices will negotiate the best wireless technology to use. Further information: EMVCo, ISO, NFC Forum.
NFC enabled device	An NFC-enabled device is a device that is capable of performing near field communication. Source: NFC Forum.
NFC Modes	NFC technology includes three modes of operation: • Peer-to-peer mode enables two NFC devices to communicate with each other to exchange information and share files. Users of NFC-enabled devices can quickly share contact information and other files with a touch. • Reader/writer mode enables NFC devices to read information stored on inexpensive NFC tags embedded in smart posters and displays. NFC-enabled devices can access information from embedded tags in smart posters. • Card emulation mode enables NFC devices to act like smart cards, allowing users to perform transactions such as retail purchases and transit access with just a touch. This mode is capable of functioning when the device is powered-off, although it is the service provider's decision whether to allow this. Source: NFC Forum.
Over-the-Air (OTA) provisioning	Over-the-air (OTA) provisioning is the ability to download and manage content on a device over a cellular or wireless network. In the context of mobile proximity payments this applies especially to the over-the-air personalization and life cycle management of a payment instrument in the secure element in a mobile device. This process is commonly executed through the mediation of a Trusted Service Manager (TSM), employing cellular and wireless networks to reach the mobile device.
Point of Interaction (POI)	Point of Interaction is the initial point where data is entered into the payment system. POI can be physical or virtual, while a POS is always physical. POI can is often used for electronic or mobile commerce.
Secure Element (SE)	A secure element is a platform or a device used to securely store application-critical data (such as secret keys). A secure element will host a number of secure element applications, also known as applets. These applications are often installed, personalised and managed over-the-air. Examples of secure element form factors in mobile devices include UICC (SIM card), embedded SE (eSE) chip cards and (micro) SD cards. Owing to space limitations on the SE of UICC, it is usual to mediate between the end-user and the SE applet through a mobile application (app). In other words, an app is needed to provide the user interface (UI) to the SE applet – although the interaction may be confined to very simple matters such as

	activation/deactivation. <u>Further information</u>: EMVCo, GlobalPlatform, GSMA
Trusted Execution Environment (TEE)	An execution environment that runs alongside but isolated from an REE (run-time execution environment). A TEE has security capabilities and meets certain security-related requirements: It protects TEE assets from general software attacks, defines rigid safeguards as to data and functions that a program can access, and resists a set of defined threats. There are multiple technologies that can be used to implement a TEE, and the level of security achieved varies accordingly. Further information: GlobalPlatform.
Trusted Service Manager (TSM)	A trusted service manager (TSM) is a role typical in a near field communication ecosystem, where hardware secure element is in use. The trusted service manager acts as a neutral broker that sets up business agreements and technical connections with mobile network operators, mobile device manufacturers or other entities controlling the secure element (SE) on mobile devices. The trusted service manager enables service providers (SPs) to distribute and manage contactless applications remotely by allowing controlled access to the secure element in NFC-enabled handsets. In typical deployments, the TSM role is split in two – the Secure Element Issuer TSM (SEI TSM) and the Service Provider TSM (SP TSM). The Service Provider TSM manages the service provider's application provisioning to the SE and its application lifecycles. The Secure Element Issuer TSM manages secure element lifecycles and security domains on behalf of SPs. The TSM is an independent business entity and many types of company are entering this competitive market. Many payment card manufacturing companies and card personalization bureaus are already providing TSM services. Mobile Network Operators (MNOs) typically need to establish one or more SEI TSMs to manage their UICC-based secure element (the MNO being the issuer of this SE type). In this case, the SEI TSM may be deployed within each MNO or may be an independent entity serving many MNOs. Note: the terminology 'Issuer' and 'Service Provider' in this context arise from outside the Financial Services industry: 'Issuer' being the Secure Element Issuer, and 'Service Provider' being known in Financial Services as the (payment instrument) issuing bank or simply issuer. Further information: EPC, EMVCo, Mobey Forum, GSMA
Trusted Third Party	A trusted third party is a body that holds keys for authorization processes.
Mobile Money	Mobile Money is a very general term meaning any financial action made with a mobile device.
Mobile remote payment	A payment initiated by a mobile device where the transaction is conducted over a mobile telecommunications network (e.g. GSM, mobile internet) and which can be made independent of the payer's location (and/or his/her equipment).
Mobile money transfer (MMT)	A Mobile Money Transfer is the exchange of funds from one party to another, using a mobile device to either initiate and/or complete the transaction.
Mobile remittance	A mobile remittance is a mobile money transfer, mostly across international borders. It is considered a separate category of mobile remote payments due to the relatively higher payment value, possible foreign exchange requirement and regulatory complexity.
Mobile Remote Capture (MRC)	The availability of cameras in smartphones has given rise to the ability to capture cheques, bills and other payment related documents remotely instead of having to bring them to a branch. Using a mobile application, the user takes a picture of a document that is analyzed by the MRC software to read out the payment instructions. The instructions are then submitted to the bank for processing. Alternative names for this type of feature are remote deposit capture, or mobile remote deposit.
MPS	Mobile Payment System

Source: *Mobile Financial Terms* Whitepaper (http://www.mobeyforum.org/whitepaper/mobile-financial-terms-explained-2/), issued by Mobey Forum.

Annex 5: Business models

A5.1 Members of the Working Group on Business Models

- **Mr Mokhtar Mnakri** (Chairman)
- **Dr Sayave Gnoumou** (Nazounki Global Medical Network)
- **Mr Yury Grin** (Intervale)
- **Dr Veena Rawat**

A5.2 Additional information for m-Commerce

Figure A1: Cloud-based initiatives

Cloud-Based Wallet Provider

Cloud Wallet Provider	Comments
Amazon	The e-commerce giant already offers a "Checkout by Amazon" platform for mobile and facilitates shopping with its Kindle Fire tablet.
Apple Passport	Many expected the iPhone 5 to support NFC. Instead, Apple, for the moment, is pursuing a cloud approach combined with scanning a QR for transaction completion. Just released, so acceptance not yet known.
Groupon	The Groupon Merchants app and card reader is a recent entry to the market. The app also lets users redeem Groupon vouchers, and businesses can get real-time business reports in the online Payments Center.
Intuit	Already well-established in personal and small-business finance.
LevelUp	Stores scan a bar code presented on a smartphone that is based on a user's smartphone credit card.
Mobile operators	Operators already allow purchases to postpaid billing accounts and as a group are pursuing a unified virtual store.
PayPal	Owned by eBay. PayPal also has a system called PayPal Here that allows merchants to scan credit cards with a small reader plugged into a smartphone; this competes with Square.
Paydiant	Offers an SDK for retailers and banks to embed mobile wallet and contactless payment functionality into their own apps.
Square	Starbucks is major investor. Uses GPS to show a picture to a store clerk for streamlined checkout in which user has only to provide his or her name. Also offers a reader that can be plugged into a smartphone to allow merchants to easily scan credit cards.
SRD Wireless	Technology called Cloud Wallet.
Starbucks	Starbucks has been successful in developing a closed payment system specific to its offerings.

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Source: Mobile Commerce: State of the Market

Figure A2: Key NFC wallet initiatives

Key NFC Wallet Initiatives

NFC Wallet Initiative	Companies Involved, Comments
C-SAM	C-SAM, MasterCard; emphasis on Asia Pacific, Middle East and Africa
Google Wallet	Sprint, MasterCard, First Data, Citi
Isis	AT&T, T-Mobile, Verizon, GSMA, Discover. Forthcoming Samsung Galaxy S4 will support Isis.
Microsoft Windows Phone 8 Wallet	Microsoft; incorporated into Windows Phone 8
Serve (Wallet)	American Express
Trustonic (Trusted Execution Environments on ARM processors)	ARM, Gemalto, Giesecke & Devrient
Vodafone (Wallet)	CorFire, Gemalto, Vodafone
Visa Digital Wallet	Visa, Intel, Orange, Vodafone

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Source: Mobile Commerce: State of the Market

Figure A3: NFC ecosystem

NFC Ecosystem

The GSM Association architecture for NFC payments shows the key technology components: The secure element (SIM card); the Trusted Service Manager (TSM); the SIM card issuer (typically a mobile network operator); the handset, which includes the NFC payment application; an NFC-enabled point-of-sale system and service provider (retailers and banks); and the application owner (mobile commerce vendors like Google).

Data: GSM Association

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Figure A4: The M-Pesa transaction System

Note: $ ——➤ indicates movement of cash.
Source: Safaricom
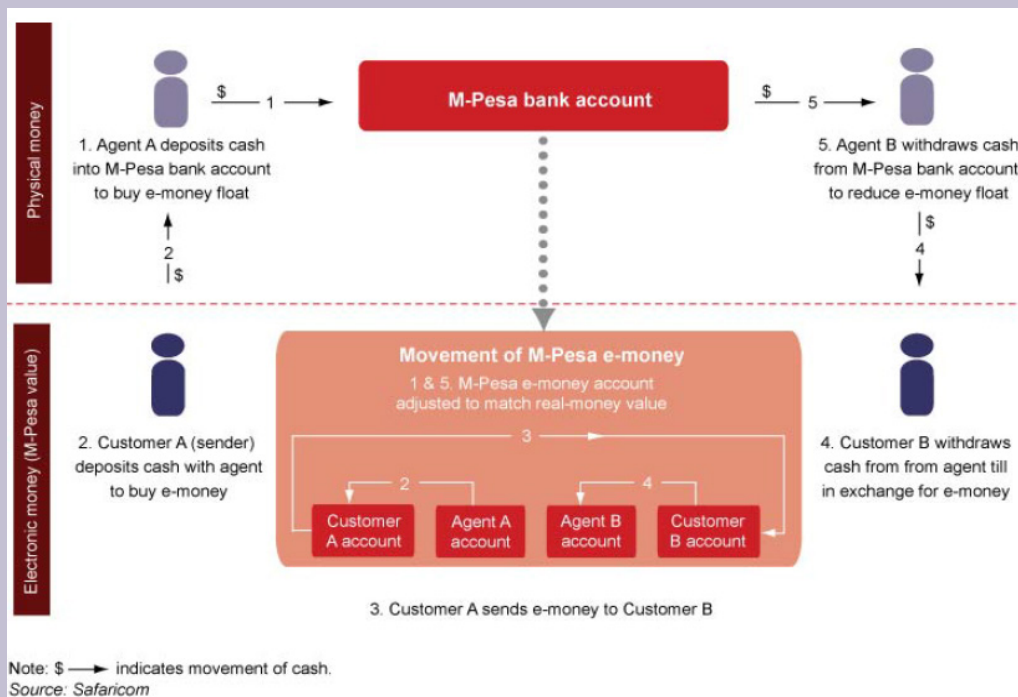
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Annex 6: Advocacy

A6.1 Members of Working Group on Advocacy

- **Ms Kathy Brown** (Chairman)
- **Ms Florence Gaudry-Perkins** (Alcatel-Lucent)
- **Mr Yury Grin** (Intervale)
- **Ms Walda Roseman** (ISOC)

Annex 7: M-Powering initiatives examples

A7.1   Real life examples for m-Payment

Vodafone's M-Pesa

- M-Pesa is a mobile phone-based electronic payments system (Figure A5).

- It was developed by Vodafone and launched commercially by its Kenyan affiliate Safaricom in March 2007.

- M-PESA operates a system of low-value electronic accounts held by the mobile operator and accessible from their subscribers' mobile phones through a SIM card-resident application.

- The conversion of cash and electronic value is performed at a network of retail stores (often referred to as agents) which are paid for by exchanging these two forms of liquidity on behalf of customers.

- All transactions are authorised and recorded in real time using secure SMS, and are capped at $500.

- M-PESA is useful as a retail payment platform because of its reach into large segments of the population.

By August 2010:

- 12.6 million registered customers, in the relatively short span of 2½ years (57% of Safaricom's customer base, 21% of the entire population or 40% of adults).

- 19,900 retail stores (of which nearly half are located outside urban centers).

- USD 350 million per month in P2P transfers.

- USD 8 million in monthly revenue (9% of Safaricom revenues)

Figure A5: M-Pesa
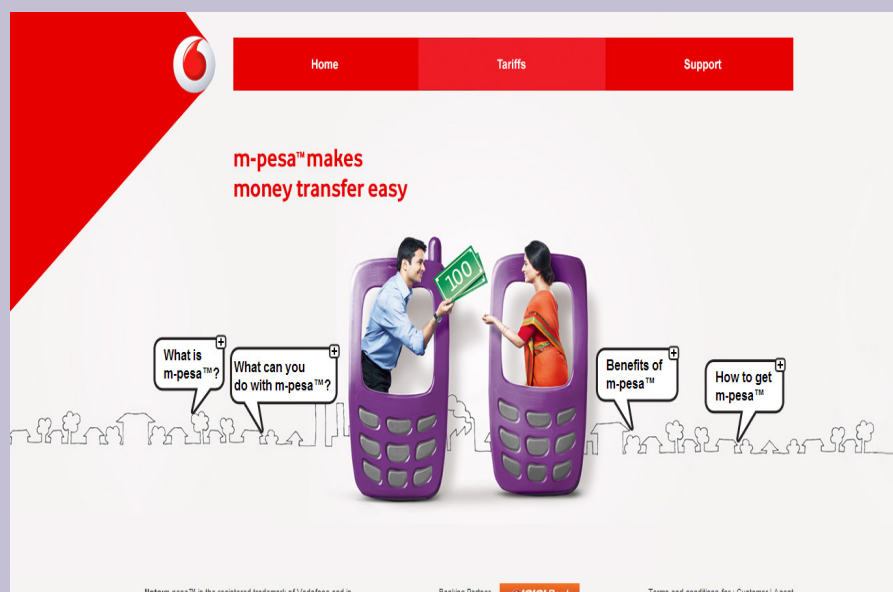
Starbucks App: m-Commerce as a strategy beyond enhancing in-store payments

Starbucks continues to expand its role as a leading mobile payment provider as evidenced in comments made recently by a company executive who said more than 2 million mobile payment transactions occur every week.

The comments were made by Howard Schultz, President/CEO of Starbucks, during a conference call with analysts to discuss the company's fourth quarter results. Mr. Schultz also said that the burden is on companies to recognise the seismic change in consumer behaviour as a result of the emergence of mobile commerce and mobile payments as well as social and digital media.

He stated: "We believe the rapid adoption of mobile gives us an opportunity to create a unique and much deeper relationship with our customers directly and in the moment like no other consumer brand or retailer…we have the unprecedented ability to reach new customers, create awareness to new products, drive incremental transactions and explore new revenue streams in music and digital publishing."

Payments squared

Mr. Schultz also reported that [Starbucks](#) had more than 100 million mobile payment transactions since the Starbucks mobile app launched in January 2011. The company continues to look for ways to expand its mobile payment offering and recently partnered with Square. For example, Starbucks customers will be able to use the Square wallet app to pay for purchases with their mobile phones. Starbucks' app generates a bar code that can be scanned at checkout to authenticate a mobile payment. This strategy has been gaining steam in the marketplace this year as other mobile payment solutions, such as NFC-enabled wallets, have been slower to experience uptake. However, as more NFC-enabled phones are adopted by consumers this year and next, it is possible NFC-based mobile payments will appeal to more companies, possibly even Starbucks. "NFC tap and go will inevitably be embraced by Starbucks," Mr. Schwartz said. "NFC is ideal for high traffic, low-value transactions."

Mdinar: BIAT's m-wallet (Tunisia)

Mdinar is a mobile payment and m-wallet service that was launched in Tunisia through a partnership between the BIAT Bank and Viamobile (a service provider); powered by Creova's mobile payment technology (Figure A6).

Figure A6: Mdinar

The Mdinar service offers P2P, top-up, and loan payment services directly from a user's mobile phone. It also offers multiple features, including the ability to view account balances, transaction history, and the possibility to save and use the list of people frequently receiving payments from the user. It also allows the user to send a request for money to another person.

People receiving money through Mdinar do not need to have a bank account. Deposits or withdrawals to credit or debit the Mdinar account can be made through the branches and ATMs of the BIAT bank network.

Tunisiana's Mobiflouss (Tunisia)

Mobiflouss is a mobile banking service (Figure A7) launched in Tunisia by Tunisiana MNO in partnership with the Tunisia mail service (La Poste Tunisienne).

The mobile service will enable users to transfer money and pay for goods and services.

The subscriber must use the prepaid e-DINAR SMART card. Once users register with Mobiflouss, they can perform various financial functions via their phones.

Figure A7: Mobiflouss

Tunisie Telecom's MobiDinar (Tunisia)

MobiDinar is a mobile banking service (Figure A8) launched in Tunisia by Tunisie Telecom MNO in partnership with the Tunisia mail service (La Poste Tunisienne).

The mobile service will enable users to transfer money and pay for goods and services.

The subscriber must use the prepaid e-DINAR SMART card. Once users register with MobiDinar, they can perform various financial functions via their phones.

Figure A8: MobiDinar

PayPal Here

PayPal Here is a mobile payment solution (Figure A9) that includes a free app and a thumb-sized card reader for your iPhone, Android or iPad device.

PayPal Here lets you simply and securely accept multiple forms of payment anytime, anywhere – credit cards, debit cards, checks, invoicing, and PayPal payments.

PayPal Here is available for small business owners who need a simple way to accept payments on-the-go or as a point of sale solution in their retail store.

The service costs a fixed 2.7% rate per transaction and the card reader is provided free of charge.

Figure A9: PayPal

Square

Square is a mobile payment service (Figure A10) that comes with two applications: Square Register and Square wallet.

- **Square Register** allows individuals and merchants to accept debit and credit cards on their iOS or Android smartphone or tablet computer.

The app supports manually entering the card details or swiping the card through the Square Reader, a small plastic device which plugs into the audio jack of a supported smartphone or tablet and reads the magnetic stripe.

- **Square Wallet** allows customers to set up a tab and pay for their order simply with their name or a barcode using a stored credit, debit, or gift card.

Figure A10: Square
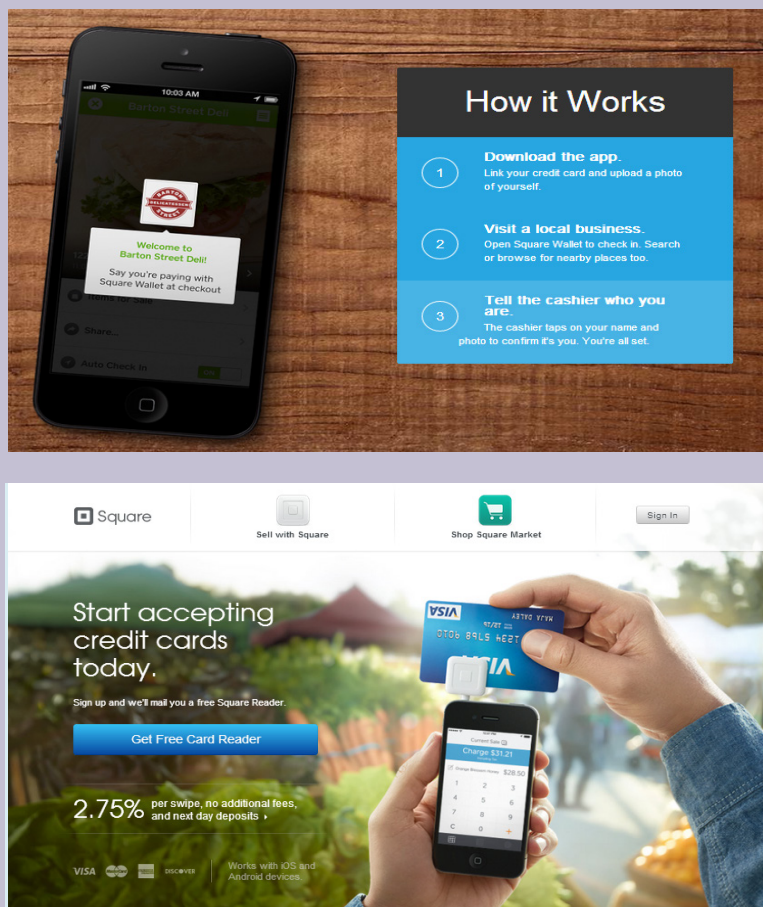
A7.2   Real life examples for m-Learning

CEIBAL plan – (Uruguay)[15]

The CEIBAL plan is a pilot programme that aims to promote technological competitiveness. It is an embodiment of the OLPC (One Laptop Per Child) programme and focuses on bridging the digital divide by developing a new low-cost laptop computer and promoting tech skills to poor children.

The programme was able to:

- Deploy 380,000 laptops in primary schools and about 100,000 in secondary schools.
- Provide Internet servers in 2,068 schools (98% student coverage); and in 250 public places with Internet connection.
- Train 20,000 teachers, 500 support teachers, and 1,500 volunteers.
- Create an educational portal and a national television channel for content dissemination and ongoing training.

Bharti Airtel: Offering mobile education to improve spoken English and enhance career prospects[16]

Global telecommunications giant Bharti Airtel's m-Education services mirror a classroom experience on a mobile technology platform, making education more convenient, accessible and affordable. A novel voice-based course for mobile customers, it has been designed for young learners who cannot afford the time or money, or both, to enroll in regular classes and uses the native language of the customer. It is available across India to all Bharti Airtel mobile customers, allowing them access to affordable services on the go, anytime, anywhere, and has received an overwhelming response in a short time frame.

Core technologies: The m-Education services are based on IVR (interactive voice response), SMS or WAP (Wireless Application Protocol) format and offer interactive learning in the native language of the customers.

Learning content: The spoken English course has been designed on the IVR format, supplemented by SMS and accessed on a toll-free number. It starts with an optional 'pre-test' to determine current proficiency and based on the results customers are recommended one of two levels – basic or advanced. Each level lasts three months (90 days) and customers are allowed to change their level once during the course if they decide they are on the wrong level.

Business model: The spoken English course is available at a daily subscription of Rs. 5/day with 10 minutes of free usage per day. This allows the customer to complete one lesson for Rs. 5. The course lasts for 90 days, with an automatic renewal on the daily subscription.

SFR's «e-école pour tous»[17]

Following a strategic review of the French educational market, SFR identified an opportunity to provide a turnkey offering designed to appeal to primary schools with minimal IT expertise. The communications service encompasses connectivity, support for learning capabilities, as well as training and maintenance support. Conceptually, this acts as a platform for the delivery of a digital educational experience, the components of which are supplied by other businesses with specific expertise in educational products and services.

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[15]   GSMA (2011) Mobile Education Landscape Report

[16]   GSMA (2013) BhartiAirtel

[17]   GSMA (2012) Connected Living programme: m-Education, New Business Models: Innovation in Practice

The scope of SFR's services includes connectivity, security services and remote device management of PCs or tablets based on the preferred devices of individual schools. The integration of a learning management system (LMS) into the overall proposition is an important step, as it opens the door for students to experience the virtual learning environment. The LMS also permits auditability. In other words, student usage information is recorded and represents a potential new service and revenue stream over the long term.

The proposition is in the early stages of being deployed and is based on a partnering model. In addition to SFR, a content provider, an LMS provider and a supplier of digital whiteboards are collaborating to deliver a 'school-as-a-service' offering; a separate finance provider handles payments from the body responsible for local school administration and disburses them to the other four service providers in the partner ecosystem. The payment framework consists of a three-year commitment of monthly subscription fees, as well as a one-time set-up charge.

Merill Lynch: How mobile devices are supporting professional learning and development?[18]

In 2007, Merill Lynch began a seven-week pilot programme in which educational content was wirelessly sent to the Blackberry smartphones of 2100 employees, enabling them to access learning materials on the daily commute or while travelling on business. The content consisted of three mandated compliance courses, accessible via both smartphones, laptops and desktop computers.

The trial participants completed their compliance training 20 days ahead of the deadline and the pilot group members were estimated to have gained 4,270 hours of extra productivity. In addition, pilot participants achieved higher scores in the compliance training than other Merill Lynch employees.

Tunisiana's 'NAJJA7NI' offering[19] (Tunisia)

The US Department of State has launched a mobile English language learning platform in collaboration with Tunisiana & Edupartage.com. This service is offered to Tunisiana's 6 million subscribers for free, for a period of 90 days.

US Department of State experts have worked in partnership with Edupartage's local teaching committee to offer "Najja7ni M-English" mobile phone-based multiple-choice questionnaires (MCQ) that cover grammar and vocabulary inspired from daily situations.

The service includes 500 MCQs and will cost 0.5 Tunisian Dinars per day of use after the trial period. The revenue will be shared between Tunisiana (30%) and Pro-Invest (70%). Users will have to dial *136# to launch the service, and then be invited to choose from different themes and topics. Thanks to USSD technology, any phone, even old, even basic provides access to Najjahni Education service.

A7.3   Real life examples for m-Health

Health care services can be classified in different ways as highlighted in the GSMA report Mobile Technology's Promise for Healthcare in 2010: Simple m-Health Solutions, Advanced m-Health Solutions and Regulatory m-Health Solutions.

- Simple m-Health solutions

Simple m-Health solutions empower patients to manage their conditions and give providers access to critical health information through the use of low-cost and accessible mobile SMS technology, which is an

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[18]   GSMA (2011) The Mobile Proposition for Education

[19]   GSMA (2014).Najja7ni: Mobile learning services for improving education, English language skills and employment opportunities in Tunisia

ideal solution to engage patients due to the ubiquity of mobile devices and the high utilisation by target populations. Text messages can be sent over any mobile operator's network. For example, SMS can be sent to patients who have an appointment; to provide the name of the patient and a phone number; or to advise when a patient is unable to attend a consultation. The objective is to reduce absenteeism of scheduled appointments by optimising available resources to decrease the number of missed appointments, thereby maximising efficiency and reducing waiting times for hospitals.

Mobile Authentication Service (MAS) (Nigeria)

The Nigerian National Agency for Food and Drug Administration and Control (NAFDAC) launched a Mobile Authentication Service (MAS) for one specific drug (BIOFEM's Glucophage) used in diabetes treatment. This service enables consumers to confirm the authenticity of the drug by scratching a label on the drug packaging to reveal a code number, and sending this number by **SMS (for free)** to a database server. An immediate text reply confirms whether the drug is genuine or fake (or if the secure PIN has already been used or is not recognised), and also contains an always-available helpline number.

The trial was a real success and it is planned to scale up the service.

BM: A sustainable BM based on SMS for Free **(Supported by pharmaceutical company)**

Vodafone's Ask a Doctor (India)

Availability: Vodafone's Ask a Doctor – Health@5 is a mobile app in India that users can activate by sending an SMS.

Business model: It is offered at a cost of Rs. 5 per day (unlimited queries).

Description: The service allows individuals to read basic information about disease management, common healthcare myths and wellness. Users can also send questions to a panel of medical experts that are answered within 24 hours.

- Advanced m-Health solutions

Advanced mobile communications offer a variety of mobile healthcare solutions:

- Devices that monitor blood sugar levels or heart rates and then transmit that information wirelessly to a physician.

- Asthma monitoring – a mobile phone application that allows patients to input readings from peak flow meters and transmits the data directly to GP surgeries, providing consistent baseline data.

- The delivery of live services for users whilst recording actual visit times; combining real-time electronic call monitoring with two-way communication.

- Mobile medical applications that let clinicians and patients easily document, retrieve and communicate patient information at the point-of-care.

3G Doctor (UK and Ireland)

Availability: Available 24/7 to residents in the UK and Ireland.

Services: Video consultations available on the 3G Doctor website and mobile platform.

BM: GBP 35 per session.

Description: Video chat with a licensed doctor on 3G Doctor. The web platform lets patients chat live with medical experts. Consultations are available with registered doctors in the UK and Ireland. A UK or Ireland-based phone number is needed to connect.

> *Heart Monitoring M2M Device (USA)*
>
> Cinterion's module in USA:
>
> • Enables secure and reliable communication of detailed diagnostic data via cellular networks and the Internet.
>
> • Provides patients and their physicians with 24/7 monitoring and improved detection and visibility of arrhythmia events.
>
> • Helps reduce hospital stays and healthcare costs.
>
> • Ensures patients' data privacy.
>
> **BM**: Package sales. **(Financial BM)**

• Regulatory m-Health Solutions

Following are the main m-Health regulatory challenges:

- Determine the right balance between the different regulatory approaches and resulting dynamics of the communications and healthcare industries while also coping with significant regional variations.

- Establish globally harmonized mobile health standards and interoperable approaches to support innovation and serve a mass consumer market.

- Find a balance that supports innovative m-Health solutions by rewarding positive health outcomes and providing regulatory controls that are proportionate to the risks and applied evenly.

- Ensure the provision of regulatory compliance assistance for healthcare professionals, insurers, and patients, for example regarding confidentiality requirements for patient data.

> "Health applications play a pivotal role in the mHealth movement because mHealth relies on providers' use of these applications when servicing patients. This creates a dilemma that has not been seen since the development of computers. Providers have been using software to aid their medical decisions for some time, but now providers can also use their mobile devices to help them make actual diagnoses. In addition, mHealth is offering solutions directly to the consumer. While in developing countries, such as the United States, this can create problems. Even though the industry is still in its infancy, statistics show that mHealth is growing exponentially." Source: FDA Regulations of mobile phone applications as medical devices, Alex Krouse, J.D., 2012, Indiana University Robert H McKinney School of Law, Indianapolis, Indiana.

Med Africa (Kenya)

Availability: Available for smartphones and less powerful feature phones.

BM: Free content supported by advertising; offers premium content for a subscription; doctors pay about $10 a month for access to its user base.

Description: Application that connects people in Kenya to quality healthcare and important health-related information. Launched in November 2011, and by March 2012, more than 70,000 users had downloaded the app from Samsung Apps.

Nokia, Safaricom and the Android Market.

A7.4   Real life examples for m-Governance

m-Governance in India

The National e-Governance Plan of the Government of India takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision. Around this idea, a massive countrywide infrastructure is evolving, and large-scale digitization of records is taking place to enable easy, reliable access over the Internet.

Mobile government is being integrated as part of India's e-Government strategy and is viewed as an instrument by which the Government can interact with citizens in rural areas, especially for the benefit of the economy. Mobile Government forms part of its vision to connect the unconnected.

As an extension of its e-Governance vision and with the mobile phone subscriber base now totaling over 870 million countrywide, the Government has also decided to facilitate access to public services via mobile devices. To this end, the Department of Information Technology has set up a Mobile Governance Innovation Fund to support the development of suitable applications by Government departments and agencies and also by third-party developers, including start-ups. The objective is to accelerate the development and deployment of mobile applications across the entire spectrum of public services. In parallel, a knowledge portal and knowledge management framework on mobile governance has been created to enhance the service provision capabilities of various m-Governance stakeholders.

This integrated platform allows Government agencies to deliver services over mobile devices using mobile communication channels like SMS, USSD (Unstructured Supplementary Service Data), IVRS (Interactive Voice Response), CBS (Cell Broadcasting Based Services), LBS (Location Based Services), mobile payment services, and through mobile applications installed on the smart phones.

m-Governance in Africa

The implementation of m-Governance can enhance the visibility of the relationship between government, citizens, businesses, agencies and organizations and allow governments to become more efficient and effective in fulfilling their service-delivery functions. Figure A11 below illustrates some examples of m-Governance initiatives in Africa.

In some cases it is the private sector driving forward the mobile government agenda. For example, IBM is working closely with the Kenyan government in shaping the framework for the organization of its data-management systems and enabling better citizen access. Elsewhere, HP is about to ramp up its investment in sub-Saharan Africa and it sees the public sector as an important part of its growth strategy in the region. Examples of its work include improving disease surveillance through mobile health monitoring technology in Botswana and the deployment of a technology platform providing education to those without access to formal schooling in Senegal.

Figure A11: M-Governance in Africa

Africa, examples of mobile government projects

Country	Project	Type	Notes
Rwanda	TRACnet	G2C	A national program supporting those living with HIV
Kenya	NAFIS/NALEP	G2B	Agricultural information service (farmers call in for recorded information)
Tanzania	Agricultural Marketing Systems	G2B	Development Program Commodity price service by SMS, administered by Vodacom and Ministry of Industry and Trade
Uganda	The Question and Answer Service (QAS) Voucher System (VS)	G2B	Voucher system enables personalized advice for farmers, run by the Rural Empowerment Network
Tunisia	Mobile Gov	G2C	Information service, run by central government and delivered by SMS, providing information on travel, weather and schools
Egypt	Government e-Procurement Portal	G2C	SMS-delivered service on government employment opportunities and health; the Ministry of State for Administrative Development worked in partnership with Vodafone Egypt
Egypt	Free SIMs for farmers	G2B	1 million free SIMs for farmers subsidized by central government
South Africa	ID Track and Trace	G2G	Tracking of ID document application via SMS
Uganda	National Water and Sewerage Corp Payments	G2C	Allows consumers to pay water utility bills via MTN Mobile Money

Source: Informa Telecoms & Media

A7.5   Real life examples for m-Sport

Telecommunications

Orange: Orange has partnered with Sky Sports to allow subscribers to watch the latest live sports action and up-to-the-minute news from Sky on the move. With access to Sky Sports 1, 2, 3, 4 and ESPN they can tune in live on their mobile and never miss a moment. They also get Sky News, Sky Sports News, CNN and At the Races.

Vodafone: Vodafone UK has partnered with Sky Broadcasting, to provide subscribers with an all-the-football-you-can-watch-per-month premium streaming service for GBP5 per month or GBP 0.50 per highlight. Vodafone and Sky Broadcasting split the revenue. The service also includes score and game alerts and is much like the addition of a premium channel in a cable TV subscription plan.

Subscribers to 4G are offered either free mobile access to Sky Sports Mobile TV or free access to the Sportily Premium music streaming service, for six months. After the introductory period each will cost an extra GBP 4.99 per month.

Media and association

The Sports Network (TSN) and Contec Innovations: According to a Mobile Marketer article published on 2 January 2009, The Sports Network (TSN) and Contec Innovations have partnered on a new global mobile sports service, providing mobile access to all things sports for carriers, publishers and brands.

Covering more than 50 sports and hundreds of leagues and events worldwide, this initiative lets mobile consumers access up-to-date news, photos, scores and results, statistics and live action.

"Available via mobile Internet, SMS and MMS, the service has three distinctive audiences: wireless carriers seeking to enhance their sports offering; mobile service providers that wish to add new services to their portfolios; and media companies and brands that sponsor mobile sports content in their local markets or on a global basis." *Dan Butcher, The Sports Network, Contec expand mobile sports services, Mobile Marketer January 2, 2009*

Monaco mobile application: AS Monaco FC launched its mobile applications in February 2013. These applications allow fans to follow live text on club matches, results, rankings, player details, videos detailing all the news about the club, and react via Twitter or Facebook. Fans can also buy tickets from the online club ticket counter, make purchases at the online club store, and take pictures of themselves with the AS Monaco FC jersey.

BBC Sport: Technology author Hannah Bouckley indicated in a January 2013 article that the BBC has launched a dedicated sports app that collates BBC sports coverage including news commentary, analysis, stats and live scores. Launched initially on iOS for the iPhone and iPod, an Android version is planned.

Users of the new BBC sports app can follow the latest sports news along with live and on-demand video highlights, and stream Radio 5 Live to listen online. Its release follows the success of the BBC Olympics app, which was downloaded by 2 million people.

Lucie McLean from BBC Future Media said: "Through the huge success of the Olympics we know that audiences love to access sport services through both mobile browser and apps. The new BBC Sport app builds on the success of London 2012 to give users an even easier way to get the content they love, whether it's checking out how their team got on, following live text updates on the day's sporting action or catching up with the latest news."

Fox Sports GO: An application that enables subscribers to watch live sports and shows. Key features of FOX Sports Go include:

- News and exclusive analysis from the FOX Sports team of writers and on-air personalities.
- Scores, statistics, standings and more for all major sports.
- Video: highlights, pre- and post-game interviews.
- Local content (news, video and analysis) from the Fox Sports Net (FSN) regional cable networks.

Annex 8: Advisory Board Member biographies

Chairman of the Advisory Board

Mr Sam Pitroda
Former Advisor to the Prime Minister of India
Broadband Commission for Digital Development Member
C-SAM Inc.

Mr Sam Pitroda is an internationally-respected telecommunications inventor, entrepreneur, development thinker, and policy maker who has spent 49 years in information and communications technology (ICT) and related global and national developments.

Credited with having laid the foundation for India's telecommunications and technology revolution of the 1980s, Mr Pitroda has been a leading campaigner to help bridge the global digital divide. During his tenure as Advisor to Prime Minister Rajiv Gandhi, Mr Pitroda led six technology missions related to telecommunications, water, literacy, immunization, dairy production, and oil seeds. He was also the founder and first Chairman of India's Telecom Commission. In these plural roles, Mr Pitroda helped revolutionize India's development philosophies and policies with a focus on access to technology as the key to social change.

As a way to induce the second phase of India's technology revolution, in 2005 Mr Pitroda headed India's National Knowledge Commission (2005-2009), to provide a blueprint of reform for the knowledge-related institutions and infrastructure for the 21st century in the country.

Recently, Mr Pitroda served as Advisor to the Prime Minister of India on Public Information Infrastructure and Innovation, with the rank of a Cabinet Minister. He served as the Chairman of the Smart Grid Task Force, as well as the committees to reform public broadcasting, modernize railways, deliver e-governance, and other developmental activities. He is also a founding Commissioner of the United Nations Broadband Commission for Digital Development and Chairman of the International Telecommunication Union's m-Powering Development Board that looks to empower developing countries with the use of mobile technology.

In addition, Mr Pitroda holds over 15 honorary PhD's, close to 100 worldwide patents, and has published and lectured widely in the United States, Europe, Latin America and Asia.

Vice-Chairman of the Advisory Board

Ms Anne Bouverot
Director General and Member of the Board
GSMA
Broadband Commission Member

Anne Bouverot is Director General of the GSMA and a Member of its Board.

Anne brings to the GSMA a wealth of experience and a proven track record of success in the highly dynamic mobile industry. With a deep understanding of the opportunities and the challenges facing mobile operators today, she leads the GSMA as the essential industry partner for its operator members around the world, enabling their continued success through driving innovation, providing thought leadership and advocating for the industry.

Before joining the GSMA, Anne was Executive Vice President for Mobile Services for France Telecom Orange, where she defined the strategic transformation programmes for a business serving more than 120 million customers and revenues of more than EUR 14 billion at the time.

Prior to France Telecom Orange, Anne led a 600-person business unit of Equant and was responsible for developing IT services for Equant's multinational business customers. She began her career in telecommunications as project manager for Telmex in Mexico in 1991.

Anne holds M.S. and Ph.D. degrees in mathematics and computer science from the Ecole Normale Supérieure in Paris and an M.S. degree from Telecom Paris. Anne was appointed as a member of the Broadband Commission for Digital Development in 2013. She also serves as a non-executive director of Capgemini, a leading global provider of consulting, technology and outsourcing services, and as a non-executive director of Edenred, the world leader of prepaid corporate services.

Mr David Atchoarena
Director
Division for Teacher Development and Higher Education
United Nations Educational, Scientific and Cultural Organization (UNESCO)

David Atchoarena is Director of the Division for Teacher Development and Higher Education at UNESCO. Prior to holding this post, he served as Senior Programme Specialist at the International Institute for Educational Planning (IIEP), UNESCO, Paris where, since 2006, he was heading the Training and Education Programmes Unit of the Institute, including the IIEP Masters Programme in Educational Planning and Management. Before joining the Institute, in 1991, he served as "Chargé de Mission" at the National Agency for Lifelong Education (ADEP) of the French Ministry of Education, and as Project Coordinator in the Ministry of Finance and Planning, in Saint Lucia.

He is also Honorary Professor in the School of Education at the University of Nottingham (UK). He holds a Doctorate in Economics from the University of Paris I (Panthéon-Sorbonne).

His research work covered several areas related to educational planning and policies, technical and vocational education and training, lifelong learning, and education for rural development. He is author of several publications and articles on education, including lifelong learning, technical and vocational education, non-formal and adult education, financing of education, educational planning, education and rural development.

In his present capacity, in addition to issues related to teachers and education policies, his responsibilities include developing and overseeing the UNESCO education programme in higher education and in ICT in education. His current themes of work include quality assurance in higher education, recognition of degrees and academic qualifications, mobility of students, governance of universities, ICT in education policies, ICT for teachers development, mobile learning and the UNITWIN/UNESCO Chairs programme.

Mr Housseynou Ba
Former Minister of Health
Mauritania

Mr Housseynou Ba was Minister of Health in Mauritania from February 2011 to February 2013.

He is currently a Consultant and Professor at Nouakchott University. He has held many senior positions in the public sector including as Minister Delegate to the Prime Minister for the Environment and Sustainable Development, Secretary General of the Ministry Delegate to the Prime Minister in Charge of Administration Modernization and Information Technology and Communication, Director, Office of the Secretary of State for the Modernization of administration and Information technology and Communication, Secretary General of the Department of Employment, Integration and Professional training, National Director of Information Technology and Communication to the Secretary of State to the Prime Minister in Charge of New Technologies, IT Director of the National Company of Telecommunications (MAURITEL), and IT Director of Telecom and Post Office.

He has conducted many professional studies and assignments. These included the study and realization of the first national node of the Internet in Mauritania to the telecommunications operator, the study and realization of the national network of the incumbent IP service, the study and implementation of IP network Intranet broadband optical fibre for Mauritanian Administration, the participation in the establishment of a national network for e-health, and the design of the transmission network for the first network bank electronic payment of Mauritania (GIMTEL).

He has conducted several wide-ranging studies in IP networks, e-health, projects evaluation, information systems, e-government for the African Development Bank, World Bank, International Telecommunication Union, World Health Organization, and Economic African Commission.

Mr Housseynou Ba holds an Engineering degree in Telecommunications from the National Institute of Telecommunications in Rabat, Morocco, awarded in June 1981, as well as a Senior Engineering degree in computer science and electronics of from ENSEA, France in July 1985. He has been Professor from 1986 - 1994, and again since April 2013. He was President of the Mauritanian Internet Society (1998-2001) and holds National Medal of recognition of Mauritania.

Mr Anthony Bloome
Senior Education Technology Specialist
Founder of m-Education Alliance,
USAID

Mr Bloome works as the senior education technology specialist in the global education offices at the United States Agency for International Development (USAID), Washington, DC. In this capacity, he has conceptualized, developed, and manages relevant projects, coordinates the exchange of good practice experiences in the appropriate use of information and communications technology for education (ICT4E) and provides advice to USAID staff, USG counterparts, and other international and national stakeholders.

Recently, he has been spearheading the formation and development of two multinational initiatives, the Mobiles for Education (mEducation) Alliance and the All Children Reading Grand Challenge for Development.

Prior to joining USAID, Mr Bloome worked as Peace Corps' global ICT specialist and as a distance education specialist at World Bank offices in Washington, DC, and Zimbabwe.

Mr Bloome has previously served in an associate editorial capacity and written several published articles on ICTs in education. He has an M.A. in international telecommunications with a concentration in distance education for developing countries.

Mr Evgeny Bondarenko
Vice Chairman ITU-D SG 2
Deputy Director General
Intervale

Mr Evgeny Bondarenko is a Deputy Director General of Intervale. His main activities are: International relations and interaction with state authorities and public organizations. At WTDC-10 Mr. Bondarenko was elected as the ITU-D SG2 Vice-Chairman and has been active in the field of usage of mobile devices for e-government, financial and medical services as the vice rapporteur of Q17-3/2. At the WTDC-14 he was re-elected as the SG2 Vice-Chairman.

Before his work for Intervale Mr Bondarenko was a Vice-President on technology development in Euroset (one of the largest Russian retailers) and Deputy Technical Director of Vimpelcom (Beeline - one of the main Russian mobile operators), where his main activities were network rollout, subcontractors control arrangement, resources distribution, flawless operation provision.

Ms Kathryn C. Brown
President and Chief Executive Officer
Internet Society

Kathryn C. Brown joined the Internet Society as President and Chief Executive Officer on 1 January, 2014. She is a veteran of Internet policy development and corporate responsibility initiatives that have aided in the Internet's global expansion. Her career spans the public and private sector, including serving in the United States National Telecommunications Information Administration (NTIA) as well as the Federal Communications Commission (FCC) during the Clinton Administration.

Ms Brown has also headed up policy and global corporate social responsibility initiatives for telecom provider Verizon as well working on legal and regulatory communications policy for law firms and consultancies.

She received her J.D., summa cum laude, from Syracuse University College of Law and her B.A., magna cum laude, from Marist College. Ms. Brown has served on the advisory boards of the Public Interest Registry (.ORG), the m-Powering Development Advisory Board of the ITU, and the USC Annenberg Innovation Lab.

Mr Robert Collymore
Chief Executive Officer
Safaricom Limited

Mr Robert Collymore is the current CEO of Safaricom Limited, effective 1 November 2010.

Prior to joining Safaricom, Mr Collymore was the Chief Officer for Corporate Affairs in Vodacom Group responsible for the Group's Corporate Communication, Ethics and Compliance, Legal, External Relationships and Corporate Social Responsibility. Prior to that, he was Vodafone's Governance Director for Africa where he was responsible for developing and driving Vodafone's strategy for its investments in Africa as well as representing Vodafone as a key direct foreign investor in a number of African countries.

Mr Collymore has more than 25 years of commercial experience working in the telecommunications sector. He is also a trustee of Holding companies in Kenya and Tanzania for M-PESA, Vodafone's pioneering money transfer service.

Mr John Davies
General Manager, Vice President
Intel World Ahead Program, Intel Corporation
ITU Broadband Commission Member

Mr John E. Davies is Vice President of the Sales and Marketing Group and General Manager of the Intel World Ahead Program. The program promotes increased access to technology in emerging markets, enabling millions to be part of the computing and connected world for the first time, and has helped improve education and healthcare, stimulate economies, and enrich lives around the world. During his 35 years with Intel, Mr Davies has worked in various senior engineering, marketing, and management positions. He has been Director of Marketing for the Mobile Computing Group and Vice President and marketing director for the Consumer Desktop Products Group. In late 90's, Mr Davies was Vice President and general manager of Intel Asia Pacific Region, based in Hong Kong.

Mr Davies was born in London, England. He received his bachelor's degree in Chemistry and his doctorate in Solid State Physics from Imperial College, London University. Prior to joining Intel, Mr Davies worked as a postdoctoral research fellow at IBM and as a development engineer at Philips in the UK. Intel has awarded Mr Davies two prestigious Individual Achievement Awards for establishing Intel in the European automotive market in 1986, and for driving Intel's mobile computing architecture into the Japanese market in 1992.

Ms Gabrielle Gauthey
Group Corporate Vice President
Alcatel-Lucent

Ms Gabrielle Gauthey is Group Corporate Vice President, in charge of government sector for Alcatel-Lucent. She is also Vice President of FIEEC, the French telecommunications, ICT and electronic industry organization, and Chair of the innovation and research commission at the French business association Medef.

Ms Gabrielle Gauthey is a graduate of the Ecole Polytechnique and holds a postgraduate degree in economic analysis. She began her career with France Telecom. In 1990 she became General Secretary of the "Invest in France" agency. From 1995 to 1997 she was adviser to François Fillon, Minister for Posts, Telecommunications and Space Affairs. From 1998 to July 2000 she was Deputy CEO of Sofirad and CEO of "Le SAT", the first satellite-based operator of French-language digital TV and radio services in Africa. Till January 2003, she was Director of the Information and Communication Technologies Department at the Caisse des Depots et Consignations, responsible for investment in "the regional digital development" programme by mandate of the State.

From 2003 to 2008, she was Commissioner at the French Regulatory Authority for Electronic Communications and Posts (ARCEP).

Ms Lindsay Glassco
Director of International Cooperation and Development
International Olympic Committee

Lindsay Glassco is Director of International Cooperation and Development at the International Olympic Committee where she is responsible for bringing to life the fundamental principle of placing sport at the service of humankind.

Prior to joining the IOC in January 2014, Glassco was President and CEO of Special Olympics Canada (SOC) where she oversaw all operations of the Canadian division of the international organization, which provides people with intellectual disabilities the opportunity to participate in sport competition and daily programs.

Glassco has more than 20 years of experience in developing and implementing policies and programs in the non-profit and government sectors globally. Prior to joining SOC, Glassco was responsible for strategic and operational planning for Right to Play (RTP). While at RTP, Glassco also oversaw relationships with governments and UN agencies worldwide and shepherded the highly successful four-year policy initiative, the *Sport for Development and Peace (SDP) International Working Group.*

Before her tenure at RTP, Glassco spent close to a decade with the Canadian federal government, including Foreign Affairs Canada, developing policies and programs in the areas of disability, global health, and Canada's labour market. Prior to her career in Canada, Glassco based in Geneva and Rome, was an international social development consultant to UN organizations such as FAO, UNV and UNDP.

Glassco first worked in the sports sector as an account manager with the world-leading sports marketing agency International Management Group.

Throughout her career, Glassco has worked tirelessly towards one overarching goal: the inclusion and social development of the world's most marginalized people. As the Director of International Cooperation and Development at the IOC, she continues on this path of building a better world through sport.

Glassco holds a master's degree (MPhil) in International Development from the Institute of Development Studies at the University of Sussex (England), as well as a Bachelor of Arts degree from McGill University.

Dr Sayave Gnoumou
Chief Executive Officer and President
Nazounki Global Medical Network

Dr Sayave Gnoumou is the founder of Nazounki Global Medical Network, a company that takes a 360° all-inclusive approach in its care of patients seeking treatment abroad. Nazounki uses technology to share with specialists all over the world, medical information of its "patients of the world".

Dr Gnoumou became a leader in the telemedicine field and has been a pioneer in developing ICT tools to provide the best medical care, and in particular to patients in the most remote places going abroad for treatment. As a result, he has become a reference for various organizations (e.g. AU and UNGAID) in the use of ICT in health.

Dr Gnoumou has been practicing medicine for over 20 years and specializes in general surgery, micro surgery, and urology.

H.E. Dr Omobola Johnson
Minister
Federal Ministry of Communication Technology
Nigeria

Dr (Mrs.) Omobola Johnson is Nigeria's Honorable Minister of Communication Technology. Prior to her ministerial appointment, she was Country Managing Director of Accenture, Nigeria (2005) and was responsible for implementing Accenture's strategy in Nigeria and the rest of West Africa. She superintended over a staff strength of 120 covering five industries – Financial Services, Resources, Products, Communications and Public Sector and a wide range of consulting services (strategy, information technology and finance and performance management). She has over 25 years consulting experience which includes significant experience in the area of enterprise transformation and has worked with Boards and Management of several major banks and the Central Bank of Nigeria to successfully transform these organizations into more competitive and dynamic ones.

She is the Chairperson of the United Nations' Commission on Science and Technology for Development (CSTD). She is a member of the World Economic Forum's Global Agenda Council on Africa with the role of actively guiding the Council to deliver insights and develop solutions to address major global challenges especially those relevant to Africa. She is also a member of UNDP's Broadband Commission Working Group on Gender whose main objective is to promote the empowerment and digital inclusion of women.

Dr Johnson is also the founding Chairperson and Member of Board of Trustees of Women in Management and Business (WIMBIZ) a non-governmental organization that seeks to improve the success rate of female entrepreneurs and increase the proportion of women in senior positions in corporate organizations.

Dr Johnson holds a Bachelor's Degree in Electrical and Electronic Engineering from the University of Manchester, a Master's degree in Digital Electronics from King's College, London, and a Doctor of Business Administration degree from the Cranfield University School of Management.

Mr Navin Kapila
Independent Consultant
Managing Director of India
Inmarsat Plc.

Mr Navin Kapila has been Managing Director of India at Inmarsat Plc since 21 January, 2013. He was a senior official within the Indian Government's Ministry of Communications and Information Technology and also served as Vice President of Corporate Development at ICO Global Communications (London), and served as its Vice President of Government Affairs and Director of Business Development. He currently serves as a non-executive Board Member of Telkom South Africa and an International Telecommunication Union Special Adviser for Emergency Communications.

Mr Kapila is a seasoned professional who has, for more the past 25 years, gained vast experience in diverse fields including investment, business and product development and relationship and alliance management. He has in-depth telecommunications experience and was involved in policy formulation and market deregulation. Mr Kapila was educated at India's Punjab University. In October 2012, Mr Kapila was presented with the only individual award by ITU Secretary-General Hamadoun Touré at the ITU's first Humanitarian Awards ceremony.

Dr Rahul Khullar
Chairman
Telecom Regulatory Authority
India

Dr Rahul Khullar joined Telecom Regulatory Authority of India as Chairman on 14 May 2012. Prior to joining TRAI, he was Commerce Secretary in Ministry of Commerce and Industry, Government of India. He also served as Secretary, Department of Disinvestment, Ministry of Finance, Government of India.

He is a permanent civil servant who joined the Indian Administrative Service in 1975. He has served in various capacities and at various levels in the Central and State Government. He has served as Director in the Prime Minister's Office, Private Secretary to Union Finance Minister, Development Commissioner for Delhi, Commissioner of Sales Tax, Delhi and Principal Secretary (Planning), Delhi. He has also served as Additional Secretary and Special Secretary in the Department of Commerce, Ministry of Commerce & Industry. He has been Chief Negotiator for India in the Doha Round of multilateral trade negotiations at the WTO. He was also Chief Negotiator for the Free Trade Agreement (FTA) with the EU.

Dr Khullar has worked as a professional economist in the Asian Development Bank (ADB), Manila from 1994 to 2000. In this assignment he worked as a Lead Economist for the Pacific, and later for the Philippines, and, thereafter, for Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Turkmenistan, etc.). He also served as Senior Economist in the Strategy and Policy Office attached to the President of the Asian Development Bank.

He has a Ph.D. in Economics and has been a Visiting Professor in the Department of Economics, Boston University (1990-91), and a Lecturer at the Kennedy School of Government, Harvard University, Cambridge USA (1982-84).

Dr. Marie-Paule Kieny
Assistant Director-General
World Health Organization (WHO)

Dr Marie-Paule Kieny was appointed WHO Assistant Director-General for Health Systems and Innovation in November 2012. Dr. Kieny was WHO Assistant Director-General for Innovation, Information, Evidence and Research from October 2010-November 2012.

Prior to this, Dr Kieny directed the WHO Initiative for Vaccine Research since its inception in 2001. Major successes under her leadership were the development and licensing of new vaccines against meningitis and against pandemic influenza in developing countries through pioneering the transfer of technology and know-how. Vaccines against poverty-related diseases and those that disproportionately affect poor and marginalized populations are continuing priorities since her first role in WHO with the Special Programme for Research and Training in Tropical Diseases in 2001.

Before coming to WHO, Dr Kieny held top research positions in the public and private sectors of her home country, France. The positions included Assistant Scientific Director of Transgene S.A. from 1981 to 1988, and Director of Research and Head of the Hepatitis C Virus Molecular Virology Group at the Institute of Virology, Institut national de la santé et de la recherche médicale (INSERM) from 1999 to 2000.

She received her PhD in Microbiology from the University of Montpellier in 1980, where she was also awarded a University Diploma in Economics, and her Diplôme d'Habilitation à Diriger des Recherches from the University of Strasbourg in 1995. Dr Kieny has published over 250 articles and reviews, mainly in the areas of infectious diseases, immunology and vaccinology.

Dr Kieny was awarded the coveted Chevalier de l'Ordre National du Mérite, au titre du Ministère de la Recherche (2000); the Prix Génération 2000-Impact Médecin (1994); and the Prix de l'Innovation Rhône-Poulenc (1991).

Mr Sipho Maseko
Group Chief Executive Officer
Telekom SA SOC Ltd.

Mr Sipho Maseko was appointed as Group Chief Executive Officer and as an Executive Director of Telkom on 1 April 2013.

He was the Group Chief Operating Officer and Managing Director at Vodacom since 2011. Prior to joining Vodacom, Mr Maseko was the Chief Executive Officer of BP Africa (Pty) Limited from 2008 to 2012 and the Chief Operating Officer in 2007. He also served in various positions at BP since 1997.

Mr Maseko has been a Non-Executive Director of the Board of the Centre for Development and Enterprise since 2009 and of the Afrox Board since 2012. He served as Chairman of the Board of SAPREF (Shell & BP South African Petroleum Refineries Pty Ltd) from July 2010 to August 2011.

Mr Mokhtar Mnakri
Chairman and Chief Executive Officer
Groupe Tunisie Telecom

Mr Mokhtar Mnakri has more than 25 years track in the business of telecommunications. Since 2012 he has been CEO and Chairman of Tunisie Telecom Group, the incumbent operator in Tunisia.

He previously worked for large manufacturing companies Alcatel, then ALU for 20 years and was, in the early stage of mobile network deployments, in charge of Sales Support and Business Development in Africa & Middle East.

In the early 2000's he led for Alcatel commercial activity for mobile in North Africa, Middle East and South Asia. In 2008, he was appointed Country Senior Officer and CEO of ALU Tunisia until end 2010. He then ensured support to European and MEA companies in Business Development & Management during 2011 until his appointment in Tunisie Telecom in 2012.

Mr Mnakri has a comprehensive view on the telecommunications sector and its actors. He has also developed intercultural management skills, along with a solid track in management of people and organizations. Mr Mnakri holds a Masters degree in Telecommunications from the Ecole Nationale Supérieure des Telecoms, Paris, and a MSc in Civil Aviation and Aerospace from the Ecole Nationale de l'Aviation Civile, Toulouse, France. He speaks Arabic, English and French.

H.E. Mr Diego Molano Vega
Minister
Ministry of Information, Technologies and Communications
Colombia

With qualifications both in electronics and economics, Diego Molano Vega is an outstanding international expert in the telecommunications world, an area in which he has been working for 20 years in entities such as the Colombian Regulatory Commission of Telecommunications (CRT) and major multinationals. Minister Molano`s experience also includes policy advice in the information technologies and communications.

In his career, he has been General Vice-Chairman of Telefonica`s Corporate Relations at the main headquarters of the company in Madrid, Spain from 2005 to 2010. In this position he supervised researches and publications on the impact of technology on public health, banking, judicial sector, education, Pymes, productivity and competitiveness as well as about innovation in the Latin American environment. Within this conglomerate that operates in fourteen Latin American countries he also led business activities in support of Free Trade Agreement between Latin America counties, Europe and, the U.S.A.

He was Director of Government Regulatory Affairs of the U.S.A international telephone company Bellsouth with headquarters in Atlanta (Georgia) between 2002 and 2005. Between 1996 and 2000, Molano was a member of the Telecommunications Regulatory Commission of Colombia for a period of two years. He was responsible for issuing the regulation that introduced competition in the land line, mobile and long distance which attracted foreign capital and increased the penetration of telecommunications services ub the country. He also designed and executed social telecommunication projects. Between 1992 and 1996 he served at Ascom as Manager of Telecommunications and, between 1988 and 1990 as Sales Manager at the Texas Instrument (Texins).

Diego Molano Vega graduated in electronic engineering in 1991 from Javeriana University where he also obtained an MA in Economics in 1994. In 2001 he received an MBA at the International Institute for Management Development (IMD) in Lausanne, Switzerland.

Dr Veena Rawat
Communications Technologies Consultant

Dr Veena Rawat is an internationally-acclaimed expert in radio frequency spectrum planning and management. She is currently working as a Communications Technologies Consultant, providing advisory services to a number of organizations and corporations nationally and internationally. In 2014 she became an Officer of the Order of Canada for her "contributions to telecommunications engineering and for leadership in establishing the global regulatory framework for radio spectrum management"

Between 2011 and 2014, prior to taking up consulting, Dr Rawat worked as Vice President and Ambassador to ITU for BlackBerry. This role included representation of BlackBerry's interests in ITU at executive level for issues dealing with spectrum for mobile broadband, network and mobile device security, and e-waste environmental issues among others.

During 2004-11, Dr Rawat was President of Communications Research Centre, the only Canadian federal government research laboratory conducting R&D in all communications technologies. As President of CRC, Dr. Rawat was member of a number of advisory boards dealing with innovation in ICT.

Before heading CRC, Dr Rawat spent 28 years within the Canadian Government where she held executive positions managing programs related to radio frequency spectrum engineering for all wireless and space communication services. This included: leading negotiations at the International Telecommunication Union (ITU), Organization of American States (OAS) and US Government (FCC, NTIA); chairing major national and international committees; and consultations with senior executives of the telecommunications and space industry at global level to develop policies and regulations. She has served on the board of numerous national and international professional organizations.

She has received numerous International and national awards for her contribution to the Canadian and international telecommunications industry. Her most recent award in 2014 is: from the Governor General of Canada, Officer of the Order of Canada, one of the highest award of the country. Other key awards, among over thirty prestigious awards, are: from IEEE for Public Service in Communications (2012); from the Government of Canada the highest Public Service Award of Excellence (2011); from ITU, a gold medal (2003) and a silver medal before that; Canadian Women in Communications' Canadian Woman of the Year (2004); and Canadian Women's Executive Network's Canada's Most Powerful Women, Top 100 (2005);

Mr Mohamed Sharil Mohamed Tarmizi
Chairman
Malaysian Communications and Multimedia Commission

Dato' Mohamed Sharil Mohamed Tarmizi was appointed as Chairman of the Malaysian Communications and Multimedia Commission (MCMC) effective 16 October 2011. He served as a Member of the Commission from 2006 for two terms during which time he was subsequently invited to join the MCMC as Chief Operating Officer in 2008 prior to his current appointment.

He was the Executive Director and Head of Strategy in BinaFikir Sdn Bhd, a financial advisory and strategy consulting firm, prior to joining SKMM as the Chief Operating Officer.

In the international arena, Dato' Mohamed Sharil is recognized as an authority in the area of Internet Governance where he was appointed as Chairman of the Government Advisory Committee (GAC) from 2003 to 2007, as well as a Board Member in the Internet Corporation of Assigned Names and Numbers (ICANN) during the same period. At the end of his tenure, he was honoured by the GAC, the ICANN Board and the global internet community for successfully navigating the GAC and assisting ICANN through the challenging early years of the debates surrounding Internet Governance at two WSIS events in Geneva (2003) and Tunis (2005).

He has also worked with the World Trade Organization (WTO) in the areas of capacity building and helping countries undergo regulatory reform in preparation for globalization. In particular, he was involved in the further development of the Telecoms Reference Paper for the Telecommunications Sector as well as the drafting of the Postal Services Reference Paper for the Postal and Express Delivery Sector. He was also one of Malaysia's lead negotiators for the telecommunications sector in various rounds of WTO negotiations as well was the various trade or economic cooperation agreements that Malaysia has had.

He was also recently elected the Vice Chairman of the ITU Council's Child Online Protection initiative, an initiative to address the ills of cyberspace particularly against young persons and children. He also sits on the Board of Trustee of the International Multilateral Partnership Against Cyber Threats (IMPACT) and he was appointed to the Board of Directors of the Multimedia Development Corporation by Prime Minister Dato' Sri Mohd Najib Tun Razak.

He holds a Bachelor's Degree in Law from University College of Wales, Aberystwyth and qualified as a Barrister from Gray's Inn, England and Wales (UK).

Prof. Tim Unwin
Secretary-General
Commonwealth Telecommunications Organisation

Professor Tim Unwin was appointed Secretary-General of the Commonwealth Telecommunications Organisation (CTO) in September 2011, and he also leads the CTO's activities on ICTs for people with disabilities and ICTs in education, focusing particularly on skills development and entrepreneurship. He serves on the ITU's m-Powering Development Advisory Board and as a Member of the UK Department for International Development's Digital Advisory Panel.

He was Chair of the Commonwealth Scholarship Commission from 2009-2014, and a Commissioner from 2004. His continuing academic roles include his role as UNESCO Chair in ICT4D and Emeritus Professor of Geography at Royal Holloway, University of London, as well as Honorary Professor at Lanzhou University in China. In 2004 he launched the ICT4D Collective, which was recognized in the authoritative *Global Go To Think Tank Index Report 2013*, as the 9th top Science and Technology think tank in the world. He has written or edited 15 books and more than 200 academic papers and chapters, many of which focus on the use of technology in development practices. His book, *Information and Communication Technologies for Development*, was published by Cambridge University Press in 2009.

Mr Binali Yıldırım
Former Minister of Transport, Maritime Affairs and Communications
Republic of Turkey.

Mr Yıldırım left his position as Minister of Transport Maritime Affairs and Communications in December 2013. Mr Yıldırım, besides his parliamentary engagements, works as the Senior Advisor to the President of the Republic of Turkey, H.E. Mr. Recep Tayyip Erdoğan.

Mr Binali Yildirim was elected as Member of Parliament from the province of Istanbul in the general elections held on 3rd November 2002 and was appointed as the Minister of Transport and Communications in the 59th Government of the Republic of Turkey.

He was re-elected as a Member of Parliament in the general elections held in 2007 and in June 2011 and after both elections he continued his post as the Minister of Transport Maritime Affairs and Communications of the Government of Turkish Republic. During his term in office, his vision on Information Society led to development of policies and projects which have been implemented in the field of ICT in addition to many important transport infrastructure projects.

He studied Maritime Safety Administration between 1990 and 1991 at the World Maritime University (WMU) – Malmoe/Sweden under the auspices of the International Maritime Organization (IMO) where he was granted MSc. degree on Maritime Safety Administration. He worked at various managerial levels of General Directorate of Turkish Shipbuilding Industry and Camialtı Shipyard until 1994. He was appointed as the General Manager of Istanbul Sea Buses Corporation (IDO), a position he held until 2000.

Mr Yıldırım headed Turkish delegations in numerous bilateral meetings in the field of transport and communications. Moreover, during his office, many intergovernmental or transport and communications related meetings of various international organizations have been held under his Chairmanship. He is presently member of the Board of Governors in the World Maritime University- Malmoe since 2007. He also served the university being a member of the Executive Board of the University until 2014.

Mr Binali Yıldırım graduated from the Technical University of Istanbul with a Bsc. Degree in Faculty of Naval Architecture and Marine Engineering in 1977. He has been awarded honorary doctorates by 14 different universities in Turkey and Europe including Technical University of Berlin (Germany), World Maritime University (Sweden), Technical University of Istanbul, Bozok University-Yozgat, Ondokuzmayıs University-Samsun and an honorary science doctorate from Cumhuriyet University-Sivas.

He is member of various Non-Governmental Organizations as well as the Head of Piri Reis Maritime Foundation and Culture and Co-operation Association of Refahiye.

Advisory Board meeting in progress

Advisory Board members during their first meeting on 15 October 2013.

Advisory Board members during their second meeting on 23 May 2014