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ITU-T

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ITU-T Focus Group Bridging the gap: From Innovation to Standards

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New Standardization Activities for ITU-T Study Groups and ICT Innovation Panel

Focus Group Technical Report

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The procedures for establishment of focus groups are defined in Recommendation ITU-T A.7. The ITU-T Focus Group Bridging the Gap: From Innovation to Standards (FG Innovation) was established further to ITU-T TSAG agreement at its meeting in Geneva, 10-13 January 2012. ITU-T TSAG is the parent group of FG Innovation.

Deliverables of focus groups can take the form of technical reports, specifications, etc. and aim to provide material for consideration by the parent group in its standardization activities. Deliverables of focus groups are not ITU-T Recommendations.

FG Innovation Reports

Deliverable 1: Successful cases of ICT innovations for developing countries

Deliverable 2: New Standardization Activities for ITU-T Study Group and ICT Innovation Panel

Acknowledgment

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List of Figures

List of Tables

Table of Contents

Preface

ICTs have a key role in enabling developing countries to meet the Millennium Development Goals (MDGs) and bridging the digital divide. Developments in ICTs fuelled by innovations and standards are important factors that can facilitate socio-economic growth. ICT innovations and related standards can bridge the digital divide and positively impact the lives of people.

The Focus Group Innovation provides an initial platform for the recognition and identification of innovations emerging in developing countries which may benefit from standardisation and furthermore support its standardisation by the ITU T-sector. It was evident from the surveyed ICT applications from the emerging economies that innovations do exist in various forms and do have different impacts. It was crucial to investigate the real connection between these innovations and the standards making process.

To accomplish its targets, this Focus Group endeavoured itself with documenting case studies of successful examples of ICT innovations, including those that have emerged in developing countries, and identifying where possible relevant standardization gaps.

Particular focus had been put on the socioeconomic impact of ICT innovation that have emerged in developing countries. The focus of the group is also extended to analyzing the innovations that may be standardized which was culminated in the form of the first deliverable specified through a separate report. A major activity in this group was to suggest future ITU-T study items and related actions; which can aid in bridging the innovations to standards gap, and help in addressing the effective participation of developing countries in the standardization activities. In addition, this Focus Group presented a sustainable development model for both the innovation and standardization industries.

This report presents the second main deliverable of the Focus Group and focuses on presenting new standardization activities for the ITU-T based on studies and in addition to an analysis of key factors that hinder the development of innovations and standards.

Dr Ramy Ahmed Fathy
Vice Chairman, FG Innovation
June, 2014

1 Introduction

Small and Medium-sized Enterprises (SMEs) and craft enterprises are a very important part the economy. For example, the SMEs and craft enterprises account for 99.8 % of all businesses, 67.5 % of all jobs and 58.4 %of value added in the European economy[1].Standards are commonly agreed reference documents that help to bring order to the world. Formally, they can be defined as a construct that results from reasoned, collective choice and enables agreement on solutions of recurrent problems. Standards present a striking balance between, the technological possibilities and associated costs of producers, and constraints imposed by governments for the benefit of society in general. They are a common and vital element of our society, and form an essential component of everyday life. Each year many existing standards are revised and updated so as to remain up to date and fit for purpose, while at the same time many new standards are also being developed.

Standards play a number of important roles in the economy, and ultimately support innovation, growth and competitiveness across any economy. Indeed, studies in selected countries suggest that standards are correlated with growth in the economic indicators of nations, altogether with innovations and other macro-economic growth stimuli. For example, growth in the stock of standards was reported to account for up to a quarter of recent productivity growth in Europe[1].Standards also offer many significant benefits for individual businesses and industries, and provide SMEs with a vital competitive edge. There are benefits to be gained from both adopting standards and from the actual participation in the standards making process.

2 Role of Standardization, Innovations, and Impact on Economy

From a macroeconomic standpoint, standardization is reported to have a direct contribution to the growth in economy. Standardization contributes an average growth in the GDP that ranges from 0.2% to 0.9% annually[2]. According to a German study on the micro- and macroeconomic benefits of standardization, the contribution of standards to the growth rate in each country is equivalent to 0.9% in Germany, Australia, 0.3% in the UK and 0.2% in Canada.

This is also in line with reported results for the French economy, where from a macroeconomic standpoint, standardization directly contributes to its growth by an average of 0.81% per year, or almost 25% of GDP growth[3].

In order for the industry in national economies to be able to contribute to the economy, classical economic theory considered three factors: labour, capital and land. These were considered as the necessary production factors that could generate growth in classical growth economics. However, the work of Robert Solow carried out empirical work where he was able to show that there is another factor that has a significant effect on the growth of an economy: the human knowledge. Qualitative improvement of labour and capital through technical progress leads to sustainable economic growth.

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[1] How to support SME Policy from Structural Funds: Using standards to support growth, competitiveness and innovation, Guidebook Series, European Commission, 2012.

[2] See: The Economic Benefits of Standardization: An update of the study carried out by DIN in 2000.

[3] See: The Economic Impact of Standardization Technological Change, Standards Growth in France June 2009, Marketing and Innovation Department – AFNOR Group.

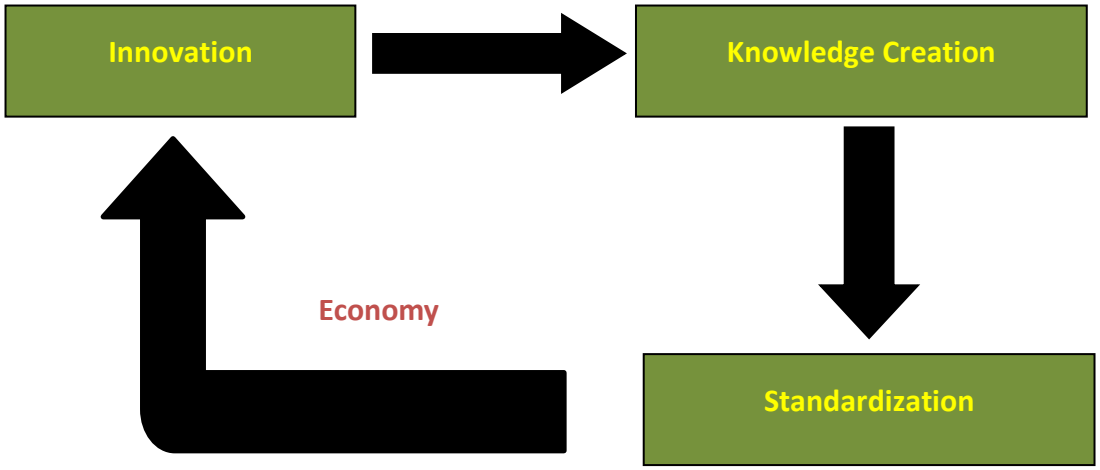

Figure 1 Link between Innovations and Standards

Innovation is one of the main sources for generating new human knowledge. It is fundamentally a social and cultural process. According to research in evolutionary anthropology[4] where an examination of the factors or processes that favour both the generation of more inventions and the spread those inventions through the population revealed a dependency on the degree of cultural interconnectedness. Inventions in this context were defined as useful or adaptive novelties; while the spread of those inventions through the population, is what makes them, innovations[4].

The results showed that a population's degree of innovativeness does not need to be connected to the degree of inventiveness of its members, given that a highly interconnected population can have high innovativeness even when it has relatively low inventiveness. On the other hand, given that invention is strongly influenced by recombination of different novelties and new ideas or knowledge from different domains of knowledge; in addition to coincidence; both larger population size and greater interconnectedness will, all things being equal, increase inventiveness and innovation.

In this sense, standards, as a means to convey and diffuse technical knowledge, and a means to implement and adopt novelties and know how, have a direct interaction on the increase in the degree of interconnectedness in societies and hence on the overall inventiveness and innovations in societies. Figure 1 demonstrates the link between innovations and standards.

The contribution of standards to the inventiveness and innovations in societies is due, to a certain extent, to businesses that apply and develop standards. Businesses actually constitute important entities in social systems. Though many macroeconomic studies demonstrate the positive impacts of committee standardization on innovation, it is still ambiguous from the companies' perspective, whether standardization contributes to innovation, and if yes, how this objective can be achieved.

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[4] Joseph Henrich, The Evolution of Innovation-Enhancing Institutions, from Innovation in Cultural System: Contributions from Evolutionary Anthropology, edited by Michael J. O'Brien and Stephen J. Shennan. The MIT Press Cambridge, Massachusetts London, England, 2010.

To achieve a sustainable success in a competitive environment, companies should look for new ways to be innovative. To generate innovations, the scientific literature has identified many methods and tools that support companies in looking for new ideas and innovation impulses. Examples of such methods are: innovative teams, creativity workshops, and innovation competitions. Standardization, however, has not been very present in the innovation literature, although many case examples show that committee standards can make an important contribution to support and promote innovation.

In a recent study, which is a result of the project "Innovation Potential in Standardization" (IPONORM), Fraunhofer MOEZ demonstrates how SMEs can increase their innovativeness by leveraging the benefits of standardization[5]. The project IPONORM is a part of the program on Innovation with Norms and Standards (INS) by the German Institute for Standardization (DIN). INS is funded by the German Federal Ministry of Economics and Energy (BMWi), according to the recommendation of the German Federal Parliament. IPONORM aims to identify the forms that the innovation potentials in standardization can take and to find how companies, especially German SMEs, can leverage these potentials. The innovation potentials are defined as the innovation driving factors of standardization. In the study, the innovation potentials not only the result of participating in standardization processes, but also of applying standards.

The term "*innovation*" was broadly understood for the purpose of the IPONORM study, including various interpretations. To identify the innovation potential in standardization, 40 interviews with experts from German SMEs were conducted in the following sectors: biotechnology, nanotechnology, services, security and mechanical engineering. The analysis of the interviews led to the identification of seven types of innovation potentials: efficient and target-oriented innovation, innovation communication, innovation impulses, differentiation, exceeding the requirements, business model innovation, and absorption of innovations. In addition, differences across sectors seem to have an impact on how standards can lead to innovation. Fraunhofer MOEZ also developed a model, which can be used by practitioners to visualize and analyze the interactions between innovation and standardization.

Since the same innovation potentials in standardization have been found in many sectors, it can be assumed that these findings may also be true in other sectors such as the ICT sector. Nevertheless, to develop concrete recommendations for ICT companies in developing countries, the results must be adapted accordingly.

It is thus recommended that ITU conducts research studies to investigate the link between innovation and standardization for ICT sector in emerging economies and to develop a framework which would demonstrate to developing countries how to enhance innovation and standards making ability at the national level. The main outcomes of the research would be to enhance the bridging standardization gap programme in ITU by also considering how to attract ICT innovations in emerging economies to ITU-T study groups.

[5] Abdelkafi, N., and Makhotin, S., The innovation potential in standardization, ISPIM Conference, Helsinki, Finland, 16-19 June, 2013.

3 Challenges of Effective Participation in Standards Making Process

The major road blocks in the pathway of the developing countries to bring forth their innovations to ITU-T for standardization are mentioned below.

3.1 Service-application oriented innovations[6]

Developing nations have always been late adopters of technology. This is also explicitly visible in the absence of any indigenous critical telecommunication R&D cum product development organization.

Requirements are the driving force behind innovations. In developing countries where the need is for basic access, requirements are mostly service application oriented. This indicates the independence of such innovations from the underlying architectural framework, making it difficult for innovations to fit within the scope of standardization.

3.2 Lack of awareness[7] [8]

Standards based educational courses are not widespread in developing countries. Partly, this is due to the fact that there are no national or regional standardization bodies in existence and the absence of Telecommunication R&D labs that work specific to the needs of developing countries.

3.3 Barriers due to the participation and standardization procedures in ITU-T

The participation in ITU is from government agencies; there is not much inclusion of small and medium sized organizations. As a consequence, such organizations are unaware of the ITU activities. In addition, no well-defined channels/ procedures are known through which innovations done in industries/ academia/ organizations can be submitted to ITU-T as contributions. This makes it difficult to find ways to take research to the level of standardization. The present status of the procedures is quite complicated.

3.4 Barriers due to the financial aspects[9] [10]

Even though ITU-T offers low-rate membership for the participants from developing countries, however till this moment the membership fees presents some affordability challenges for academic and sector members from developing countries. On the other side, until SMEs realize

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[6] [Innovation-I-051] Issues in Standardizing ICT Innovations in Developing Countries, Dr A Karandikar.

[7] [Innovation-I-41] Proposal for New ITU-T Standardization Activities, Dr. Ramy Ahmed Fathy, NTRA, Egypt.

[8] [Innovation-I-051] Issues in Standardizing ICT Innovations in Developing Countries, Dr A Karandikar.

[9] [Innovation-I-41] Proposal for New ITU-T Standardization Activities, Dr. Ramy Ahmed Fathy, NTRA, Egypt.

[10] Egypt's Experience in ICT standardization, Ramy Ahmed Fathy, NTRA Egypt, Joint ITU-AICTO Regional Standardization Forum for Arab Region Tunis, Tunisia, 27 January 2014

the potential benefit of participating in the standardization process, and quantify the true positive impact on their P&L, they will keep looking at the ITU participation as a cost incurring process.

3.5 Lack of representation at global level[11]

Significant number of innovations in the developing countries addresses local problems and is service related. They do not get a global platform to showcase their innovations due to reasons like lack of global presence, interest or capability. A crucial link to standards is the 'essentiality' patent route. Embedded Innovations by claiming their essentiality to standards through patent claims is a useful route to get representation at the global level. However this requires a patent portfolio for its effectiveness.

3.6 Political instability and lack of vision[12]

As innovation is a continuous process, it requires proper foresight and efficient long term planning. Such innovations can follow a progressive trail only when it can be ensured that the focus area, availability of funds etc. will not get affected even when the governing bodies change. If such recommendations are incorporated by the policy makers, then innovative projects will not be withheld midway and no such hindrance will come in the pathway to innovations and standardization.

3.7 Standardization synchronization with technical and scientific progress and internal state level coordination

Low effectiveness of standards is mainly caused by the absence of its synchronization with the actual results of scientific and technical progress together with low controllability of technical committees/secretariats. Harmonization with international standards is in the works in order to remove technical barriers to trade and reflect in a proper measure the interests of states including promoting modernization, innovation and improving productivity.

In addition, the fact that medium-sized companies cannot often get through the complex jungle of standardization and technical regulations mark the need for their pro-active role in developing standards[13] [14] [15]. For example, generally all the current challenges faced by Russia in standardization are connected with the transitive period of reformation in the field of technical regulation. Though the change is in the making it seems to be a long and drawn-out process –

[11] [Innovation-I-051] Issues in Standardizing ICT Innovations in Developing Countries, Dr A Karandikar.

[12] [Innovation-I-051] Issues in Standardizing ICT Innovations in Developing Countries, Dr A Karandikar.

[13] [Innovation-I-41] Proposal for New ITU-T Standardization Activities, Dr. Ramy Ahmed Fathy, NTRA, Egypt.

[14] [Innovation-I-057] Standardization of Innovations in Russia, Dr. Mikhail Komarov and Dmitry Kabanov

[15] Egypt's Experience in ICT standardization, Ramy Ahmed Fathy, NTRA Egypt, Joint ITU-AICTO Regional Standardization Forum for Arab Region Tunis, Tunisia, 27 January 2014

most of Russian standards are still state standards, and participation of the interested parties is considered to be urgently necessary[16]. This very problem often leads to the situation when even innovative and very promising projects in the Russian automotive sector are challenged with the following implementation of the serial production when stable results and quality are rarely guaranteed[17].

4 Multi-Tiered Development Strategy (MTDS)[18]

According to the WSIS Declaration of Principles [WSIS Declaration of Principles B6 No. 44], standardization is one of the essential building blocks of the Information Society. It emphasized on the importance of developing and adopting international standards. It also emphasized on the importance of developing open-use, interoperable, non-discriminatory and demand-driven standards that take into account needs of users, and consumers as a basic element for the development and greater diffusion of ICTs.

Two important concepts must be highlighted in the above declaration principle: the first; is the concept of essentiality of the development of standards, and the importance of the participation of developing economies in the standardization activities. The second; is the concept of demand-driven standards which highlights that standards eventually are created to serve the mass population which uses them.

Initial analysis for the root causes of the standardization gap between developed and developing countries, indicates that the latter neither possess foundational infrastructure industries that could create a strategic target or appeal for their participation; nor do the majority of their mass population have the needs or demand for highly sophisticated top-notch technologies. Hence, the main drivers behind the *effective* participation of developing countries face some difficulties. *Effective* participation of the developing countries refers to their engagement in the standardization activities by submitting contributions that reflects their true interests and concerns; in addition to their participation in the standards development process with proper competences that would eventually enable them from submitting proposals, defending them, and possibly obtaining global consensus.

Further thorough analysis of the root causes behind the lack of *effective* participation of the developing countries in the standardization activities; revealed some key obstacles: lack of technical and financial Competences, lack of Drivers, and lack of Foundational ICT Infrastructure. To overcome these obstacles, a multi-tiered strategy is proposed, where actions related to increasing the competency level on the individual and corporate levels are to be executed. Competency level actions include exposure and training on how to participate in the

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[16] DIN supports knowledge transfer to Russia// Russian Center for SME. Source: http://www.din.de/cmd?bcrumblevel=1&cmstextid=63374&level=tpl-artikel&languageid=en. 2007Y.

[17] Innovative Technology Development in the Russian Automotive Sector Report// Swiss Business Hub Russia. Source: http://www.osec.ch/sites/default/files/AutomotiveInnovation2011.pdf. 2011Y.

[18] [Innovation-I-41] Proposal for New ITU-T Standardization Activities, Dr. Ramy Ahmed Fathy, NTRA, Egypt.

standardization process, BSG programmes, and amendments in academic curricula to include standardization related studies. Enhancing drivers for the effective participation targets two main dimensions; namely developing means to increase demand for top notch ICT services, and providing industrial incentives to develop national industries in the field of ICT.

For instance, telecom operators around the world are facing serious threats that affect their revenues, margins and business models. Since Smartphones are becoming more and more widespread and business and consumer requirements for new communications services are growing quickly, telecom operators are finding themselves marginalised and underperforming in an industry they once ruled[19].

To cope with the new challenges of telecommunications ecosystem, telecom operators must select a path of innovation and find the right ways and strategies to foster their innovative efforts and identify new opportunities in order to position themselves for growth, and to remain among the winners in such rapidly evolving telecommunications arena. These strategies differ from an operator to another regarding its market position (incumbent operator, new entrant …) and its financial situation, in addition to economic and cultural characteristics of its country. The same strategies can be exploited by other stakeholders in the telecommunication field depending on their specificities and activity domain.

Finally, actions targeting the enhancement of foundational ICT infrastructure are foreseen to be achieved through the development of national R&D strategies and developing innovation which have the utmost socio-economic impact on the community. Figure 2 illustrates a synopsis of the proposed multi-tiered strategy. It's important to note that some antecedents of some action items belonging to different tiers might be inter-related. For example, the root causes for the lack of demand as part of the drivers tier, might also affect negatively the innovation development action item of the Foundational ICT Infrastructure tier.

Innovation is identified as one of the fundamental strategic mechanisms; that is foreseen to assist in bridging the aforementioned gap. And hence, WTSA-12, adopted these concepts through Resolution 44 that specifically aims at bridging the standardization gap between developed and developing countries [Rev Dubai, 2012, Res. 44], where under the *resolves* section it is mentioned that ITU-T, in collaboration with the other Sectors as appropriate, shall develop a programme to assist developing countries in:

i) facilitating the process of linking innovations to the standardization process and
ii) developing means to align their industrial and innovation national strategies towards the goal of achieving highest impact on their socio-economic ecosystems.

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[19] [Innovation-I-92] A Study on Possible Ways for Telecom Operators to Promote and Identify Innovations, Rim Belhassine-Cherif, Ph.D., Vice-Chair FG Innovation.

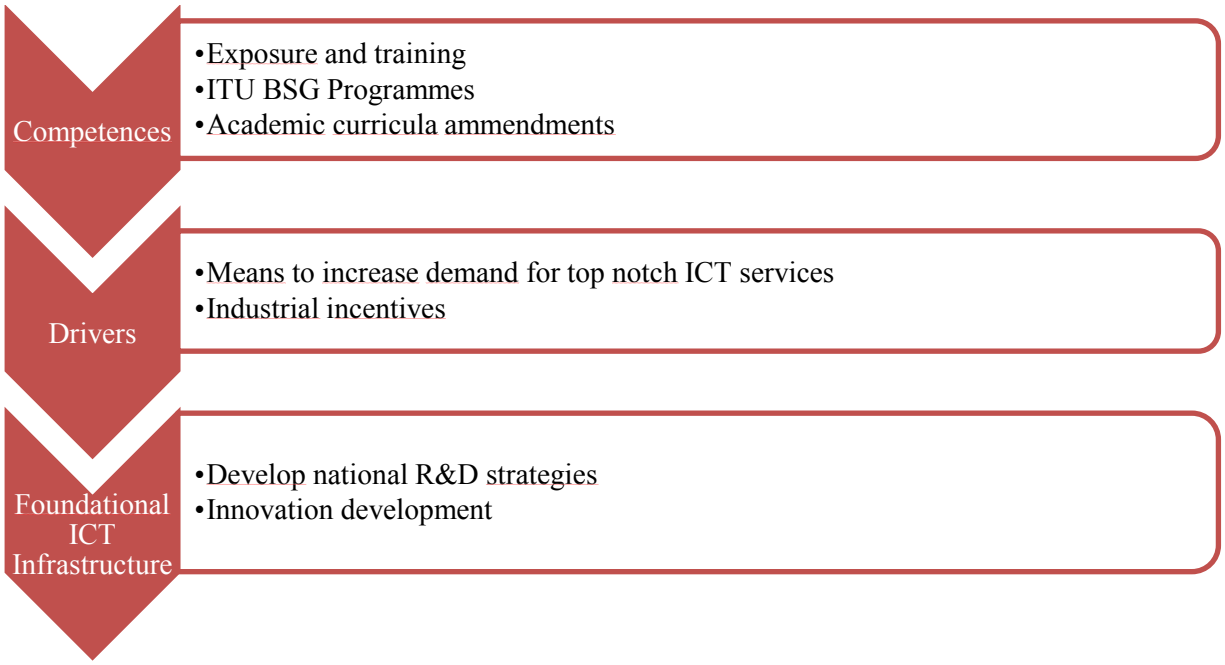

Figure 2 Multi-Tiered Development Strategy (MTDS) for addressing the lack of *effective* participation of developing countries in the standardization activities

The following sections introduce different recommendations and measures in each tier of the proposed MTDS, to realize its goals. One measure is to propose new ITU-T standardization activities that would help in developing the competences in the different tiers. Another is to develop the capacity of operators and industry players to promote and identify innovations. However, for that to be effective, some means to link innovation to standards.

5 Possible Ways for Telecom Operators to Promote and Identify Innovations

This section sets out the threats that enable telecom operators and other industrial stakeholders to focus on innovation, and studies some possible ways to promote and identify innovations both internally and externally.

5.1 Reasons for telecom operators to focus on promoting and identifying innovations[20]

For a telecom operator, competition with other local operators is no longer the most important motivation for it to focus on innovation. Other factors are becoming more imposing. To begin with, consumers and businesses have become more demanding than ever before especially with the expansion of Smartphone market (number of Smartphones tops one billion in Q3 2012)[21] and the availability of end-user devices with advanced capacities, in addition to the offering of a wide variety of services and applications. On one hand, consumers are showing little loyalty to brands,

[20] [Innovation-I-92] A Study on Possible Ways for Telecom Operators to Promote and Identify Innovations, Rim Belhassine-Cherif, Ph.D., Vice-Chair FG Innovation.

[21] Rushton, K., "Number of smartphones tops one billion", The Telegraph, 17th of October, 2012. Retrieved from: http://www.telegraph.co.uk/finance/9616011/Number-of-smartphones-tops-one-billion.html

providers, devices, or types of content and they expect their applications and services to be available everywhere and every moment. On the other hand, and since industry sectors become more and more digitised, businesses are requiring varied new services such as mobile payment services and cloud computing. Telecom operators should satisfy the requirements of such aware end-users through heavy capital expenditures to increase network capacity and connectivity, putting then a pressure on their cash flows and margins.

Furthermore, new rivals have emerged from outside the traditional telecom operator ecosystem in order to satisfy and often shape end-users demands. These competitors, who have shown successful entrances to the telecom market, such as Google, Apple, together with electronics and OTT (Over-The-Top) actors, are offering new products and services to end-users in a way that challenges traditional telecommunications revenue streams. In fact, VoIP-based applications such as Skype and Viber, and potentially software-based SIMs threaten traditional voice products, while proprietary and third-party instant messaging clients tend to replace SMS services. Enterprise services are also threatened by public cloud services and proprietary device cloud services, while third-party stores and user-generated content, on Youtube and facebook for example, constitute alternatives for telecom operators walled garden content proposed through IPTV service, proprietary media stores or WAP portals.

Therefore, it is obvious that the telecom ecosystem has become much more competitive and more challenging for operators, and the integrated value chain on which telecom operators have long depended (including proprietary networks, key applications and services, billing platforms, and even the billing relationship with customers) is rapidly moving out of their control.

In these circumstances, where network capability alone is no longer a differentiator, operators must analyse minutely their actual situation and then develop and enhance their innovation capabilities required to transform themselves in such fast-evolving and ever more complex telecom ecosystem. At this stage, developing new possibilities to monetize data services beyond the existing business models is no longer sufficient. Operators should shift their whole mind-sets away from focusing on cost optimization and synergies among current offerings and operating companies, or relying on Mergers and Acquisitions and globalization to drive growth[22]. To be more effective, they should focus on new ways to enable totally innovative services and industry partnerships in order to generate new revenue streams. In a word, Operators must learn, as quickly as possible, to take the lead on innovation in the telecom industry.

5.2 Possible ways to promote and identify innovations by telecom operators and other stakeholders

This sub-section includes some possible ways for a telecom operator and other stakeholders to promote innovation and identify new opportunities. In fact, the efficiency of the listed solutions depends on operator's financial and technological situations and the specific needs of each country.

[22] Speed-Dialling in to Innovation: The Pressing Need for Telecom Operators to Innovate or Lose Relevance, Booz & Company Report, 2012.

5.2.1 Infrastructure and service delivery enhancement

5.2.1.1 Telecom Operators

For telecom operators to drive innovation, technology should play a very important role since it has a major impact on new offerings in addition to network and service delivery developments. To strengthen their innovation efforts, telecom operators should define a strategic orientation that fully exploits network convergence trends. This will enclose convergent service offerings, new network infrastructure, and developing synergies in operations. In this context, and since innovations will be full IP-based, telecom operators will need to shift from the traditional voice and data independent networks, having two different services layers, to an open convergent multimedia service layer for voice, data, and video with integrated Operations Support Systems (OSS).

Furthermore, operators should explore the opportunities brought by Long-Term Evolution (LTE) networks. In fact, LTE will enable new capabilities that exceed those of traditional voice and data services. This will impact the way with which customers use their mobile devices and enhance consumers' experiences while accessing contents and applications. Nevertheless, this possibility is not affordable for many developing countries especially those who have recently migrated to 3G technology.

By acquiring the latest network technology and network intelligence, telecom operators are having a backbone for innovation. However, infrastructure potential should be improved by an effective delivery of new services to subscribers.

For this purpose, operators should implement a common service delivery framework for integrated platforms. This should be supported by a single service delivery platform acting as a network gateway to integrate with different network technologies. Besides, telecom operators should continually enhance service delivery by using structured innovation and development processes for products and services.

5.2.1.2 Industrial Telecom Stakeholders

Manufacturers and service providers are always focusing on integrating the last telecommunication technologies on the market in their equipments and solutions on the market. The use of these technologies, coming from adjacent markets (Information System, TV & video, etc.) opens new horizons for innovation and for enhancing the quality of the proposed products, which will make these companies more competitive.
For example, the emergence of protocols for video telephony over Circuit Switched 3G mobile networks has urged many telecom companies to propose innovative solutions and services that are based on these protocols such as Ring Back Tone service and Video IVR. Mobile device manufacturers were also precipitating to integrate these protocols into their mobile devices in addition to the integration of a secondary camera in these devices to ensure video conferencing services.

5.2.2 Research and Development (R&D)

5.2.2.1 Telecom Operators

Traditionally, telecom operators have not been known for their innovation potential, especially in comparison with companies in adjacent industries (software, Internet...) and computing and electronics industries. In fact, according to the results of Booz &Company's 2011 Global Innovation

1000 study[23], telecom industry, including operators, invest in R&D activities with only 1.4% of its total revenue, which is significantly lower than each of the two other groups (12.8% for software and Internet Industries and 6.1%, for computing and electronics industries).

Revenues of worldwide leading telecom operators reached around 45% of global telecom industry revenues in 2011, but these operators contribute with only 10% of total telecom industry's R&D investments24 and their revenues are mainly spent in equipment acquisition from the equipment manufacturers. Reciprocally, telecom equipment companies, which account for the other 55% of the global telecom industry revenues, are responsible for nearly 90% of the R&D expenses for the entire telecom industry.

Except a few incumbent operators with mature R&D labs, telecom operators have traditionally been service companies. For many of the technological innovations they commercialized, operators relied on other companies in the telecom value chain (such as handsets manufacturers, solutions providers etc.). For example, the telecom operator Verizon Wireless depended strongly on manufacturer Qualcomm for many of its technology and service innovations, including network infrastructure and service development platforms[25]. Until a few years ago, this model was viable for telecom operators which occupied an imposing position in the telecom market thanks to their licensed spectrum and the end-user billing relationship. Instead of investing in R&D activities, telecom operators have devoted their financial and management resources to marketing and sales, and have spent a significant part of their revenues on promotions and advertising. The disadvantage of this operators' model is that it has placed innovation processes in the second rank of the operators' priorities. Thus, with the new telecom ecosystem requirements, operators will find themselves forced to focus more and more on innovations and to multiply its efforts in order to shift their status from innovations recipient to innovations generator.

Operators need to pay more attention to R&D activities as a way for innovations, and invest more for this purpose. For example, AT&T invested in its AT&T Foundry programme with around $100 million with the opening of two new research centres in order to drive innovation in areas such as home security, inventory tracking and in-car online services through collaborations with technology partners[26]. Besides, some Member States obliges incumbent telecom operators to contribute in R&D funding. This is the case of France Telecom, for example, which was mandated to devote up to 4% of its revenues to R&D activities (Decree n° 96-1225, 1996)[27].

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[23] "Global Innovation 1000 study", *Booz & Company*, 2011.

[24] Simon, J.P., "Are telecom services the hidden engine of innovation in the ICT ecosystem?", Network Industries Quarterly, vol. 13, N° 2, 2011.

[25] "Speed-Dialling in to Innovation**:** The Pressing Need for Telecom Operators to Innovate or Lose Relevance", *Booz & Company Report*, 2012.

[26] "AT&T plans two new R&D centers to speed up innovation", 25th of June, 2013. Retrieved from:

http://www.totaltele.com/view.aspx?ID=482022

[27] Simon, J.P., "Are telecom services the hidden engine of innovation in the ICT ecosystem?", Network Industries Quarterly, vol. 13, N° 2, 2011.

Furthermore, telecom operators are not only outperformed in terms of the percentage of sales they allocate to R&D and innovation by companies like Samsung, Google, and Apple, which are always classified among the most innovative companies worldwide, they also they are far overtaken in the number of patents they have received. Patent ownership in the mobile communications field has become extremely essential, judging by the increasing number of patent lawsuits. As of 2011, AT&T was the only telecom operator among the top 10 US companies with the highest number of patents (more than 7,000 patents)[28].

One of the alternatives for telecom operators to promote their R&D and innovation activities, especially in developing courtiers, is to enter mutually supportive partnerships with the top national and international universities in the ICT domain. These partnerships may enclose research teams and units funding, research activities in the purpose of developing new products and services and patent generation, training sessions for the operator staff about innovative technologies and consultancy work. Telecom operators can also co-supervise graduate, master and Ph.D. projects for both theoretical and applied researches.

5.2.2.2 Industrial Telecom Stakeholders

Research and Development are key techniques used by telecom Manufacturers and service providers to innovate. For this reason, they make important investment in R&D activities. Table 1 below resumes the R&D expenses of wireless industry's top vendors in 2009 and 2010[29].

Table 1 R&D expenses of wireless industry's top vendors

Company	2009	2010	% growth	% of total in 2010
Alcatel-Lucent	$3,125,319,000	$3,510,379,400	5.50%	15.6% of revenue
Apple	$1,333,000,000	$1,782,000,000	34%	2.7% of net sales
Ericsson	$4,998,955,698	$4,998,698,399	0%	15% of total sales
Motorola	$1,591,000,000	$1,479,000,000	-7%	12.9% of revenue
Nokia	$7,792,198,300	$7,731 ,538,100	-1%	13.8% of net sales
Qualcomm	$2,440,000,000	$2,549,000,000	4.46%	23% of revenues
RIM	$684,702,000	$964,841,000	29.03%	6.5% of net sales

Telecom manufacturers and solutions providers in Developing countries are also showing great interest to R&D activities. For example, Huawei, a Chinese multinational networking and telecommunications equipment and services company, engages around 46% of its 140,000 employees in research and development and spent around US$3.74 billion in R&D in 2011. Moreover, Huawei has opened 10 R&D centres and 20 customer innovation centres in Europe until

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[28] "Global Innovation 1000 study", *Booz & Company*, 2011.

[29] "Top wireless companies report strong R&D spending in 2010", Retrieved from fiercewireless.com, 26th of April, 2011:http://www.fiercewireless.com/tech/special-reports/top-wireless-companies-report-strong-rd-spending-2010

2012[30].

Another global provider of telecommunications equipment and network solutions, ZTE, has also believed in technology innovation as a core value of the company, and invests more than 10% of its annual revenues in R&D. ZTE has established 18 R&D centres in China, France, India and employs over 30,000 research professionals[31].

With 107 subsidiaries dedicated to innovation globally, ZTE was the world's biggest originator of technology patents in each of the past two years, according to data from the World Intellectual Property Organization. It fact, ZTE has currently applied for more than 50,000 patents globally and has been granted 14,000 patents[32].

5.2.3 Building strategic partnerships

5.2.3.1 Telecom Operators

Building strategic partnerships with other large companies, not just from the telecommunication industry but also from adjacent sectors such as television, computer games and publishing, is nowadays compulsory for telecom operators as it is for most of telecom enterprises because services offering is becoming more and more sophisticated. For example, in order to deliver the full "quad play" of next-generation services over IP, operators will need to manage a huge portfolio of services that responds to a wide variety of customer requirements[33]. As a result, telecom operators should work with a much wider array of partners and suppliers, across the value chain and adopt a more collaborative approach that will allow it to integrate new technologies and embrace open standards.

Besides, innovation is becoming more complex and more expensive. By building partnerships, operators intend to maintain, increase their market share, access to a base of ideas and broader technologies and bring to market new goods and services before their competitors.

In most countries, collaboration with foreign partners is as important as cooperation at the national level, which leads to the creation of global innovation networks. These partnerships always bring together equipment and component manufacturers, software and applications developers, solutions and content providers, in addition to channel and training partners. All strategic partnerships offer an array of potential advantages such as leveraging greater intellectual input and creativity from diverse sources, leveraging more global approaches to problem-solving and process optimisation, minimising innovation risks thanks to sharing and reducing own resources requirements. However, an analysis performed in 2010 by the Organisation for Economic Co-operation and Development (OECD) shows that firms that collaborate on innovation spend more on

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[30] "Connecting Europe", Huawei, 2012

[31] "About ZTE", Retrieved from zte.com.cn: http://wwwen.zte.com.cn/en/about/corporate_information/

[32] "Euraxess Links China", Euraxess, November 2013

[33] "The Innovation Paradox in the Telecom Industry", IBM Global CEO Study, 2006.

this activity than others, which suggests that the collaboration aims to further expand the scope of projects or fulfil the business skills than just reduce costs[34].

Moreover, it is important to mention that external innovation partnering couldn't be successful and effective if telecom operators don't adopt new business logics and a new way of thinking about innovation. Let's take the example of Bharti Airtel, the India's leading mobile telecom operator; realizing that competitions are more and more intensified in the telecom market and that it will need better operational efficiencies and innovative revenue streams, the Indian telecom operator has outsourced its IT and network management, considered by most telecom operators as core functions, to focus on marketing, sales and distribution. As a result to this business model change, the number of Bharti Airtel subscribers tripled within two years (from 8.2 million in 2004 to 27 million in 2006)[35].

5.2.3.2 Industrial Telecom Stakeholders

Strategic partnerships are very promising for improving company's innovation potential and extend their expertise domain. It allows enterprises to propose mega innovative projects and extend the reach of their operation.

As an example, a recent strategic partnership, signed between GOWEX, a leading Spanish company in creating Wireless Smart Cities and Smart Transport, and ZTE, has as objective to make ZTE the equipment provider for GOWEX in the deployment of its intelligent connectivity systems in China and all over the world, and thus will enable the proposal of innovative intelligent Wi-Fi services in 300 of the principle towns in the world[36].

In addition, in a business environment characterized by the development of deep, niche expertise in a particular domain, business partnerships can provide a source of innovative upgrading by outsourcing the innovation to business partners who have complementary skills and expertise[37].

5.2.4 Challenges and Competitions

5.2.4.1 Telecom Operators

Innovation competition is viewed as a method or a process that ensures development of the industrial processes, products or businesses. It is a form of social engineering that aims to identify and elaborate the best ideas, generated from the best innovators and thinkers.

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[34] "Mobiliser l'innovation pours affermir la croissance et relever les défis planétaires et sociaux: Principales constatations, Rapport aux Ministres sur la Stratégie de l'OCDE pour l'innovation", May 2010.

[35] "The Innovation Paradox in the Telecom Industry", IBM Global CEO Study, 2006.

[36] "Partenariat entre GOWEX et ZTE sur des projets de « Wireless Smart City", Retrieved from gowex.com, 15th of October, 2013 : http://www.gowex.com/fr/partenariat-entre-gowex-et-zte-sur-des-projets-de-wireless-smart-city/

[37] "Building strategic partnerships for managing innovation outsourcing", Retrieved from emeraldinsight.com, 2008: http://www.emeraldinsight.com/journals.htm?articleid=1735059

Some major studies were done on Innovation Competition, among which the "Innovation Tournaments", by Christian Terwiesch and Karl T. Ulrich from The Wharton School. The two authors explained that innovation can be thoroughly managed by viewing and structuring the innovation process as a collection of "opportunities"[38]and that effective innovation do not come from increasing investments in R&D, but from systematically identifying more exceptional opportunities through innovation tournaments. Terwiesch and Ulrich define innovation tournaments as "a process in which many raw opportunities are considered at the outset and only the best survive selection. An innovation tournament, just like its counterpart in sports, usually consists of multiple rounds of competition. It begins with a large set of opportunities ("contestants") that are compared with each other. A filtering process selects a subset to move to the next stage (into the "playoffs") and, from those, picks one or more winners".

Another form of innovation competitions is challenges. This recent concept consists on bringing together teams of designers, developers, students, etc. for a short definite time (usually 24 to 72 hours) and asks them to develop a new application or make a layout for an innovative project.
These competitions should be always well rewarded in order to motivate the competitors and fulfil their objectives in finding breakthrough ideas.

Telecom operators can organize open competitions and challenges for professionals in the telecom industry or university students that help them to generate new ideas and identify opportunities. In developing countries, operators are more likely to sponsor national competitions and challenges organized by other parties such as universities, public institutions or worldwide top enterprises in adjacent domains (IBM, Microsoft, etc.).

5.2.4.2 Industrial Telecom Stakeholders

Challenges and competitions are always very useful techniques to detect innovative ideas coming from both professionals and academics (university students).The trend in challenges and competitions launched by the top telecommunication companies is that they are more often concerning application development for mobiles.

In this regard, Samsung has launched annually, since 2012, its SAMSUNG SMART APP CHALLENGE in order to determine the best GALAXY S4 applications based on Samsung Chord SDK. In the 2013 edition, 10 winning entries received $800,000 in total prizes and were eligible for investment evaluation from Samsung Venture Investment Corporation in addition to multiple marketing promotions[39].

Ericsson launched recently the fifth edition of its international contest « Ericsson Applications Awards » which has as theme « applications for professional life »[40].

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[38] Terwiesch, C. and Karl T. Ulrich, "Innovation Tournaments", Harvard Business School Press, 2009.

[39] "Samsung Smart Apps Challenge 2013", Retrieved from developer.samsung.com:

http://developer.samsung.com/ssac2013/s4/aboutTheChallenge.do

[40] "Participez au concours Ericsson Application Awards 2014", Retrieved from startupsalgeriennes.wordpress.com, 21th of December, 2013 : http://startupsalgeriennes.wordpress.com/2013/12/21/participez-au-concours-ericsson-applications-awards-2014/

A new contest, InnoApps, was also launched on 22 July 2013 to challenge youth developers to design innovative mobile applications in order to promote social inclusion. The contest is a joint initiative of Huawei, Microsoft and the European Young Innovators Forum (EYIF). "InnoApps" was open to university students and young professionals under 27 residents in EU. This contest was well rewarded in order to encourage and motivate the participants. In fact, the winner of the first prize was awarded €5000 and would have a full commercialisation support to help them promote their application.

The winner, first runner-up and the top female developer would be taken to visit Huawei innovation centres in China. These developers, as well as the audience's selected winner, would all have their applications included in Microsoft's Windows store. The six finalists would receive technical and marketing mentoring at a Brussels workshop, as well as promotion on the organisers' websites[41].

5.2.5 Market analysis

5.2.5.1 Telecom Operators

Market analysis is one of the important ways to identify innovative ideas. It's not only about exploring telecom market orientation at national and international levels, but also analyses and focuses on adjacent markets or even markets related to different sectors such as banking, automotive, agriculture, etc.

In fact, since mobile services tend to be predominant in different domains, the analysis of the local market related to these boarder activities can help find new ideas and catch innovation opportunities. In fact, in developing courtiers, innovations in mobile and broadband services are supposed to help in facing daily life difficulties in such countries and bring solutions to some economic and social issues (health, education, agriculture, transport...). Services such as mobile payment come from the need of people to a secure and much comfortable way for payment and money transfer and the need of banks and financial institutions to urge people to keep their money in their accounts as long as possible and to make its services reach the majority of the population.
In addition, network operators can use data collected over their network for the purpose of analytics. They can enhance their service offering by using network analytics to identify issues with service quality and improve user experiences.

Collected data about customer's network usage can be useful for establishing innovative services, offerings, and even generating new revenues. Information about customer profiles can be exploited in marketing strategies to develop services that best match customer's needs and propose targeted offers and promotions. For example, innovative services, such as location-based advertising service can be offered by combining network information (instant location by device tracking) and profile data (favourite products, brands) related to its customers along with external information (online shopping/surfing data, products rating through social networks).

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[41] Retrieved from Innoapps, European Union: http://innoapps.eu/innoapps_prizes

In addition, by being able to study and use usage patterns in data across various devices, telecom operators will gain the knowledge required for future customer innovations.

5.2.5.2 Industrial Telecom Stakeholders

Market analysis is one of the important ways to identify innovative ideas for telecom operators and also for manufacturers and service/solutions providers.

The need for telecommunication technologies in other domains such as banking, health care, education, etc. has urged manufacturers to innovate and design special devices in order to satisfy these requirements. As examples, in the domain of m-Health, Nokia has designed a heart monitor phone in 2009, while LG proposed the world's First Glucose Phone in 2004[42].

Application developers have also proposed thousands of applications dedicated to many domains. And it is not only about applications; in fact, services providers presented innovative voice solutions to meet customer's requirements and enhance service quality. For example, the Indian VAS solution provider OnMobile, has proposed "Home Health", a home phone solution to improve the relationship with patients by providing a unique number to access several services (standard, making appointments, general information, health news bulletin) while using the latest voice technologies to guarantee optimum reception (virtual operator, natural dialogue, speech recognition, speech synthesis)[43]. In the banking field, it proposed "OnMobile Bank"[44], an interactive voice service in natural language to accommodate customers.

5.2.6 Start-ups and local companies

5.2.6.1 Telecom Operators

Start-up businesses, not only in telecom sector but also in other industrial sectors, are always considered as sources of promising ideas with a possible future application in telecoms. Their funding needs are always presenting opportunities for an enterprising Telco to intervene as an investor or even assume full ownership.

It's not only about providing funds but also helping these start-ups to develop skills and experiences needed in the telecommunication sector. Besides, telecom operators should create an investment arm that aim to identify start-ups that can be of great use to the operators' future business.

In this context, operators such as Vodafone, T-Mobile, Telefónica, and Orange have established autonomous venture capital units responsible of investing in promising businesses, in particular

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[42] Sung Su Han, "Mobile Healthcare From LG ElectronicsPerspective", LG Electronics.

[43] "OnMobile Home Health", Retrieved from onmobile.com :

http://www.onmobile.com/products_speechservices_demos_health.html

[44] "OnMobile Bank", Retrieved from onmobile.com :

http://www.onmobile.com/products_speechservices_demos_bank.html

local projects, at an early stage of development and to speed up innovation's rate[45]. These units are essentially composed of people with specific core skills, having a solid background in the telecom ecosystem and a better understanding of its related characteristics. They need the ability to identify investment targets, evaluate the right investment size and the risk involved, and negotiate with the management of the target company.

5.2.6.2 Industrial Telecom Stakeholders

Relying on the start-ups potential for innovation is widely adopted by telecom manufacturers and service providers especially the biggest ones which not only help in financing star-ups through a venture capital, but also establish start-ups accelerators in many parts of the world. As an example, Samsung Electronics, which opened a new start-up accelerator in New York City in September 2013 in order to incubate promising start-ups and then acquire them to incorporate their innovations into Samsung's devices and that, just months after it launched a similar centre in Silicon Valley[46]. In fact, Samsung believes that the future for it "is about the thoughtful integration of hardware and software, and that means start-ups"[47].

5.2.7 Intra-organization innovation strategies

5.2.7.1 Telecom Operators

It is obvious that effective innovation doesn't occur by chance. It should be minutely planned for, and resourced at the organisational level, and an organisational capability to support innovation must be build involving both direct costs (related to trainings, equipment and information support systems) and opportunity costs (including time availability). To build such organisational innovative capacity, operators shouldn't only rely on developing human resources, enhancing information technology and defining policy development and program implementation plans. They must also facilitate innovation pathways in a collaborative approach in order to bring together all the organization potentials and capabilities referring to a requirement or an opportunity. Besides, leadership, investment and commitment are needed to stimulate innovation within the organization and empower and support staff in their path from innovative ideas to final products or services. Intra-organization Innovation promotion can be achieved through various strategies and procedures that are part of the managerial expertise such as the following:

- *Create a culture of innovation*

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[45] "Innovate or Lose Relevance: The Urgent Need for Telecom Operators", 8th of October, 2012. Retrieved from: http://www.qatartodayonline.com/innovate-or-lose-relevance-the-urgent-need-for-telecom-operators/

[46] Goldstein P., "Samsung seeks software prowess via new startup accelerator", Retrieved from fiercewireless.com, 13th of September, 2013 :

http://www.fiercewireless.com/story/samsung-seeks-software-prowess-new-startup-accelerator/2013-09-13

[47] Popper B., "Why is Samsung throwing money at startups?", Retrieved from theverge.com, 12th of September, 2013 :

http://www.theverge.com/2013/9/12/4722750/samsung-accelerator-startups-software-vertical-integration

Creating and fostering a strong culture of innovation that takes into account the following seven points: innovative processes, rewards and incentives, people development, key performance indicators, clear communication, leadership support, and a diverse workforce. Establishing this strong culture will help telecom operators gain wide support for innovation initiatives and guarantee that the defined programme would be effective.

- *Engage all the organization's staff in the innovation process*

In innovation and development process, every idea, even the simplest, can have a weight. Thus, managers should involve all the organization departments such as finance, purchasing, sales, marketing, operations, manufacturing and design and encourage all the staff to contribute by ideas and suggestions. In this context, the mobile operator O2 has implemented an I-based idea management platform aiming to capture employees' ideas once emerged[48]. In addition, managers should reward individuals and teams who come up with captivating ideas in order to motivate the creativity of all the staff.

- *Make time for brainstorming*

Brainstorming is an effective way to make new ideas emerge. Managers should allocate available time for this activity by setting aside time for brainstorming, holding regular workshops and arrange team days out for example. Brainstorming sessions allow various ideas to rise and to be more and more refined.

- *Promote pilots and prototypes*

The culture of piloting should be promoted within the company. Pilots and prototypes submission should be encouraged by managers as a better way to stimulate innovation and test innovative ideas' potential.

5.2.7.2 Industrial Telecom Stakeholders

The Intra-organization innovation strategies can be applied by any company that seeks to involve their internal human resources in the innovation process. These companies can then use techniques of innovation management in order to enhance their innovation potential.

5.2.8 Workshops

5.2.8.1 Telecom Operators

Telecom Operators can contribute in international workshops including experts and specialists in telecommunication domain, and they can even contribute in sponsoring and hosting workshops. These workshops concern the ultimate innovations in the telecom industry and then give the opportunity to operators to more assimilate these innovations and generate ideas about the most effective ways to adopt these innovations to their environment in the appropriate time. Workshops are occasions to let developing countries operators discover new horizons and share experiences and discussions with high qualified people which helps new ideas to rise.

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[48] Odenthal, S., Tovstiga, G., Tambe, H., Van Oene, F., "Co-Innovation: Capturing the Innovation Premium for Growth", Prism|1|2004.

Another type of workshops can be organized inside the operator organization: the innovation workshop. This type of workshops is effective because it can involve a relatively large number of people in the process rapidly, it encloses the fundamental ideas of innovation tournaments, and it leads to the identification of some exceptional opportunities[49]. The workshop concept has demonstrated that exceptional opportunities can be identified through an uncomplicated organizational process. Workshop can also generate enthusiasm among the staff that can be oriented to establish the permanent organizational processes for identifying and selecting exceptional opportunities.

5.2.8.2 Industrial Telecom Stakeholders

Telecom manufacturers and service providers always focus on organizing and participating in international and regional workshops in order to present their last products and services or their strategic views concerning current telecommunication subject and issues. As examples, worldwide telecom companies such as Nokia Siemens and Ericsson have effective and repetitive participation in workshops organized by ITU.

Workshops are also considered as occasions for telecom manufacturers and service providers to approach the telecom operator's strategies and the markets needs and trends in order to propose, for the future, innovative products and services that better satisfy their customer requirements. The workshops organized by telecom companies can be dedicated to professionals or to academic students in a way that explores their innovation potential.

The intra-organization innovation workshops can also be exploited by manufacturers and service providers in order to engage their staff in the innovation process and thus identify exceptional opportunities.

5.2.9 Web opportunities

5.2.9.1 Telecom Operators

With the great potential that Internet has nowadays, and the increased number of Internet users and web sites all over the world, telecom operators can take advantage of the Internet as a source of innovative idea and can even create their own internet channel for innovation.

In fact, electronic dedicated forums, blogs, and especially social networks constitute a free space to exchange ideas and share experience with people around the world.

Telecommunication related websites, which are becoming more and more sophisticated and rich in information, allows operators, especially in developing countries, to have a detailed ideas about the last innovations in the sector and even let them contact experts to consult them regarding innovation issues.

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[49] Terwiesch, C. and Karl T. Ulrich, "Innovation Tournaments", Harvard Business School Press, 2009.

Another use of the web, that can help identifying innovative ideas, consists on collecting customer feedback on offered products and services, together with their suggestions through telecom operators' dedicated web portal or social networks.

5.2.9.2 Industrial Telecom Stakeholders

Web can offer great opportunities for innovation especially to SME and that, thanks to the possibilities of new technologies exploration, experience sharing, experts consulting and market overview that it provides.

6 Emerging Innovations Identified Standardization Challenges

The FG Innovation has endeavoured itself with the task of identifying innovations that have an utmost impact on the socio-economic indicators of countries. FG Innovation Working Group 1 (WG1) has produced a report (Deliverable 1) on Successful ICT Innovations for Emerging Economies[50] that discusses a wide range of innovative early-stage and mature ICT projects that are already operational and identifies the upcoming trends in mobile and web technologies that will change the lives of people in the near future. The Report features some innovations from a repository of 202 ICT innovations researched in the emerging economies, in the field of mobile payments, mobile banking, e-health and e-agriculture. The Deliverable 1 report identifies some reported standardization gaps and challenges. The new standardization activities identified in this deliverable, will address these along with those challenges previously identified by the MTDS[51] and innovations to standards bridging mechanisms[52].

For the sake of consistency, the following sub-sections present a brief account on what has been reported in WG1 Report (Deliverable 1) in the section on standardization challenges for different identified innovations from emerging economies. The purpose is to integrate identified set of standardization challenges highlighted in Deliverable 1 report together with those identified in this report.

6.1 Mobile Payments

Mobile Payments refer to the process of using mobile devices to pay for a product or service from any place (by sending a message SMS or using account companies) or at the point of sale (by presenting a wireless system like NFC technology).

The ubiquity and popularity of card payments across the developed world are based on two interconnected principles; security and standardization. Trust is a prerequisite in the success of mobile transactions. It must be provided by every member of the value chain; from financial institutions, mobile telecom operators and regulators, through to retailers, vendors and of course, end-users. Common standards and interoperability have been identified as vital aspects for both merchant and consumer adoption of mobile transactions. The new technology resulted from innovation requires standards for market adoption. Heterogeneous and cross-industry players produce complexity in the development of Mobile Payments, because consensus for standards is more difficult to reach among heterogeneous players.

The financial mobile services sector however has distinct developmental challenges. Issues of trust, consumer protection, and network systemic risks that can slow the pace of progress require clear and strong regulations. In general, interoperability and security across phone devices and mobile phone carriers is a big concern; as mobile payments ecosystems develop, it is important for retailers to choose partners that allow them to accept payments from as many end-clients as possible.

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[50] WG1 Deliverable, Successful ICT Innovations from Emerging Economies, Ajay Ranjan Mishra, and Mridul Tiwary

[51] [Innovation-I-41] Proposal for New ITU-T Standardization Activities, Dr. Ramy Ahmed Fathy, NTRA, Egypt.

[52] [Innovation-I-0061]ICT Innovation Panel, by Dr. Ramy Ahmed Fathy, regarding the establishment of the ICT Innovation Panel.

Another concern is open loop payment processing, where the payment must be capable of being processed via the open national or international payment networks, and not restricted to a 'closed loop' environment. Moreover, the security of transactions for mobile payments using NFC technology is also another area where there is a lot of work taking place. Standardization should also address the issue of portability of m-payment applications (i.e. how payment applications follow consumers when they change mobile network operators). Integrity for mobile payments is important and covers the entire mobile payment ecosystem, the systems as well as the data.

Accordingly, it is clear that information security of mobile payments, including the full services stack of confidentiality, integrity, availability and non-repudiation are crucial for the development of this ecosystem.

6.2 Mobile Banking

Mobile banking (M-Banking) refers to the availability of platforms that allow users to access financial services (transfers, payments, receipts or investment) from mobile devices. Financial services can be accessed through a regular internet browser or a mobile application especially designed for this kind of services.

M-Banking is an activity whereby a customer uses their mobile phone to interact with their bank either directly or indirectly via mobile Financial Service Providers (mFSPs). The customer issues instructions, authenticates themselves and or receives information through their mobile phone. The M-Banking ecosystem is challenged by diversity in terms of mobile devices, computing system, application, communication channel, banks and service providers. There are a number of issues encountered by financial institutions and mobile network operators that pose doubts about the security of financial transactions on mobile devices. Again information security is manifested as a critical standardization activity that acts as an enabler for this ecosystem. Despite all reasonable precautions, banks may be exposed to high risk of liability to customers on account of breach of secrecy and\or denial of service resulting from potential mobile malware. Encryption in SMS and USSD communication is not necessarily end-to-end.

Interoperability is another key issue owing to more complex banking transactions. Other areas of concern would be accounted for incorrect transaction due to user error, transaction errors and lack of knowledge or experience of users in remote regions. Revenue sharing is a key issue as there are many stakeholders like the bank, the mobile technology vendor and the mobile network operator. On the procedural side, programs that allow remittances to be sent via cell phones raise anti-money laundering compliance issues for banks because of different identity checks protocols applied in the mobile and banking sectors. Prepaid mobile accounts have few checks on the identity of the user giving rise to potential threats of money movement for illegal activities.

6.3 E-Health

Mobile and E-Health-Care in most countries is characterized by isolated and small-scale applications that cannot promote effectively enough, communication and information-sharing among health-care providers, medical institutions and health insurance organizations.

One of the biggest challenges is scalability: while pilot projects have generally been successful, when taken to scale, they resulted in costly and inefficient programs due to the proliferation of discrete and independent systems. Success in the future will depend on achieving much more interoperability between all the major stakeholders.

There is little reliable evidence to demonstrate the measurable impact, risks, or cost-effectiveness of e-Health innovations, except in a modest number of application areas and regions. One set of challenges related to privacy and security. How, for example, can one design the system to safely provide patients access to their private health care information over the Internet, yet still allow needed information to be shared in an emergency situation?

Interoperability is a key challenge. This is the fragmentation problem - many pieces of information, in many formats, on many platforms, in many stakeholder environments, and in many geographic locations. The data sets are thus heterogeneous both physically (stored in different locations) and logically (not organized in the same fashion) accentuating issues of interoperability that are raised by lack of compatibility of systems and equipment. Another key challenge for the care providers is the reliability and validity of the collected data and protection of health data throughout a person's lifetime. Finally, lack of awareness and education about the public use of e-health services are encountered due to high illiteracy and e-illiteracy levels of a nation.

6.4 E-Agriculture

E-agriculture needs to provide the whole breadth of agricultural value-chain with the interaction of various stakeholders. E-agriculture has to provide solutions for when to plant and what seeds to use, weather information, soil information, fertilizer information, commodity prices, transportation information, crop and pest control, market information, storage information, food processing guidelines etc.

With regard to patterns in access to e-agriculture, farmers are affected by restricted access to digital media/technologies, high cost of access, insufficient content in the correct language, lack of equipment, and lack of power and sustained technology support.

A big challenge for the deployment of e-agriculture services is to make sure that relevant and localized content is made available. Another challenge is developing and sourcing content in local languages. For e-agriculture apps and platforms to be successful and reach a wide range of audience, they need to also have graphic support and should be able to cater to illiterate masses. Agri-insurance, micro insurance and mobile money transfers also need to be interoperable amongst large number of mobile financial service and mobile network operators.

E-Agriculture also involves providing crucial information to farmers and for agriculture information monitoring, water, soil conditions, crops, fruits conditions, as well as conditions of livestock are required to be monitored in real-time by many spatially distributed wireless sensors. This creates an infrastructural and technology challenge for remote areas where continuous monitoring could be interrupted due to technical snag.

Agriculture applications and remote sensors need the network to be functional for years, however energy limitations on the sensor node can hardly afford this, especially when the network is large and the sensor has many data to forward. On the other hand, the adverse weather effects will challenge the durability of the hardware. The growth of crops will block or affect the wireless links, causing the network working in a highly dynamic radio environment.

7 New ITU-T Standardization Activities

Proposing new standardization activities in the ITU-T does act as a catalyst for the success of innovations emerging from developing communities, especially in vertical markets like health and transport. Providing these new standardization activities, agreed at the global level involving stakeholders from the innovation ecosystems and vertical market communities, would provide cost-effective platforms, which can easily be deployed in hardware and/or software, with diversity in vendors and across different sectors.

The proposed standardization activities can be classified into four main areas of activities as follows:

- Information Security
- Machine Intelligence
- Mobile Money
- Sign Language Communication

7.1 Area 1: Information Security

Information Security is one underlying foundational aspect that is necessary for the development of innovations, especially in developing countries. The scope of Information Security is comprised of five main services; namely, Authentication & Access-Control, Confidentiality, Integrity, Availability, and Non-Repudiation. Every service is considered essential for a specific type of applications/services.

As presented in the previous section, two main drivers could be identified for the *effective* participation of the developing countries in the standardization process:

a) Industrial incentives and drivers: Governments may target to secure their strategic industrial position globally, and one possible means to achieve that is through the standardization process. However that necessitates the presence of strong foundational infrastructure industries that would eventually generate technologies to be standardized; a task while not impossible, however requires a substantial amount of investments; that needs to be secured on the mid-to-long terms.
b) Demand: Demand stimulation policies have a huge impact on the development of the industry in many economies. Demand is affected by many parameters; of most important are the levels of illiteracy, affordability of the services provisioned, purchasing power parity,

and the availability of e-content that is adequate for distribution. The problem with e-content availability lies in two main issues:

i. the availability of the content itself: Developing countries are diverse in culture which provides very rich content wise material
ii. Content digitization: the process of content digitization is a fundamental step in e-content creation, and hence in the whole process of creating suitable content that fits the taste of a certain population. That in turn is reflected on the demand for specific application/services. It's worth noting that this is a very costly process.
iii. Copyright protection and interoperability: this step is essential for the protection of the content to be created. Since the whole process of content creation and digitization is very costly; it is hence extremely important to secure these investments by utilizing Digital Rights Management (DRM) systems and copyright protection systems. DRM systems in addition provide services against tampering with the content after its production, which provide excellent mechanisms for the authorities to combat against fraud and other malicious attempts on the content/services provided. On the other hand, one of the major issues DRM systems for e-Contents (video, music, streaming, etc.) is interoperability[53]. In fact, the use of different DRM systems, in the digital content market, has locked-in consumers to proprietary technologies of respective companies. Currently, no single DRM standard exists for digital contents. Hence, a content purchased from one vendor may not be compatible with another one's client or digital player. Besides, existent DRM systems in the industry only cover a reduced set of mobile operating systems mainly iOS, Android and Windows phone. Moreover, there is little motivation, for leading competitors in the DRM industry, to license their technology or provide support for other technologies to enable interoperability. For these reasons, ensuring interoperability between these systems is becoming a tough task. However, standardization may help guarantee interoperability for DRM systems that is currently exceptionally needed especially with the advanced capabilities supported by Smartphones and tablets on the market and the diversity of mobile operating systems.

It is thus evident that Information Security is of tremendous importance on the whole processes of demand, and industry stimulation; which furthermore stimulate the required drivers behind the *effective* participation of the developing countries in the standardization process.

SG-17 is currently the lead SG on security, identity management (IdM), and on languages and description techniques. SG-17 Responsible for studies relating to security including cybersecurity, countering spam and identity management. Also responsible for the application of open system communications including directory and object identifiers, and for technical languages, the method for their usage and other issues related to the software aspects of telecommunication systems.

There are some lacking aspects in the standardization activities inside the ITU-T, related to security, which can be alleviated by the introduction of new Questions, and the amendment of the scope of SG 17, For example, study items related to Digital Rights Management (DRM) systems, Watermarking technologies, Fidelity, and Availability is proposed to be added to the list of Questions currently under study by SG-17. An account of SG-17 scope and questions under study

[53] [Innovation-I-90] DRM Interoperability Issue, Dr. Rim Belhassine-Cherif, Vice-Chair FG Innovation.

in addition to the proposed new standardization activities are presented in the following subsections.

7.1.1 ITU-T Study Group 17

This section presents a synopsis on the scope, and role of ITU-T Study Group 17 (ITU-T SG 17) and possible standardization activities under its mandates, related to Digital Rights Management (DRM) systems, and Cognitive Radio (CR) systems security.

Currently ITU-T SG 17 is responsible for building confidence and security in the use of Information and Communication Technologies (ICTs). This includes studies relating to cybersecurity, security management, countering spam and identity management. It also includes security architecture and framework, protection of personally identifiable information, and security of applications and services for the Internet of Things, smart grid, smartphone, IPTV, web services, social network, cloud computing, mobile financial system, and telebiometrics. Also responsible for the application of open system communications including directory and object identifiers, and for technical languages, the method for their usage and other issues related to the software aspects of telecommunication systems, and for conformance testing to improve quality of Recommendations.

It is the lead study group for

- Security
- Identity Management (IdM)
- Languages and Description Techniques

7.1.2 Proposed New Standardization Activities for ITU-T SG 17

The following Questions\Working Items are proposed to the TSAG for approval and working items amendment.

New Proposed Question Title
Digital Rights Management (DRM) systems
Cognitive Radio (CR) systems security

1. Proposed Question on Digital Rights Management (DRM) systems

Motivation:

Information Security is one underlying foundational aspect that is necessary for the development of innovations, especially in developing countries. The scope of Information Security is comprised of five main services; namely, Authentication & Access-Control, Confidentiality, Fidelity, Availability, and Non-Repudiation. Every service is considered essential for a specific type of applications/services.

Recent studies have identified a fundamental cause for the standardization gap between developed and developing countries; that's the lack of *effective* participation of the developing countries in the standardization process. One major driver behind the stimulation of *effectiveness*

property in developing countries' participation is manifested in demand stimulation technologies and policies.

Demand stimulation policies have a huge impact on the development of the industry in many economies. Demand is affected by many parameters like the levels of illiteracy, affordability of the services provisioned, purchasing power parity, and the availability of e-content which adequate for distribution. However fundamental and necessary technologies that help in the sustainability of the e-content availability business models are needed. Accordingly this Question assists in covering this gap which acts towards developing standards related to copyright protection. Copyright protection systems are essential for the protection of the content that will be created and distributed to its intended audience. Since the process of content creation and digitization is very costly; it is hence extremely important to secure these investments by utilizing Digital Rights Management (DRM) systems and copyright protection systems. DRM systems in addition provide services against tampering with the content after its production, which provide excellent mechanisms for the authorities to combat against fraud and other malicious attempts on the content/services provided.

Question:

Study items to be considered include, but are not limited to:

- What are the copyright protection ecosystems, and value chain that affects and/or is affected by underlying telecommunication infrastructure?
- How should content developers and content producers secure their content, and maintain secured content distribution networks to protect their content against tampering?
- What possible architectures of DRM systems that can be used to secure the licensing, distribution, and playback of digital content on consumer equipments?
- What are the specifications of DRM systems that can be used to secure the licensing, distribution, and playback of digital content on consumer equipments?
- What are the security requirements that content, content distribution systems and architectures; telecommunication operators need to consider in the design, development and sharing of best practices in the copyright protection ecosystems?
- What are the DRM specifications necessary to achieve interoperability between different systems and players?

Tasks:

Tasks include, but are not limited to:

- Develop Recommendations identifying the architecture as well as detailed specifications of DRM systems for content protection, playback, and distribution

2. Proposed Question on Cognitive Radio systems security

Motivation:

Cognitive radio offers the promise of intelligent radios that can learn from and adapt to their environment in order to satisfy some goals. Introducing artificial intelligence techniques in radio systems allow cognitive radios to achieve the best spectrum utilization. Techniques like machine learning, and reasoning algorithms allow the radio from autonomously take decision with minimal supervision. The applications of cognitive radio are very promising. Reports and studies indicate

their applicability in Public Protection and Disaster Relief (PPDR) use cases in addition to Dynamic Spectrum Access (DSA) scenarios. However, several issues arise before the complete adoption of such systems. Spectrum management as well as spectrum sharing in cognitive radio systems proves to be prone to possible types of attacks. Amongst the most important are Primary User Emulation (PUE) attacks which are found to be effective in DSA environments. In such environments, a primary user owns is licensed, and accordingly protected for its operation and use of a particular frequency band. When primary users are idle, secondary devices can opportunistically use the available spectrum under a condition that their operation is not to affect the operation of primary users in any way. Frequency sensors are usually used to detect the appearance of a primary user in a specific band. An attacker emulating a primary user waveform could fool other peer secondary terminals in deciding to vacate the band of operation in favor of its presence. This gives the adversary an unrivaled access to the frequency band. This Question studies the possible security threats present in cognitive radio environments in addition to the possible security architectures, protocols, and solutions needed to mitigate them.

Question:

Study items to be considered include, but are not limited to:

- What are the different security threats facing cognitive radio systems deployment in DSA use cases?
- What are the different security threats facing cognitive radio systems deployment in PPDR use cases?
- What are the possible forms of attacks found in cognitive radio architectures that might compromise its intended purpose of operation?
- What are the best radio architecture that mitigate the security threats of cognitive radio terminals?
- What are the protocols or protocol amendments needed to mitigate the possible attacks found in different cognitive radio use cases?

Tasks:

Tasks include, but are not limited to:

- Develop Recommendations identifying the architecture, protocols for mitigating security hazards in cognitive radio system deployments

7.2 Area 2: Machine Intelligence related standardization activities

Machine Intelligence is the foundational technologies that will impact the ICT systems and devices for next 50 years. It is evident that by the introduction of every new Generation of ICT systems/applications; intelligence (Machine Intelligence) is constantly being pushed towards the edge of the network. Convergence of devices and the progress of smart devices only highlight the beginning of a new era of ICT systems and services where machines would be able to think for themselves, take decisions and actions with the slightest possible intervention from the end-user.

Innovations emerging from the developing countries indeed cover aspects and problems which are related to core scientific disciplines. However, quite a major portion of these innovations does target vertical markets; which eventually depend on underlying systems/hardware for being smart and intelligent. Hence, standardizing Machine Intelligence algorithms and protocols, will definitely

assist solution/systems developers in developing more viable business cases; by providing cost-effective platforms, which can easily be deployed in hardware and/or software, across different sectors.Some common examples of the impact of Machine Intelligence on the very recent and possible future developments of technologies could be illustrated by several case studies as shown in the following sub-sections.

7.2.1 Artificial Neural Networks Models for Predicting Effective Drought Index in Sub-Saharan Africa[54]

The now more rampant and severe droughts have become synonymous with the Sub-Saharan Africa where they are a major contributor to the acute food insecurity in this region. Though this is not different from other regions in the world, the uniqueness of the problem in the Sub-Saharan Africa countries is the ineffectiveness of the drought monitoring and predicting tools in use in these countries. Accurate and reliable drought forecasts, when delivered in a timely fashion and in formats that are comprehensible to the targeted users, are a precursor to successful drought mitigation strategies. There is a link between weather monitoring and droughts; accurate weather monitoring can detect droughts occurrence long before they strike. In Sub-Saharan Africa, resource-challenged National Meteorological Services are tasked with this responsibility. Although the National Meteorological Services use well-calibrated weather stations that meet the World Meteorological Organization (WMO) standards, the high cost of acquiring the stations allows only a sparse deployment.

Despite this challenge, these institutions continue to provide regular climate forecasts especially in form of seasonal climate forecasts. The utilization of these forecasts by the small-scale farmers whose crops/livestock depend solely on rainfall is still very low; they instead continue to consult their indigenous knowledge forecasts for their crop decisions. This is partly because the seasonal climate forecasts are too supply-driven, too 'coarse' to have meaning at the local level and the dissemination channels are ineffective. Why small-scale farmers? Economies of most countries in the Sub-Saharan Africa are agri-based with over 70% of food being produced by small-scale farmers practising rain-fed agriculture. The latter in extremely responsive to weather patterns and a good rain season translates to bumper harvest and hunger and despair otherwise.

Though the robust Indigenous Knowledge Forecasts that these farmers have relied on since time immemorial has always worked, there is evidence that the knowledge is under serious threat from events such as climate change and 'modernization'. Some of these threats can be countered by blending it with the seasonal climate forecasts. On the other hand, incorporating Indigenous Knowledge Forecasts into the seasonal climate forecasts will improve its relevance (both locally and culturally) and acceptability and hence boost their utilization among the small-scale farmers.

The advantages of this mutual symbiosis relationship between the two forecasting systems have been recognized and pursued in a few initiatives, but with little success. The main challenge is the inability of these initiatives to scale-up beyond a region/community and two, the lack of micro-level weather data to validate the forecast outcomes. Information and Communication Technologies (ICTs) can accelerate this integration; this is the focus of this research. The thesis describes a novel drought monitoring and predicting solution that is designed to work within the unique context of small-scale farmers in Sub-Saharan Africa. The research produced a unique

[54] By Muthoni Masinde (PhD), Central University of Technology, [Innovation-i-0084-ITIKI.doc]

integration framework that creates the much-needed bridge (ITIKI) between indigenous knowledge forecasts and seasonal climate forecasts.

7.2.1.1 Information Technology and Indigenous Knowledge with Intelligence (ITIKI)

7.2.1.1.1 Overview

ITIKI is a novel bridge that delivers a drought early warning system (DEWS) composed of four elements:

(1) Drought Knowledge

(2) Drought Monitoring and Prediction;

(3) Drought Communication and Dissemination; and

(4) Response Capability.

The ITIKI acronym stands for Information Technology and Indigenous Knowledge with Intelligence. ITIKI was conceptualized from *itiki* which is the name used among the Mbeere people (found in the Eastern part of Kenya), to refer to an indigenous bridge made using sticks and was used for decades to go across rivers. It is a bridge that integrates indigenous drought forecasting approach into the scientific drought forecasting approach. Until mid-90s, this bridge used to be constructed by 'experts' who possessed indigenous knowledge on the rivers' terrain as well as on the strength of the various trees along the rivers and the trees' ability to sustain the weight that the bridge would eventually carry. Such was the accuracy of this knowledge that during the 1992 floods, a newly constructed modern bridge was swept away while the *itiki* nearby was left standing.

To achieve sustainability, relevance and acceptability, indigenous knowledge was integrated in the ITIKI system. Mobile phones were used as both input and output devices for the system. In order to facilitate collection and conservation of indigenous knowledge on drought monitoring, the system use an Android-based mobile application while text-to-speech and speech-to-text plug-ins were incorporated to cater for semi-illiterate farmers. Wireless sensor-based weather meters were used, calibrated against conventional weather stations and deployed as a compliment to the weather stations during the project. This proved the hypothesis that, when deployed in hundreds, these sensors are capable of extending the weather network coverage to enhance weather forecasting by downscaling the reading of weather parameters to tens of meters.

Weather data is a 'gold mine' for many sectors of an economy and to allow public access to drought monitoring system data, a comprehensive web portal and an SMS-based component were also implemented. In order to collect real data for the indigenous drought forecast aspect, a case study of two communities in Kenya (Mbeere and Abanyole) was carried out. On completion of the system prototype, participants from the two communities evaluated it; based on content and format of the integrated forecasts, 90% of respondents gave a score of 'excellent'.

The complexity of the resulting system was enormous and to ensure that the above diverse parts worked together, artificial intelligence technologies were heavily used in developing the system. Artificial Neural Networks were used to develop forecast models whose accuracies ranged between 75 and 98% for lead-times of one day to four years. Fuzzy logic was used to store and

manipulate the holistic indigenous knowledge while intelligent agents were used to integrate all the sub-systems into a single unit. After evaluating it using over forty years of historical weather data from Kenya, Effective Drought Index was adopted for drought monitoring because of its ability to quantify and qualify drought in absolute terms.

7.2.1.1.2 Features of ITIKI

The overall goal of ITIKI was to come up with a relevant, affordable, sustainable, integrated, resilient, useable, effective, generic, and micro-level early warning system for droughts for the Sub-Saharan Africa and Africa at large. Below is how each of these attributes is achieved in our integrated framework:

a) Indigenous Knowledge (IK)

Going by the phrase by Stern et al.(1999), "The effectiveness of forecast information depends strongly on the systems that distribute the information, the channels of distribution, the recipients' models of understanding and judgment about the information sources, and the ways in which the information is presented." One way of achieving an effective early warning system for droughts is therefore to put into consideration the targeted users' coping strategies, cultural traits and specific situations. In the case of the Sub-Saharan Africa, this is easily achieved by incorporating the local people's indigenous knowledge on weather/climate forecasting (Silitoe, 1998, Brokensha et al., 1982, Fernado, Jaywardena, 1998 and Orlove et al., 2009).

b) Effective Drought Index

As the name suggests, the Effective Drought Index (EDI), is a very effective index compared to other drought indices. Its uniqueness stems from the fact that it provides spatial and temporal distribution of droughts on a daily-basis (Byun, Wilhite, 1999). EDI computes the intensity of droughts by using cumulative precipitation as a weighting function of time and also gives the Available Water Resources Index (AWRI); the latter is a measure of hydrological drought and can be used to assess the quantity of soil moisture. By incorporating it into our drought early warning system framework, it makes it possible to quantify and qualify droughts in micro scale (time and spatial distribution) as well as in absolute terms (Masinde, Bagula, 2011).

c) Wireless Sensor Networks (WSN)

A deeper look into the problem of early warning system for droughts in SSA reveals a grave situation where the meteorological institutions the National Meteorological Services (NMSs) charged with weather forecasting rely on weather stations that are thousands of kilometres apart (Jarraud, 2008 and EAC, 2008). This sparse network makes it difficult to provide locally relevant information necessary for scaling weather information down to the local (say village level) communities. Furthermore, weather stations are very expensive and their operation may be difficult to sustain in many developing countries where the lack of expertise and high cost of maintenance may hamper operation after funding from donors. In our framework, the now readily available versatile and WSNs-based weather stations were employed to fill the gap. Further WSNs are used to automatically extend the available climate maps and prediction through (1) collection of climate data; (2) analysis of this data; and (3) modelling of climate change in the remote villages.

d) Mobile Phones

Africa has achieved a mobile phone penetration level much higher than that of computers. With well-designed solutions, the use of these phones can be extended from the traditional use, as mere communication devices, to computing devices on which the much needed e-applications can be executed. The DEWS utilizes this window of opportunity by using the mobile phone to not only disseminate drought alerts but also as an input device for the IK. This way, the system is both affordable and sustainable.

e) Artificial Intelligence

In order to create an integrated system that can juggle all these myriad moving parts at the macro and micro-level, some reasoning was necessary; use of intelligent agents achieved this. Further, IK on weather and drought is so rich; it has been said to be holistic (Berekes et al., 2009); in order to model this aspect of IK and ensure preservation of its richness, the use of Fuzzy Sets (Zeden, 1965) were employed. In order to build a complete early warning system, forecasting/predicting future droughts was crucial; therefore Artificial Neural Networks (ANNs) were used for this purpose.

7.2.1.1.3 ITIKI Architecture

ITIKI Architecture is shown in Figure 3 and its components are described

1- Element 1: Drought Risk Knowledge

1(a): Using wireless sensors that are capable of sensing temperature, humidity, atmospheric pressure, wind (direction and speed), precipitation and soil moisture, weather data is automatically collected and sent to a structured store 1(f) in form of text messages (SMS).

1(b): Rainfall data observed from rainfall stations (contains only rain gauges, the Mbeere case) stations is manually entered into the system and stored in the same database as the sensors' data.

1(c): Other data elements (IK) are retrieved from various publications available in print and on-line. These are in form of limited studies on IK in Mbeere and SCFs by KMD. Out of these, the structured elements are stored in 1(f) while the unstructured ones are stored in 1(g).

1(d): IK on droughts collected during various field studies is stored in 1(g).

1(e): This is the real-time IK from the IK Experts.

1(h) and 1(i): the structured data is stored in a database 1(h) while the pre-processed indigenous knowledge is represented as Fuzzy Sets 1(i).

2- Element 2: Monitoring and Prediction

This was implemented using two sub-components: (1) Drought Monitoring that pre-processes the data to detect suggestive patterns as well minimise duplicates and other errors. This is achieved through EDI Monitor (2(a)) and IK Experts (2(b)) ; and (2) Drought Prediction using Artificial Neural Networks ((2(c)) and Fuzzy Logic System ((2(d)). In 2(e), the resulting forecasts are reviewed by both the scientists and IK Experts after which 'reconciled' forecasts are generated and passed to the Dissemination component. This is partially a manual activity where the meteorologists and the IK experts sit to reconcile SCFs and IKFs. However, the short-term forecasts (a few hours to two weeks) do not need the manual 'reconciliation'; the system

intelligently reconciles the two (from IK and from ANNs) and sends them to the Drought Communication and Dissemination Component. Further, in line with fuzzy system, for purses of 'recovering' IK's original meaning/format, the output 2(e) is passed through 1(i) for Defuzzification

3- Element 3: Forecasts Dissemination

Mobile phones are used to send customized forecasts in form of test message and where possible, free phone calls to the farmers. Other forecasts are posted on websites while others are generated in audio formats that can be broadcasted via community radios stations and visual displays on strategically located village digital billboards. Though not implemented, the Framework is designed to support natural language processing to allow for translation of the forecasts into the local languages.

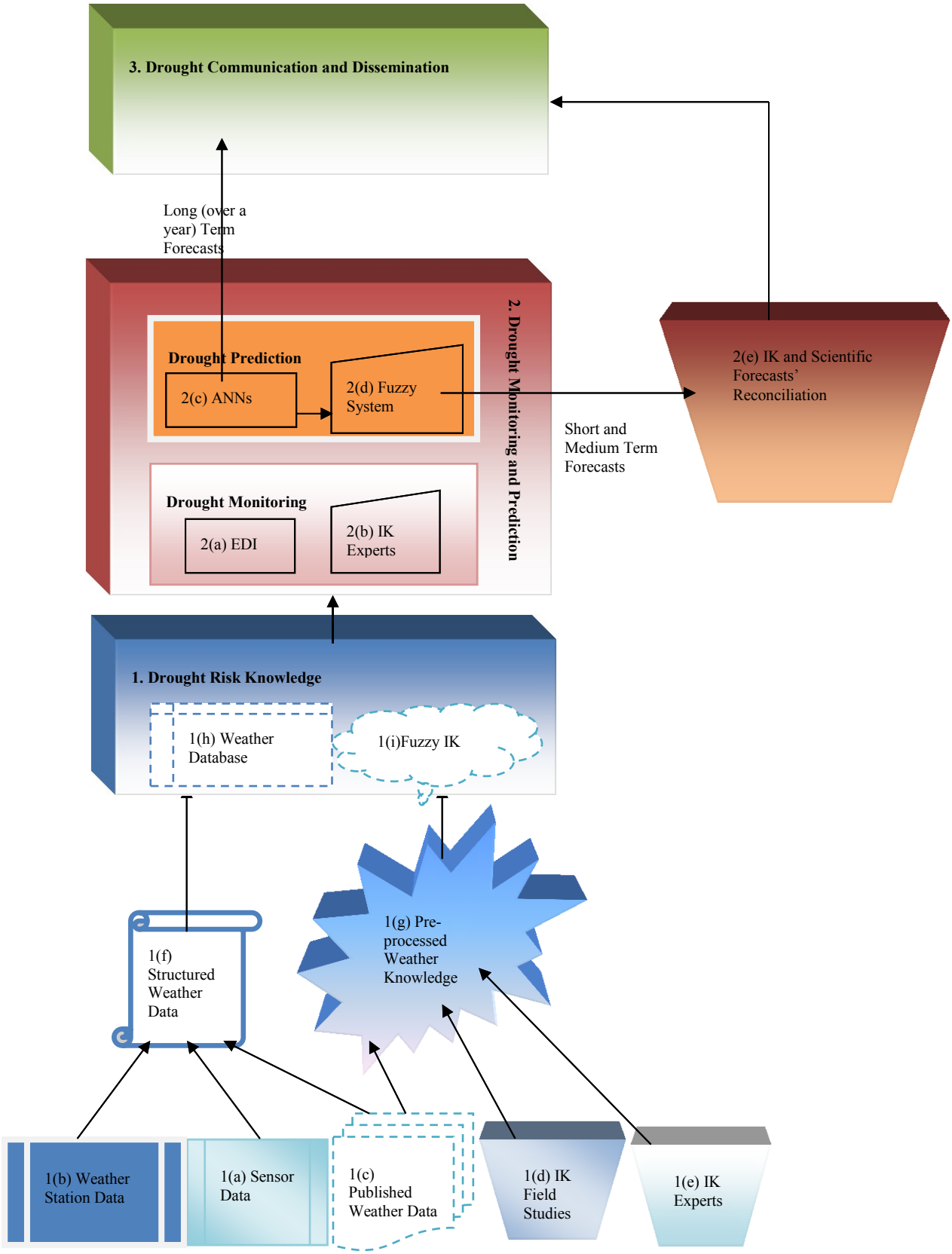

Figure 3 ITIKI Architecture

7.2.2 Cognitive Radio Use Case

Chronologically speaking, in the 1999 paper that first used the term “Cognitive Radio”, Joseph Mitola III defined a cognitive radio as: “A radio that employs model based reasoning to achieve a specified level of competence in radio-related domains.”In his 2000 doctoral dissertation, Mitola further identifies an important aspect of his CR concept, known as knowledge representation. Knowledge in CR is contained within a modeling language such as Radio Knowledge Representation Language (RKRL).

In November 2003, the IEEE USA offered the following definition to aid the FCC in its efforts to define cognitive radio: “A radio frequency transmitter/receiver that is designed to intelligently detect whether a particular segment of the radio spectrum is currently in use, and to jump into (and out of, as necessary) the temporarily-unused spectrum very rapidly, without interfering with the transmissions of other authorized users.”

In February 2005, Haykin gives a comprehensive definition for CR focusing on three on-line cognitive tasks, namely, radio-scene analysis, channel identification, and transmit-power control and dynamic spectrum management. He defines CR as: “An intelligent wireless communication system that is aware of its surrounding environment (i.e., outside world), and uses the methodology of understanding-by building to learn from the environment and adapt its internal states to statistical variations in the incoming RF stimuli by making corresponding changes in certain operating parameters (e.g., transmit-power, carrier-frequency, and modulation strategy) in real-time, with two primary objectives in mind: highly reliable communications whenever and wherever needed; and efficient utilization of the radio spectrum.”Haykin clearly identified six aspects, which he considered core, to his definition: awareness, intelligence, learning, adaptivity, reliability, and efficiency.

By September 2009, under the framework of World Radiocommunication Conference 2012 Agenda item 1.19, “to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution 956 (WRC-07)”, ITU-R Working Party 1B has developed definitions of Software Defined Radio (SDR) and Cognitive Radio System (CRS) to assist in the conduct of studies and related preparations for the second session of the Conference Preparatory Meeting for WRC-12.

And finally in a recent publication by the author it was illustrated that cognition includes – among others – some fundamental tasks like learning, adaptation, and intelligence. Intelligence through an intelligent agent is foreseen as an implicit mandatory component of a CR.

CR are finally formulated as QUESTION ITU-R 241-2/5, titled "Cognitive radio systems in the mobile service" which tackles the concept of CR from a very limited perspective, nevertheless; the concept of cognition even from the linguistic perspective includes activities related to the faculty of knowing with all the underlying implications of knowledge representation and inference based on that knowledge.

Recent research illustrates the use of Artificial Intelligence (AI) algorithms in major parts of CR; which provide a live example on the necessity of Machine Intelligence standardization activities in the ITU-T even though the technology itself is being considered from the perspective of its implicationsin the ITU Radiocommunication Sector.

The area of Machine Intelligence is much diversified. It covers areas like Supervised and Unsupervised Learning, Classification and Clustering, Heuristics and Meta-Heuristics, Inference, Knowledge Representation, and Case-Based Reasoning.

7.2.3 ITU-T Study Group 13 on future networks including cloud computing, mobile and next-generation networks

It is evident that the dependency of ICT systems and services on machine intelligence will continue to grow in the future. Currently there is no dedicated ITU-T Study Group that works on machine intelligence. Due to its foreseen impact, working items related to ITU-T SG 13 could be added to cover areas like supervised and unsupervised learning, classification and clustering, heuristics and meta-heuristics, inference, knowledge representation, ANN, and Case-Based Reasoning (CBR).

This section presents a synopsis on the scope, and role of SG-13 and identified possible standardization activities under its mandates.

ITU-T Study Group 13 works on studies relating to the requirements, architectures, capabilities and mechanisms of future networks including studies relating to service awareness, data awareness, environmental awareness and socio-economic awareness of future networks. It is responsible for studies related to:

- Cloud computing technologies such as virtualization, resource management, reliability and security.
- Network aspects of IoT and network aspects of mobile telecommunication networks, including International Mobile Telecommunications (IMT) and IMT-Advanced, wireless Internet, mobility management, mobile multimedia network functions, internetworking and enhancements to existing ITU-T Recommendations on IMT.
- NGN/IPTV enhancements, including requirements, capabilities, architectures and implementation scenarios, deployment models, and coordination across Study Groups.

It is the lead study group for:

- Future Networks
- Mobility Management and NGN
- Cloud Computing
- Software-Defined Networking (SDN)

7.2.3.1 Proposed New Standardization Activities for SG-13

The following Questions\Working Items are proposed to the TSAG for approval and working items amendment.

Proposed Question Title
What are the AI architecture, techniques, and methods applicable in NGN?
Investigation on machine learning algorithms in NGN.

7.2.4 ITU-T Study Group 5 - Environment and climate change

This section presents a synopsis on the scope, and role of ITU-T Study Group 5 and identified possible standardization activities under its mandate.

ITU-T Study Group 5 (SG5) is responsible for studies on methodologies for evaluating ICT effects on climate change and publishing guidelines for using ICTs in an eco-friendly way. Under its environmental mandate SG5 is also responsible for studying design methodologies to reduce ICTs and e-waste's adverse environmental effects, for example, through recycling of ICT facilities and equipment.

It is the lead study group for

- electromagnetic compatibility and electromagnetic effects
- ICTs and climate change

The standardization of the ITIKI architecture and methodology for the Effective Drought Index can be studied in ITU-T Study Group 5. The following new Question in ITU-T Study Group 5 is recommended for this and proposed to the TSAG for approval.

Proposed Question Title
On the applicability and methodology of using Artificial Intelligence techniques in drought forecasting and prediction.

7.3 Area 3: Mobile Money

In the developing world, mobile money has a strong potential to become an enabler for financial inclusion. The innovations in mobile money transfer are forcing regulators to re-evaluate their rules for financial service provision. Non-banks like MNOs could be strategically positioned to dramatically expand the reach and range of financial services for the poor and unbanked. The challenge is to develop policies and flexible regulations that mitigate the risks for the customer without hampering innovation in this field. E-money has traditionally been seen by regulators as a payment instrument rather than being also positioned as a means for savings (i.e. earning interest on deposits) for the poor. Passing on such interest would not only benefit customers but bring more money into the economy.

With individuals in emerging markets still conducting over 90 percent of all transactions in cash, mobile money is poised to become a multi-billion dollar industry in the near future. The ability of providers of mobile financial services to optimize the value chain through collaborative partnerships and effective use of technology will be a critical success factor. Players who aim to become global leaders in mobile money services cannot avoid entering emerging economies. They need to invest, however, if they want to enter the attractive markets for mobile money. Anticipating changes in regulations, establishing a sound agent network and responding to country-specific market and consumer characteristics, are all essential for success.

Encryption in SMS and USSD communications is not necessarily end-to-end, creating vulnerabilities at various points where data can be intercepted, read and acted on by third parties. There are no common technology standards for mobile money transfer and there are many different mobile phone devices, specific client-based and server-based technologies used; it is a major challenge for banks to offer mobile banking solutions on any type of device. Interoperability is a key issue and becomes tougher with more complex banking transactions and the proliferation of smartphone apps for mobile money. The end-user must be able to transfer money to anyone, regardless of the recipient's bank, and even if they are unbanked.

In addition, cloud computing is likely in the near future to offer a very efficient platform for handling mobile money transfer services in emerging economies. Banks could leverage the cloud to offer mobile banking services to existing clients, and could offer transaction management services integrated with the core banking system through mobile Internet to their clients. The cloud could also be leveraged as an interoperable platform to enable mobile payments. In this scenario, a large multinational bank or mobile network operator (MNO) in collaboration with a service provider could jointly offer mobile money services in a given region. In this case, multiple MNOs could also use the cloud to offer their mobile money services to clients in the region. Other players such as agents and retail outlets could also join the cloud as cash in/cash out agents. This model may be attractive for governments looking to create a national interoperable mobile payments ecosystem, and the operational costs for MNOs, banks and retailers would also be low as the central cloud infrastructure model would provide economies of scale.

ITU-T Study Group 13 has developed two Recommendations related to securing mobile financial services. Recommendation ITU-T Y.2740 elaborates approaches to develop system security for mobile commerce and mobile banking in the next generation networks (NGN). It describes security requirements for the mobile commerce and the mobile banking systems, based on four specified security assurance levels. It outlines probable risks in mobile commerce and mobile banking systems, and specifies means for risk reduction. Recommendation ITU-T Y.2741 specifies the general architecture of a security solution for mobile commerce and mobile banking in the context of NGN. It describes the key participants, their roles, and the operational scenarios of the mobile commerce and mobile banking systems. It also provides examples of the implementation models of mobile commerce and mobile banking systems.

ITU-T Study Group 2 is currently working on the development of a Recommendation on Telecom Finance, which will provide an overview of mobile money services from the operators' perspective to enhance the customer experiences in telecom service and strengthen B2B, C2C and B2C financial infrastructure.

ITU, as a multi-stakeholder body with representation from the governments of 193 countries around the world, could also work towards developing a code of practice for regulators (especially in the developing world) with a view to creating a level playing field that will enable stakeholders to engage in mobile money services, thereby promoting financial inclusion. As a precursor to this, ITU could establish a Task Force on Mobile Money for Emerging Economies, with stakeholders such as GSMA, the World Bank, the Gates Foundation which could discuss issues related to standards, technology for mobile payments and regulation for mobile money with relevant

stakeholders with the aim of elaborating a code of practice for governments in emerging countries and sustaining innovations in the field.

ITU-T could also play an important role in facilitating the standardization of innovations in the area of mobile money in emerging economies, by setting up an ITU-T Focus Group on Mobile Money.

The Focus Group on Mobile Money could work towards:

- Defining the role technology trends in digital financial services and the roles of the various stakeholders in this ecosystem.
- Standardizing the definition of terms used in digital financial services;
- Establishing liaisons and relationships with other organizations which could contribute to the standardization activities of digital financial services.
- Describing the ecosystem for digital financial services in developed and developing countries and the respective roles and responsibilities of the stakeholders in the ecosystem.
- Identifying successful use cases for implementation of secure digital financial services in developing countries;
- Suggesting future ITU-T study items and related actions for various ITU-T study groups for example on:
  - Characteristics and requirements for digital financial services.
  - Architectural framework for digital financial services including security of transactions.
- Studying the best practices related to policies, regulatory frameworks, business models and ecosystems for digital financial services in developed and developing countries.
- Initiating consultation process to develop an enabling policy and regulatory environment for digital financial services which could be submitted for endorsement at the ITU Global Regulators Symposium.

7.4 Area 4: Sign Language Communication

7.4.1 Introduction

In recent years, modelling and animating virtual characters become more and more important. The first work of standardization for synthetizing 3D models was initiated in 1997 by the VRML group. The specificities of the animation models of humanoids have been made by the group H|Anim. It defined the geometry of the human body constituted as a hierarchical structure.

The MPEG4 standard developed by MPEG (Moving Picture Experts Group) aims to create a common framework for multimedia applications by defining complex scenes of audiovisual content and 2D and 3D text or graphic objects, to ensure the compression and transmission of such scenes. It was presented at the end of 1998 and designated as the official ISO / IEC 14496. MPEG4 provides the specification Face and Body Animation (FBA) which sets up a precise representation of the geometry and animation of a virtual character.

7.4.2 MMSSign[55]

7.4.2.1 Objectives and Problematic

Our objective is to contribute in the improvement of e-accessibility of deaf community and to make the mobile phone a way of communication usable by deaf people. In this context, MMSSign enables to transform the text to MMS containing the video sequence of the text in sign language in a format which can be sent to deaf people through MMS. This transformation is realized in two steps: The first consists on the generation of 3D animation of a 3D avatar, by the use of our web-service WebSign. Then, the MMSSign software transforms the 3D animation to an MMS containing a 3GP video sequence.

Some of the main challenges to be overcome are:

- Contrary to popular belief, unfortunately, Sign Language (SL) is not universal. Wherever community of deaf people exists, a specific SL has been developed. Likewise spoken languages, SLs vary from region to region. Many SLs exist in the world and are at the core of local deaf cultures. Some SLs have obtained some forms of legal recognition, while others have no status at all.
- Linguistic treatment: the automatic translation of written text to sign language should not be a word-to-word translation. As all natural language processing applications, it requires a lot of information: lexical, grammatical, translation equivalences, etc. The most difficult aspect remains the semantic analysis.
- Technologic problems: the animation of the avatar needs sophisticated programming skills.
- Cost problem: the construction of dictionaries of signs is an expensive operation and needs a lot of time.
- The mobile phone does not contain a 3D accelerator of the 3D scene and it does not contain a big memory to allow the animation of 3D scene.

7.4.2.2 General approach of MMS SIGN

MMSSign is a converter of textual message to a video sequence in sign language. This system offers to the deaf the possibility to use cell phones. In fact, in order to communicate with a deaf person via cell phone, anyone can send him a textual message via SMS or via a dedicated web interface (Figure 4 (step 1,7)). The text of the message is then processed by our system and precisely by our MMSSign server. If MMSSign server does not respond to the request in a reasonable period of time the server of the operator should return a negative acknowledgement of delivery (Figure 4 (step 6)).

In the normal work of the procedure, MMSSign server should return an MMS containing the video transformation of the text in sign language (Figure 4 (step 3)) and the operator of the telecommunication becomes the responsible of the deliverance of the MMS.

[55] [Innovation-I-76] Standardization of sign language communication trough avatars and mobile phones, by Prof. Mohamed Jemni and Oussama Elghoul, Research Laboratory LaTICEUniversity of Tunis, 2014.

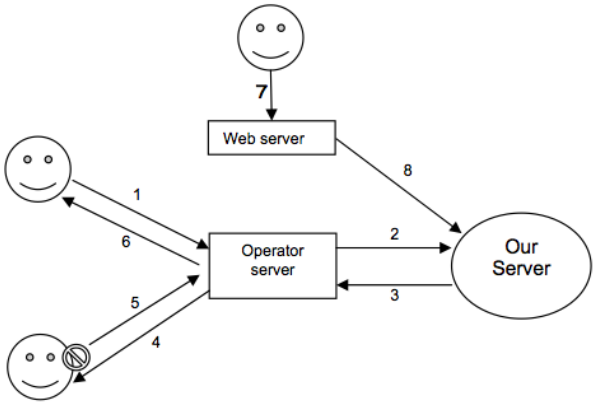

Figure 4 Architecture of MMSIGN

7.4.2.3 Standardization Required

It is possible to standardize sign language transmission and rendering engines in order to guarantee compatibility between sign languages communication systems. It is proposed to standardize a description language for encoding avatar gestures for sign languages and some of the requirements to assure a minimum degree of accessibility to the rendered animation.

7.4.2.3.1 Encoding sign languages

The need to create languages to describe the gestures and facial expressions made by virtual characters has encouraged many researchers to propose languages to meet these needs. Indeed, the needs are often based on a set of six criteria: recess body animation, facial animation and sign language support in the first place and emotion, dialogue and respect of the Mpeg4 standard in second place.

Many languages are proposed in order to describe avatar animation. However, they are still insufficient to ensure sign language animation needs. In sign languages gestures are not a simple animations of body and face. The sign should respect many linguistic and physical rules. In fact, a sign language text is a real show, in which the speaker describes objects, their places in the scene, their shapes, and the relation between them.

For these reasons, it is important to develop and standardize a new language that describes sign languages gestures. The language will define a standard to encode and transmit sign languages through Internet and mobile networks.

Table 2 A set of languages for describing gestures

Languages	Emotion	Faciale animation	Body animation	Dialogue	Mpeg4	Project	Sign language
HumanML	Yes	Yes	Yes	Yes	-	-	No
CML	Yes	Yes	Yes	-	Yes	SAFIRA	No
AML	Yes	Yes	Yes	-	Yes	SoNG	No

APML	Yes	Yes	No	-	-	Greta	No
DAMSL	-	-	-	Yes	-	-	No
GESTYLE	Yes	Yes	Yes	-	-	-	No
MPML	Yes	Yes	No	-	-	Mobile	No
MURML	-	Yes	Yes	No	-	Max	No
VoiceXML	No	No	No	Yes	-	-	No
RRL	Yes	Yes	Yes	Yes	-	NECA	No
AIML	-	-	-	Yes	-	ALICE	No
VHML	Yes	Yes	Yes	Yes	Yes	InterFac MetaFac MentorSys	No
XSTEP	No	No	Yes	-	-	-	No
SigML	No	Yes	Yes	No	-	eSign	Yes
SWML	No	Yes	Yes	No	-	vSign	Yes
SML	Yes	Yes	Yes	No	-	WebSign	Yes

7.4.2.3.2 Avatar requirements

In order to obtain the same animation in different players and different avatars, the standardization of avatar's structure and parameters should be done. Below are some characteristics that a signing avatar should check.

- The avatar should be a 3D avatar. It should be MPEG4[56] compliant.
- The avatar should be at least compliant to the Level of articulation two of the H|Anim standard[57].
- The avatar should support facial animation.
- The possibility to change clothes and body textures and color.

[56] MPEG4 : Information technology — Coding of audio-visual objects, ISO/IEC 14496-2:2001

[57] H|Anim : H-Anim 200x specification, ISO_IEC_FCD_19774

7.4.2.3.3 3D animation requirements

The quality of the avatar and the animation should not be the same as a normal animation of a 3D virtual avatar[58]. As an example, the minimum frame rate of the animation should be fixed by the standard according to researcher studies, in order to ensure that the sign will be visible and comprehensible by deaf persons when they received it through Internet and mobile networks. Also, the contrast between hand and clothes colors should be also fixed.

- Color and luminance contrast are important on the understandability of signs within a video or an animation. Color blindness affects an individual's ability to distinguish between red and green and the shades in between. Luminance contrast is the difference in the amount of light reflected from the sign compared with the light reflected from the background or surrounding surface. There must be a luminance contrast of not less than 30 per cent between the raised tactile components of the sign and the surface of the sign, and the surface of the sign and the background it is mounted on.
- Hellström proposes a resolution for the video of CIF format (352*288) and 3:4 aspect ratios to frame the upper body and signing space[59].
- The minimal frame rate, which has to be higher than 15 frames per second.
- The ability to pause and stop animation at any time whenever it is longer than 5 s (WCAG 2.0 Guidelines).
- The possibility to control the speed of the animation.
- The possibility of zooming and increasing the size of rendered images, so that deaf people can see the facial expressions and gestures of hands better without lowering the quality of the rendered images.
- The inclusion of subtitles, which are used by deaf and hard-of-hearing to assist their comprehension and the fluency of the sign language interpreter.
- The possibility to move the clip to another part of the screen when desired by user.
- The rapid display of the animation on the web site. Extended waiting time for a animation to load may lead to the confusion of the deaf person, since there is no proper feedback on what is going on.
- The use of sound. Although the sign language video is aimed at deaf people who do not hear sound, the video can also be used for hard-of-hearing people who wear hearing aids and still know sign language.
- The possibility to use a transparent background.

7.4.3 Candidate Study Group: ITU-T Study Group 16 - Multimedia coding, systems and applications

ITU-T Study Group 16 leads ITU's standardization work on multimedia coding, systems and applications, including the coordination of related studies across the various ITU-T SGs. It is also the lead study group on ubiquitous and Internet of Things (IoT) applications; telecommunication/ICT accessibility for persons with disabilities; intelligent transport system (ITS) communications; e-health; and Internet Protocol television (IPTV).

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[58] Matjaž D. , Primož K. and Andreas H., Improving multimodal web accessibility for deaf people: sign language interpreter module, Multimedia Tools and Applications, August 2011, Volume 54, Issue 1, pp 181-199

[59] Hellström G., Quality measurement on video communication for sign language. 16th International Symposium on Human Factors in Telecommunications, Oslo, Norway, 1997

It is the lead study group for

- multimedia coding, systems and applications
- ubiquitous and Internet of Things applications
- telecommunication/ICT accessibility for persons with disabilities
- intelligent transport system (ITS) communications
- IPTV

The relevant Questions\Working Party to which the standardization for MMSSIgn could be allocated for study is shown below.

WP2/16	Multimedia services and accessibility
Q26/16	Accessibility to multimedia systems and services

8 Proposals for Linking Innovation to Standards

WTSA-12 Resolution 44 [Rev Dubai, 2012] instructs the TSB Director to carry out the necessary studies on the role of innovation management and innovation stimulation programmes on bridging the standardization gap between the developed and developing countries.

Traditionally, national policymakers have been long interested in promoting technological innovation due to its expected impact on the economic conditions and overall quality of life of their nation's citizens. National policies were generally directed towards enabling a healthy ecosystem for innovation through either offering incentives for the industry or by removing obstacles hindering the development of startup businesses and new industries.

Globally, policies to encourage innovation by the industry included; amongst others, government funding for Research and Development (R&D), tax credits or other benefits like deducting R&D expenses, subsidies, and incubation programs. However, even though governments and administrations have put efforts to stimulate innovations and provide benefits for the industry, there are questions on the degree of effectiveness of policies to stimulating investment at companies in the industry, given their fiscal cost to taxpayers, and the extent (real impact) of the company innovation, as induced by these policies, on the broader economic growth.

While the effectiveness of innovation policies on the economic and well-fare of the state are not questionable, it is however sought to complement these policies by an international collaborative innovation stimulating framework that would ultimately spur national innovation, while reduce the burden costs of state budgets directed to stimulating innovation. The collaborative framework is conducted by the establishment of an "Innovation Panel" that will aid the stimulation of innovation in member states, with minimal burden on the state budget. In addition, it will help provide a sustainable and attractive ecosystem for scientists and entrepreneurs that will eventually spur their innovations and creativity.

In terms of policy, it is a well-established result that market economies normally do not generate a socially optimal volume of knowledge creation, innovation and entrepreneurship. However, there is no consensus concerning what institutional frameworks and policy measures that might generate such a social optimum given the imperfections in both the economic and the political markets. This has not stopped policy-makers from launching a large number of institutional changes and policy measures to stimulate knowledge creation, innovation and entrepreneurship. Nevertheless, the number of carefully carried through policy evaluations is limited, and hence there is knowledge gap regarding which policies are effective and justify its costs. This "Innovation Panel" is one major vehicle that could serve to conduct such evaluations to assist the community in identifying and analyzing the best strategies and policies that can stimulate knowledge creation and innovation, and help bridge the standardization gap in reference to Res. 44 WTSA-12. The following subsections present the ToR foreseen for the ICT Innovation Panel together with its foreseen structure. This innovating new mechanism does enable the ITU-T from applying a pull strategy for innovations occurring in developing countries rather than the currently apparently dominating push strategy in which technologies are being pushed into developing economies and efforts are being endeavored to motivate and assist developing countries in actively contributing in the standardization process. Activities related to the study of different possible innovation stimulation programs that could assist developing countries in bridging the Standardization Gap could also be a possible future action item mandated by this panel.

8.1 ICT Innovation Panel[60]

This section introduces the ICT Innovation Panel, highlighting its main functions, and deliverables, and relationship to other related ITU-T vehicles like FG Innovation.

8.1.1 Definition

The ICT Innovation Panel, hereafter the Panel is a vehicle inside the ITU-T for stimulating ICT innovations, under ITU-T, with the objective of enhancing global collaborative innovation to bridge the standardization gap between developed and developing countries and to identify and support innovations from developing countries. The panel is expected to review, assess, and produce political, economical, technical and social innovation stimulation studies, policies, and strategies that are recommended to be employed by the members of the ITU.

8.1.2 Terms of Reference (ToR)

The Panel ToR has several items that would eventually assist it in promoting global collaborative innovation and assist in bridging the standardization gap as well as bridging innovations to standardization. The main items are:

Item 1- Identify, analyze and study the best policies and practices that enable the development of sustainable innovations which produces maximum benefits for societies.

Item 2- Identify the criteria of sustainable innovations, which have the most impact on societies, and foreseen to be of utmost impact on the welfare and prosperity of humanity.

Item 3- Provide assistance to ITU members in how to introduce their innovations into the standardization process by providing assistance to formulating new Questions, and building case studies in relation to their introduced innovations. The Panel acts like an incubator for developing standards to newly developed innovative products and solutions, i.e. it acts like a standardization incubator.

Item 4- Conduct studies related to the role of innovation management, and innovation stimulation programmes in developing economies and bridging the standardization gap in addition to the potential maximization of investment returns related to innovation management policies and strategies.

Item 5- Produce an annual scientific report on policy means to stimulate innovation, and possible governmental tools that could be used to bridge the gap between technological development and standardization.

Item 6- Produce policy recommendations for its constituent members to adopt specific policies that help in the development of innovation solutions and services.

Item 7- Take actions to safeguard the required intellectual property rights at the request of the innovators[61].

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[60] [Innovation-I-0061]ICT Innovation Panel, by Dr. Ramy Ahmed Fathy, regarding the establishment of the ICT Innovation Panel.

Item 8- Conduct studies on how to provide linkages between innovations, standards and the market.

8.1.3 Expected Deliverables

The Panel is expected to produce the following deliverables:

1. Policy *Guidelines* and *Recommendations* that advise the ITU on promoting standards that stimulate global innovations specifically those which have a profound impact on the socio-economic indicators on economies.
2. Policy *Guidelines* and *Recommendations* for the ITU members to adopt innovations stimulating policies and innovation to standardization procedures that aims at bridging the standardization gap
3. Assist developing countries in developing means to align their industrial and innovation strategies towards the goal of achieving highest impact on their socio-economic ecosystems.
4. Assist developing countries in developing methods that facilitate the process of linking innovations to the standardization process.
5. Promote new critical success standardization activities, defined as standardization activities that are necessary for the development of innovative products, solutions, and services, e.g. Digital Rights Management (DRM) systems for e-content development and watermarking technologies for copyright protection. Standardizing these technologies will help promote the proliferation of e-content in the member states, promoting the demand side in developing and developed countries.
6. Annual scientific report on means to stimulate innovation and methods to assess the socio-economic impacts of innovations in societies.
7. Assist the innovation ecosystem stakeholders by providing a link to the standardization ecosystem.
8. Provide safeguards for the required intellectual property rights at the request of innovators.

8.1.4 Relationship to FG Innovation

The ITU-T FG Innovation is expected to report on successful cases of ICT Innovations in different economic sectors from various geographical areas which may benefit from standardization in ITU-T (Innovations Report) in addition to preparing proposals on new standardization activities for ITU-T, as appropriate.

The Panel on the other side extends the scope and mandates of the work conducted in the FG Innovation by developing methods that facilitate the process of linking innovations to the standardization process, and producing *Guidelines* and *Recommendations* both to the ITU and the innovation and standards community about innovation management and its effective role in bridging the standardization gap. Furthermore, the Panel is foreseen to be a permanent vehicle that extends the work of the FG beyond its current scope, mandates, objectives, and timeframe.

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[61] Comment on TD 161 (GEN/13) from Mr. Simon Bugaba, Vice-Chair SG-13 on Future Networks and Rapporteur of Question 5\13, January, 2014.

8.1.5 Panel Structure

The Panel is comprised of two committees as follows:

8.1.5.1 Technology Committee

The Technology Committee is responsible of tracking strategic innovative technologies that could be of significant impact on societies and economies. It is also responsible of developing a list of recommended technologies and solutions that best meets societies' needs and produces the maximum socio-economic returns. The Committee will be engaged in relevant Panel ToR items.

8.1.5.2 Policy Committee

The Policy Committee is responsible of developing harmonized policy recommendations and guidelines to facilitate and promote the application of Technology Committee's recommended technologies and solutions, in addition to develop a consensus on how to standardize the newly developed innovative solutions. That includes also the development of guidelines in intellectual property protection, industrial production and distribution. The Committee will be engaged in relevant Panel ToR items.

8.1.6 Financing Schemes for ICT Innovation Panel[62]

Innovative enterprises seek to commercially exploit new ideas, technologies, and inventions by introducing new products or services, and\ or applying new or more efficient development processes. Accordingly, these enterprises function as engines of innovation and solid contributors to economic growth and job creation.

The financial needs of these innovative enterprises vary according to their upfront feasibility, and product's development costs. The length of their market development, entry process, and the available competition are also important factors which affects their business cases. Several critical milestones in this development process which needs sufficient financing, logistic, and technical assistance are crucial for their success. Crucial development process milestones as shown as follows:

1. Idea Generation and Market Research
2. R&D
3. Product Conception
4. Prototype Development and Testing
5. Production
6. Distribution
7. Marketing

The usual starting amount of financing and other logistical and technical support needed is often consumed by available resources coming from the founders' themselves, friends and\or family. Innovations emerging in developing countries have no channel to be exposed to international standardization activities due to the lack of necessary funds to be engaged in the standardization process. The usual concern of entrepreneurs and accordingly of state agencies promoting

[62] [Innovation-I-081] Financing Schemes for ICT Innovation Panel, by Dr. Ramy Ahmed Fathy, on novel financing schemes for the ICT innovation panel.

innovation and ideas generations are more focused towards securing enough investments for product generation, production, and marketing.

The proposed ICT Innovation Panel can act as a stimulus for generating standards emerging from developing countries and from SME in general. However, the problem of financing the Panel's operations; and integrating the goals of the ITU BSG programs with those of the innovation industry still remains to be a challenging process. The proposal presented here is to merge and complement the efforts conducted in the standardization and innovation communities by forming a mixed financing scheme of ITU main financial contributors, and specialized financial intermediaries, such as business angels and venture capitalists. Two probable financing schemes are proposed in the following section.

Two financing schemes that aim at bridging the standardization gap in accordance to Resolution 44 of the last WTSA-12 while stimulating innovations on the national levels; hence mitigating one of the root causes which hinder the development and sound formulations of innovative technologies, which furthermore hinders the development of new standards, especially emerging from developing countries.

8.1.6.1 Scheme 1: Combined Incubator for Standards and Prototype Development[63]

The ICT Innovation Panel, hereafter the Panel, as proposed by Egypt [Innovation-I-0061], were thought of becoming a vehicle inside the ITU-T which reviews, assesses, and produces political, economic, technical and social innovation stimulation policies and strategies to be employed by the members affiliated to the ITU.

For the Panel to act as a combined incubator for standards and prototype development, an innovative enterprise can apply directly to the Panel under pre-specified business\technology categories, through a well-documented transparent filing process where applications are assessed by means of a Review Committee. A Review Committee for every business\technology category is composed of member states and sector members interested to fund projects belonging to this business\technology category. A mixed financing scheme is proposed where the founders (innovative enterprise) together with the Review Committee members (Member States and Sector Members) to finance the product to the stage where a prototype and a business plan are developed. Members of the Review Committee have different roles besides financing. Sector members can help the innovative enterprise develop a business plan in exchange of an agreement for adopting the resulting product and introducing it to the market. Member states can ensure to harmonize and promote policies and regulations that will aid the introduction of the resulting product in their respective markets. In addition, they will be responsible for following up the resulting contributions in SG meetings.

The innovative enterprise is provided with a possible standardization roadmap where the members of the Review Committee are to adopt (through a mutual agreement) the introduction of the resulting technology\product for possible standardization in the ITU-T. The innovative enterprise is not required to be a member of the ITU.

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[63] [Innovation-I-081] Financing Schemes for ICT Innovation Panel, by Dr. Ramy Ahmed Fathy, on novel financing schemes for the ICT innovation panel.

However, an application fee is deemed to be exercised for every filed application to cover for the ITU administrative costs. Figure 5 demonstrates a schematic for the combined incubator for standards and prototype development option.

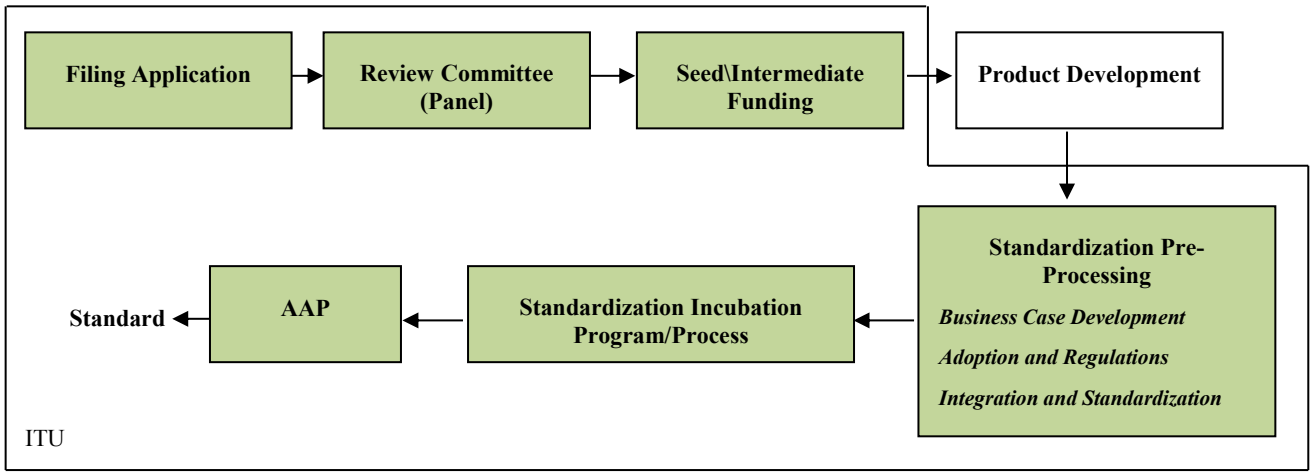

Figure 5 Combined Incubator for Standards and Prototype Development

8.1.6.2 Scheme 2: Trans-National Funding Repository Council[64]

Another proposed alternative approach is to develop the Trans-National Funding Repository (TFR) Council, where national intermediary financing schemes can be engaged together with the Panel management for coordinating efforts related to product and standards development. Different financing schemes/intermediary financing institutions can be integrated in the panel financing sources as follows:

1. Feasibility Grants\Merit Based Awarding Schemes
2. Micro-Credit Institutions
3. Business Angels\Seed Funding Networks
4. Corporate Venture Capital

The Trans-National Funding Repository (TFR) Council, is composed of a combination of the above mentioned national intermediary financing institutions where requests for funds are directed from the Panel to the Council with an assessment of the probability of standardization of the yet to be developed product\technology. A certain maturity level of the proposed product\technology is yet required.

In this case, the Panel acts as an incubator for standards only, where it assesses the potential impact of the proposed innovation economically, and socially, and helps the applicant in securing funds from the different intermediary financing institutions in an effort to secure the prototype development (financed mainly from the intermediary financing institutions) in exchange for a showcase of high probability of standardization.

The innovative enterprise is not required to be a member of the ITU to file an application. However, membership fees could be included in the initial financing request directed to the

[64] [Innovation-I-081] Financing Schemes for ICT Innovation Panel, by Dr. Ramy Ahmed Fathy, on novel financing schemes for the ICT innovation panel.

intermediary financing institutions for a limited time period. An application fee is deemed to be exercised for every filed application to cover for the administrative costs. An agreement between the Trans-National Funding Repository (TFR) Council and the ITU should be established specifying the roles, scope and procedure of each entity in the process. Figure 6 demonstrates a schematic for the Trans-National Funding Repository Council option.

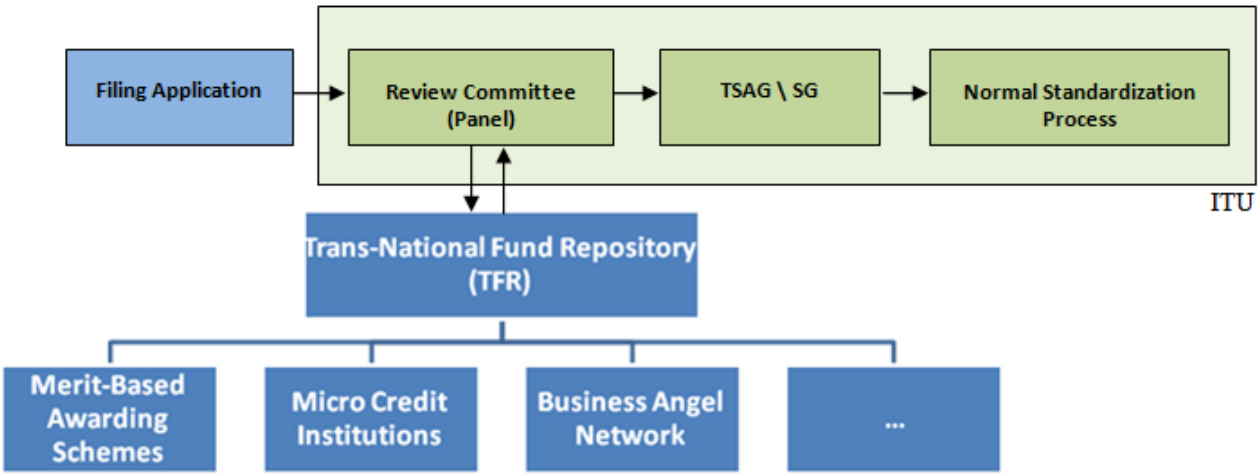

Figure 6 Trans-National Funding Repository Council Option

8.1.6.3 Conclusion

The proposed two schemes provide two possible alternatives for bridging the innovations to standards gap by satisfying the needs and goals of all the stakeholders in the innovation and standardization eco-systems. Innovation enterprises are focused on establishing start-ups and developing a sustainable business while intermediary funding institutes focus on long term business case viability and ROI. The panel in both proposals is foreseen to have an impact on bridging the innovation to standards gap, increase the technical competence of SME and innovation enterprises when it comes to standards making process, in addition to providing a self-sustainable financing model with minimal financing\budgetary implications on the ITU.