International Telecommunication Union

QUESTION 12-2/1

Final Report

ITU-D STUDY GROUP 1 4th STUDY PERIOD (2006-2010)

QUESTION 12-2/1:

Tariff policies, tariff models and methods of determining the costs of services on national telecommunication networks, including next-generation networks

THE STUDY GROUPS OF ITU-D

In accordance with Resolution 2 (Doha, 2006), WTDC-06 maintained two study groups and determined the Questions to be studied by them. The working procedures to be followed by the study groups are defined in Resolution 1 (Doha, 2006) adopted by WTDC-06. For the period 2006-2010, Study Group 1 was entrusted with the study of nine Questions in the field of telecommunication development strategies and policies. Study Group 2 was entrusted with the study of ten Questions in the field of development and management of telecommunication services and networks and ICT applications.

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ACKNOWLEDGMENTS

It would be remiss to conclude this period of work without mentioning everyone who has contributed, whether in small or large measure, to the dynamic and fruitful process of producing this report. Once again, the work could not have been completed without the active participation and support of those who have been involved throughout. They are deserving of our acknowledgement.

Our thanks are extended first of all to the Rapporteur's Group. The study could not have been concluded without the highly appreciated input from this extremely active group, which supplied comprehensive and detailed analyses reflected in the report. Special thanks go to the vice-chairmen, Mr Amah Vinyo Capo from the Regulatory Authority for the Posts and Telecommunication Sectors (ART&P), Togo; Mr Abdoulaye Dembélé from the Mali Telecommunication Company; Alex Ipou from the Côte d'Ivoire Telecommunication Agency (ATCI); and Philippe Mège from Thales Communication, France. We also thank Mr Michel Lemaître for his editorial expertise which was so precious in helping to finalize the report.

We also owe a debt of gratitude to the experts and participants in the workshop organized with the support of ITU-BDT on Tariff policies, tariff models and methodologies for the determination of costs of services provided with NGN, held in Geneva, Switzerland, on 8 September 2008, within the framework of Question 12-2/1. Many thanks also to ITU-T Study Group 3 (Tariff and accounting principles, including related telecommunication economic and policy issues) for its constant and productive collaboration and coordination of work, not forgetting also the chairmen of ITU-D Study Groups 1 and 2, Ms Audrey Baudrier-Loridan and Mr Nabil Kisrawi, for their wise recommendations and advice, and the rapporteurs for all the other Questions, for the highly relevant exchanges which facilitated the conduct of our work.

To all the countries which have contributed by sharing their experiences, many thanks for your regular participation and for following the work.

The Rapporteur's Group found in BDT the necessary forum for work and exchanges in order to progress its studies. It extends its sincere thanks to the Regulatory and Market Environment (RME) division, especially Ms Carmen Prado-Wagner, focal point, who has always shown great interest and participated actively in the studies on the Question, and Ms Alessandra Pileri, coordinator for the ITU-D study groups, for all the support and advice she has given us throughout the study period.

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PREFACE

This document addresses the tariff policies, tariff models and methods of determining the costs of services on national telecommunication networks, including next-generation networks (NGN), that are applied in developed countries and in developing countries. It is thus of interest to all administrations worldwide.

Whereas in most developing countries the telecommunication networks are already built and are meeting users' needs, this is the not the case in the developing countries where networks are still in the construction phase. Even before the investment put into constructing conventional networks has been amortized, we are having to migrate to NGN. This migration requires major investment, and ways and strategies will have to be identified in order to minimize investment costs and secure a return on existing networks. Furthermore, with NGN, new services are emerging which in the coming years will replace the conventional telephone service. It is these various issues that are addressed in this report, with a view to offering some ideas for solutions that may help administrations develop an appropriate strategy.

One of the interesting conclusions of the study is that, while national regulatory authorities (NRA) worldwide play a central role in the implementation of tariff policies for determining the costs of telecommunication services, the resources and authority available to NRAs to enforce policies and regulation are not an end in themselves, but rather one of the key means that an NRA should have at its disposal to achieve its primary objective, which is **to offer services at fair, affordable and cost-oriented prices**.

The report comprises three main sections. The first, on aspects to be studied, looks at cost models, financial and tariff implications of site sharing for terrestrial mobile services, and economic aspects of NGN investment projects. The second section sets out the results of the study on business strategy for transition to NGN. Finally, the third section offers guidelines for growth in data communication in developing countries.

The active participation of countries, in particular developing countries, through the submission of contributions has been of immense value. I wish to extend my sincere thanks to all the authors of contributions, which have been of considerable assistance for the work on Question 12-2/1 and for the preparation of this report.

Last but not least, I genuinely hope and trust that this report will be useful, both for everyone involved in establishing tariff policies and for those whose job it is to calculate costs and tariffs for telecommunication services.

Sami Al Basheer Al Morshid
Director of BDT

TABLE OF CONTENTS

Page

Page

QUESTION 12-2/1

1 Introduction

Formerly entitled "Tariff policies, tariff models and methods of determining the costs of national telecommunication services, including spectrum aspects" in the study period 2002-2006, Question 12/1 on national tariff policies entrusted to ITU-D Study Group 1 was revised for the new study period 2006-2010.

Further to the conclusions of the World Telecommunication Development Conference (Doha, 2006) (WTDC-06), the new title of the revised Question is as follows: 12-2/1 "Tariff policies, tariff models and methods of determining the costs of services on national telecommunication networks, including next-generation networks".

Work accomplished

During the 2002-2006 study period, the focus was on an inventory of tariff regulations and policies and on models or methods for calculating the costs of national telecommunication services. The aim was, first, to ascertain the evolution of tariff structures for different services in countries that had implemented a tariff rebalancing policy, and, secondly, to expand the database on tariff policies for telecommunication services.

The work undertaken by the rapporteur group during the study period 2002-2006 moved slowly, on account of the unavailability of the rapporteur, who was assigned to new duties, and the lack of contributions from administrations of Member States. Nevertheless, the rapporteur produced a document, setting out conclusions and recommendations for administrations in relation to pricing and competition (http://www.itu.int/md/D02-SG01-C-0128/). Study of the Question continued, with the appointment of a new rapporteur and vice-rapporteurs at the Study Group 1 meeting in September 2004. The World Telecommunication Development Conference (WTDC-06) confirmed the appointment of the new rapporteur and the vice-rapporteurs. The group, in line with the new terms of reference handed down by WTDC for the period 2006-2010 and on the basis of the results obtained during the previous period, continued to study the Question.

2 Aspects to be studied

Essentially, the terms of reference assigned to the rapporteur group for the period 2006-2010 were based on the outcomes of ITU-T Study Group 3 (Tariff and accounting principles, including related telecommunication economic and policy issues) namely to:

- continue work on cost models and tariff policies started during previous study periods;
- continue work on the issue of regulation of dominance raised during the 2002-2006 study period;
- study cost models and economic aspects in relation to investment and strategies for migration from conventional networks to NGN networks for the developing countries.

The results of the rapporteur group's work are set out in this final report containing recommendations and guidelines on economic and tariff policies in respect of national telecommunication services, and particularly migration to next-generation networks (NGN).

2.1 Working method

The main working method adopted by the rapporteur group with a view to obtaining a large body of contributions and information was a survey covering all the issues to be studied. This choice was consistent with the methodology adopted during the previous study periods.

At its June 2006 meeting, the rapporteur group decided to use as a basis the questionnaire on tariff policies[1] drawn up under Programme 4 (Economics and finance, including costs and tariffs), which is sent annually to all Member States, Sector Members and Associates.

It was decided to supplement the questionnaire by adding questions on the concept of dominance, on next-generation nteworks (NGN), and on the financial implications of site sharing for terrestrial mobile services. A new set of questions on the economic aspects of NGN investment projects was included to this end.

In addition, the rapporteur group agreed that case studies should be presented by countries on their experience with NGN in order to supplement the data yielded by the questionnaire. The terms of reference for the case studies were laid down and transmitted to this end. The results of contributions would thus be made available for use by other study groups, such as ITU-D Study Group 2 and ITU-T Study Group 3.

2.2 Coordination with other Sectors and study groups

For the purpose of coordination with other Sectors and ITU study groups, the rapporteur group sent liaison statements to ITU-T Study Group 3 and ITU-D Study Group 2 in order to obtain contributions on issues that may be related to Question 12-2/1. Furthermore, the rapporteur group invited the regional tariff groups (TAF, TAL and TAS) to participate in work on Question 12-2/1 and requested them to transmit, where possible, data on the tariff models for services. Only the chairman of the TAF group actually participated.

ITU-T Study Group 3, in reply to a liaison statement from the rapporteur group, reported that work was under way on the revision of a number of Recommendations relating to NGN and cost methodologies. Furthermore, the rapporteur was given the opportunity to participate in ITU-T Study Group 3's final meeting for the study period, from 31 March to 4 April 2008 in Geneva. The meeting followed the meeting of the Rapporteur Group on ITU-D Question 12/1 and the meeting of the experts group on future revision of the International Telecommunication Regulations. This gave an opportunity to ascertain the status of studies on certain issues in relation to which contributions were used by the rapporteur group to address the study items listed in § 2 of this report.

2.3 Current situation

The telecommunication world, at least at the commercial level, is going through a significant upheaval due to changes in networks and increasing competition in the developed countries.

Whereas in most developed countries the telecommunication networks are already built, this is not the case in the developing countries, where networks are still in the start-up phase. Even before the investment put into constructing conventional networks has been amortized, we are having to migrate to NGN.

This migration to NGN requires major investment, and ways and strategies have to be identified in order to minimize this investment and continue profiting from existing networks. Furthermore, with NGN, new services are emerging which in the coming years will replace the conventional voice service.

Competition in the developed countries and unbundling of the local loop have had a big impact on the supply of telecommunication services. Indeed, it is quite common to find service packages offering high-speed Internet access and several additional services (voice, video and others).

This indicates that voice is tending to become an additional service, which is of significant consequence for operators in developing countries, where "voice" still accounts for a large portion of their turnover and the conditions for rapid development of data communication are far from being in place (equipment rates, purchasing power, illiteracy, etc.).

Analysis of current situation – results of the questionnaire:

The questionnaire on tariff policies sent to administrations of ITU Member States and to ITU-D Sector Members under ITU-D Programme 4 yielded the following results during the period 2007-2009 in terms of response rate:

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1 The results of the survey on tariff policies are available on the website at: www.itu.int/ITU-D/icteye/.

Year	2007	2008	2009
Total number of replies received	98	57	63
– Administrations	59	40	63
– Operators	39	17	na

Analysis of the replies to the questionnaire was based on the replies received. It should be pointed out that the response rate is falling year on year.

It should be noted that as from 2009 a new questionnaire on tariff policies was drawn up and sent to administrations of Member States as well as ITU-D Sector Members (see Annex 2) in order to collect the 2008 data.

The replies received have been classified by:

- Region[2] (Africa, Americas, Arab States, Europe and CIS countries, Asia and Pacific)
- administrations (regulators)
- operators
- trend for each type of question.

For the 2007 questionnaire, for example, the replies received break down as follows by income level (GDP)[3].

Table 1: Number of countries responding to the questionnaire, by region and income level – 2008

Region	Income level			Total
	High	Middle	Low	
Africa	0	4	13	17
Americas	1	21	0	22
Arab States	7	6	1 + (1)	14 + (1)
Asia & Pacific	2	6	1	9
Europe and CIS	19	16	0	35
TOTAL	**29**	**53**	**15 + (1)**	**97 + (1)**

2 Classification of countries by BDT region.

3 The replies received to the 2009 questionnaire have not been broken down in this way.

Region	Answers			Total
	Only 1 operator	More than 1 operator	Authorities	
Africa	8	0	9	17
Americas	5	2	15	22
Arab States	5 + (1)	2	7	14 + (1)
Asia & Pacific	2	3	4	9
Europe and CIS	11	0	24	35
TOTAL	**31 + (1)**	**7**	**59**	**97 + (1)**

Source: ITU-BDT tariff policies survey, 2008

Number of countries responding to the questionnaire, by region and income level – 2009

Region	Income level			Total
	High	Middle	Low	
Africa	1	4	14	19
Americas	0	17	0	17
Arab States	3	4	0	7
Asia & Pacific	0	1	2	3
Europe and CIS	8	9	0	17
TOTAL	**12**	**35**	**16**	**63**

Source: ITU-BDT tariff policies survey, 2009

As regards the breakdown of countries replying to the questionnaire in 2008, it may be noted that:

– 29 are developed countries
– 53 are emerging or developing countries
– 16 are considered as low-income or least developed countries (LDC).

Study of the replies received points to the following:

For some questions, the same replies are given by both administrations and operators. For others, on the other hand, replies come either from administrations or from operators.

The analyses are based on data for 2007-2009.

2.4 Cost models and tariff policies

From the replies to the questionnaire on tariff policies sent to administrations of Member States and ITU-D Sector Members under ITU-D Programme 4, the following analysis may be made in relation to the question on use of cost models and the tariff policy applied in the different countries:

2.4.1 Cost model

The prices of domestic telecommunication services offered (local, long-distance and interconnection communications) are determined in many countries on the basis of the individual production costs for each service.

Operators which have elected to use a cost-based tariff model have generally selected a cost model developed by the company itself.

Most of the models developed by operators depend on cost accounting data.

The two types of costs on which most of the tariff models are based are historical costs (the majority) and long-run incremental cost.

In many cases, telecommunication service tariffs are calculated on the basis of fully distributed costs (FDC). Some operators, however, display a preference for incremental costs.

2.4.2 Tariff policy

2.4.2.1 Universal service policy

In many countries, universal service is implemented through a mandatory contribution by all operators to a universal service fund or through the obligation on operators to invest in financially unprofitable areas. Universal service costs are generally financed by receipts from a fund covering all costs.

2.4.2.2 Tariff rebalancing

In most countries, no time-period is given for absorbing the access deficit. In some countries, however, a period of between three and seven years has been set. Not all countries are following this strategy of tariff rebalancing.

Domestic tariffs are often approved by the regulatory authority.

2.5 Concept of dominance

In most countries, the concept of "dominance" is defined. The terms most commonly used to describe the concept are "dominant" and "powerful".

With regard to the types of wholesale or retail markets to which the concept of "dominance" applies, the combined replies from operators and regulatory authorities tend towards the interconnection market, followed to a lesser extent by the leased links and basic telephony markets. The Internet and mobile telephony markets come in last place.

It may further be noted that the criteria used in determining dominance are:

a. the operator's or service provider's capacity to act independently from their competitors, customers and consumers.

b. market share in terms of subscribers, turnover, traffic in relation to the market in question.

Furthermore, these criteria are usually combined with further criteria, including the control exercised by the operator over facilities allowing access to the end user, easy access to financial resources, and geographical criteria, etc.

Table: Criteria applied for the concept of "dominance" (examples of some countries):

Country	Criteria for "dominance"
Benin	Dominant operator on a market is one with a market share of at least 25% according to community standards
Brazil	Operators having significant influence in a relevant market
Bulgaria	On the basis of examination with respect to three EU criteria
Columbia	Decree 2870 (2007) defines dominant position as the ability of one or more participants in the market to determine market conditions, whether directly or indirectly
Côte d'Ivoire	Has at least 25% share of market of its sector of activities
Hungary and Romania	Is capable of acting independently from competitors, clients and consumers
Mali	Has at least 25% share of market (expressed in terms of monetary income)
Morocco	Dominance is a position whereby an operator can act independently from competitors, clients and consumers
Mongolia	Has at least 1/3rd of total market
Niger	Has at least 25% of market for a given segment
Czech Republic	Concept based on analyses of the relevant market
Senegal	Has at least 25% of telecom market, taking account of turnover, number of subscribers and traffic
Serbia	Has at least 20% of users of given service
Zambia	Has at least 50% of share of market
Zimbabwe	Has at least 25% of share of market

Source: ITU-BDT tariff policies survey, 2008-2009

When the geographical criterion is considered, operators' and regulatory authorities' replies differ in terms of the choice of geographical scope. For regulatory authorities, the national territory is the predominant reply, whereas operators all opt for a notion of geographical territory at the local level.

According to the combined replies from operators and regulatory authorities, several obligations are imposed on operators and service providers for each type of market. The most common obligations are cost-orientated wholesale and retail tariffs, interconnection obligations and tariff framework.

With regard to the frequency with which the dominance is reviewed, it is noteworthy that the replies from operators and regulatory authorities diverge. The regulatory authorities mention time-frames of one year or, to a lesser extent, two years, whereas operators opt for time-frames of more than three years. A large number of operators and administrations indicate another, but undefined, periodicity.

2.6 Financial and tariff implications of site sharing for terrestrial mobile networks

The question of infrastructure sharing is a major issue for ITU. In including it in the Questions for study in the 2006-2010 period, the ITU membership called for the issue to be addressed from the following standpoints:

- Should infrastructure sharing be regulated, imposed by public authorities or simply encouraged by incentives to make operators consider it as a business opportunity?
- What are the financial, tariff and environmental implications?

- What is the impact on the deployment of mobile networks and the provision of services?
- What financing and management mechanisms are necessary?

In order to pursue this reflection, the 8th Global Symposium for Regulators, held from 11 to 13 March 2008 in Pattaya (Thailand), was devoted to the theme of "Sharing infrastructure to catalyse deployment of broadband in the developing countries"[4].

At least six levels of sharing were identified at the meeting:

basic infrastructure sharing
functional and operational separation
sharing mobile networks and spectrum
sharing the optical fibre network
end-user sharing
liberalization and sharing of the international backbone.

The study under Question 12-2/1 has focused solely on the case of site sharing for terrestrial mobile networks.

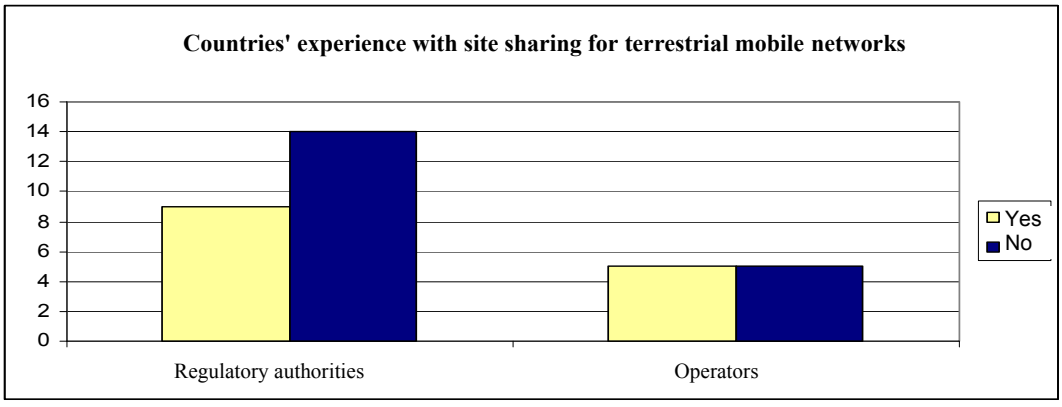
The proliferation of terrestrial mobile service operators in most countries of the world is leading to parallel deployment of their networks in the same environment. The problem of site sharing thus arises for at least two reasons:

- the limited number of high locations
- the parallel deployment of network infrastructures at different sites generates additional costs for operators and hence for end users.

2.6.1 Terrestrial mobile network operators' experience with site sharing

Site sharing by terrestrial mobile network operators is not yet a widespread practice in ITU Member States. Of the administrations which replied to the survey, only 14 of the 33 respondents reported any experience with site sharing, as shown in Chart 1 below.

Chart 1: Countries' experience with site sharing for terrestrial mobile networks (2008)



Source: ITU-BDT tariff policies survey, 2008

The experience of site sharing reported by operators and regulators falls into the following categories:

- co-location of terrestrial mobile network operators' equipment at the incumbent operator's sites;

4 See http://www.itu.int/ITU-D/treg/bestpractices.html

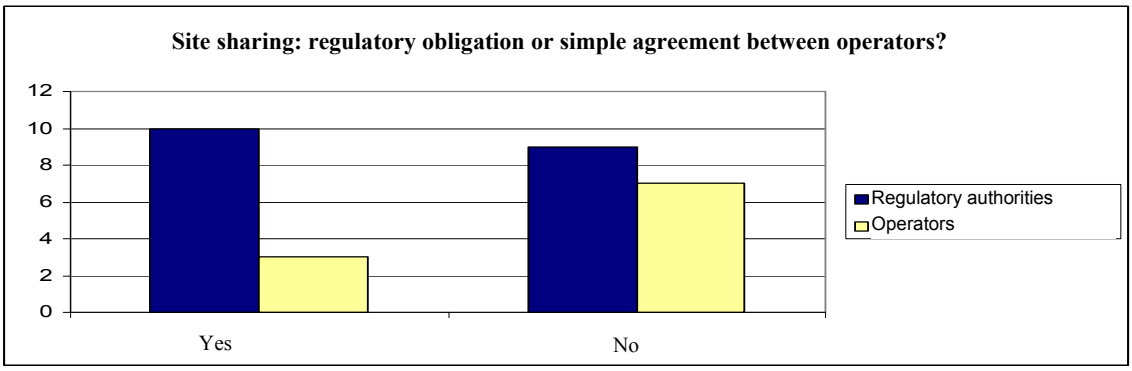
- rental of sites from existing operators by new entrants;
- site-sharing agreement between operators;
- obligation on the dominant operator to include in its interconnection reference offers a clause on sharing of high locations;
- co-financing of sites;
- site sharing for GSM base stations;
- obligation placed on all operators by the regulator to accede to requests to rent sites;
- commercial site-sharing agreement between operators;
- co-location and hosting of BTS.

Experience with site sharing thus takes several forms depending on the country involved. Without being exhaustive, the most common are:

- regulatory obligations on all operators to accede to requests to rent sites;
- obligation placed on the dominant operator to include in its reference interconnection offers a clause on sharing of high locations;
- co-location agreement;
- commercial site rental agreement;
- co-financing of sites.

Depending on the country's regulatory situation, site sharing between operators takes a given form. Analysis of the replies to the questionnaire (Chart 2) shows that, while site sharing between terrestrial mobile network operators is a regulatory requirement in some countries, other countries do not make it an obligation. In this case, site sharing is rather seen purely as a business opportunity between operators.

Chart 2: Site sharing: regulatory obligation or simple agreement between operators?

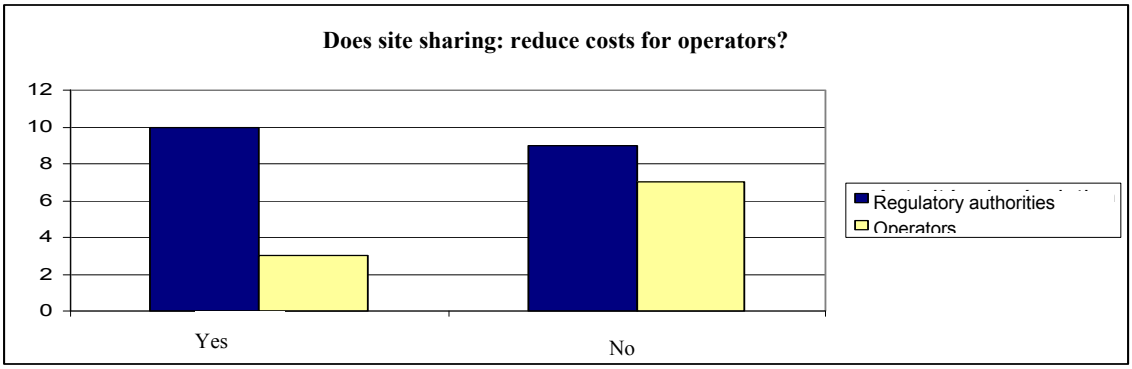


Source: ITU-BDT tariff policies survey, 2008

2.6.2 Whether site sharing is to be recommended, and whether or not to impose site sharing on operators

The crux of the matter is to analyse whether or not site sharing is a good thing, in order to determine whether or not to make it an obligation on operators with the aim of reducing costs. The replies received are not unanimous in regard to any probable cost saving from site sharing by operators. Chart 3 shows a breakdown of replies in this regard.

Chart 3: Does site sharing reduce costs for operators?



Source: ITU-BDT tariff policies survey, 2008

Of 11 regulators responding to the 2008 questionnaire on this specific item, five consider that site sharing reduces costs for operators, whereas of the five operators responding, only three hold that view. Although there is thus no unanimous view on the matter, it should be noted that half of regulators consider that site sharing would reduce the costs borne by operators. This means that it is worth considering the issue further and exploring it in greater depth, since – we should recall – the ultimate goal is to facilitate the deployment of mobile services at low cost and promote end-user access at affordable prices.

One may wonder whether all regulators are in fact pursuing the same objective with site sharing.

This question is worth asking, particularly since the results of the 2009 survey show that, of the 22 replies received from administrations, nine stated that any cost saving was indeed passed on to the end-user, whereas 13 indicated the contrary. Moreover, some administrations consider that the gain is not substantial enough to have any impact on the end-user tariff, shareable sites being few in number. Others consider, on the other hand, that the gain should only serve to increase operators' revenues. All these contradictory views suggest that the matter merits further study. It should be remembered that most operators do not have cost accounting, which makes it difficult to identify the specific cost of sites. This might explain the wide range of replies to this question.

2.6.3 Two types of sites to be shared

Irrespective of the difference in views on the issue, it is important to draw a distinction between two types of site that may be shared by operators:

- sites that can be easily redeployed in parallel;
- sites considered as essential resources such as high points or locations, including at altitude.

In our opinion, while sites that are easy to redeploy in parallel can be handled through incentives for operators to achieve productivity gains which may or may not be passed on to the end-users (issue still under discussion), it is desirable for sites constituting essential resources, particularly public ones, to be able to be covered by regulatory or legislative sharing obligations in order to speed up network deployment, stimulate competition nationwide and provide good-quality telecommunication/ICT services to all citizens at affordable prices.

2.7 Economic aspects of NGN investment projects

According to the 2007 publication by ITU "Trends in telecommunication reform: The road to next-generation networks (NGN)"[5]:

"NGN is equally important for users in developed and developing countries. NGN will impact the kinds of ICT services end users can access, how much they will pay for these services and whether they have real choice in selecting their service providers. The ultra-high-speed broadband associated with NGN opens the doors to an ever-growing number of people to generate their own content or to sell their goods, services and advertising to the global community. In short, NGN promises to open doors to economic development. Entirely new business models can and are being built on NGN. Access to NGN in developing countries, for example, promises to boost new service markets such as back office processing, enabling poorer countries to climb the ladder of development, while opening doors to service providers in all countries to sell content and advertising to new subscribers, as well as increasing sales by vendors of ICT hardware and software. NGN also poses challenges. Will the significant investments required in the migration to NGN and new business models centered on IPTV, advertising, gaming and other content pay off? Will the vaunted separation of the transport and service layers of NGN deliver robust competition and enable multiple service providers to offer their products on a common transport network? Or will tomorrow's markets actually suffer undue distortion of competition because operators control both the transport and service layers of NGN? Will business models associated with today's circuit-switched networks, such as those ADSL service providers that have built their businesses by accessing unbundled local loops, still be possible in the NGN world? Much of this depends on the regulatory framework developed for NGN."

The migration of existing networks to NGN raises numerous questions. This section of the present report analyses the following two aspects:

- Investment costs and financing models used by countries that have already migrated from conventional networks to NGN.
- Cost models used in setting tariffs for new services carried by NGN and tariffs for services offered.

The method used for gathering information comprised the BDT questionnaire and eliciting case studies.

It should be noted that GSR-08 set out guidelines for migration to NGN (see Annex 4 hereto).

2.7.1 Investment cost and financing models used by countries that have already migrated from conventional networks to NGN

With regard to the stage of introduction of an NGN system, we observe that, from the replies for 2008, 17 organizations declare being in the feasibility study phase; 25 in the NGN planning phase; 17 in the introduction phase; and, finally, 19 in the implementation phase.

Replies for 2009 indicate one organization in the feasibility study phase; 15 in the planning phase; 11 in the introduction phase; 15 in the implementation phase; and seven with no short-term plan yet.

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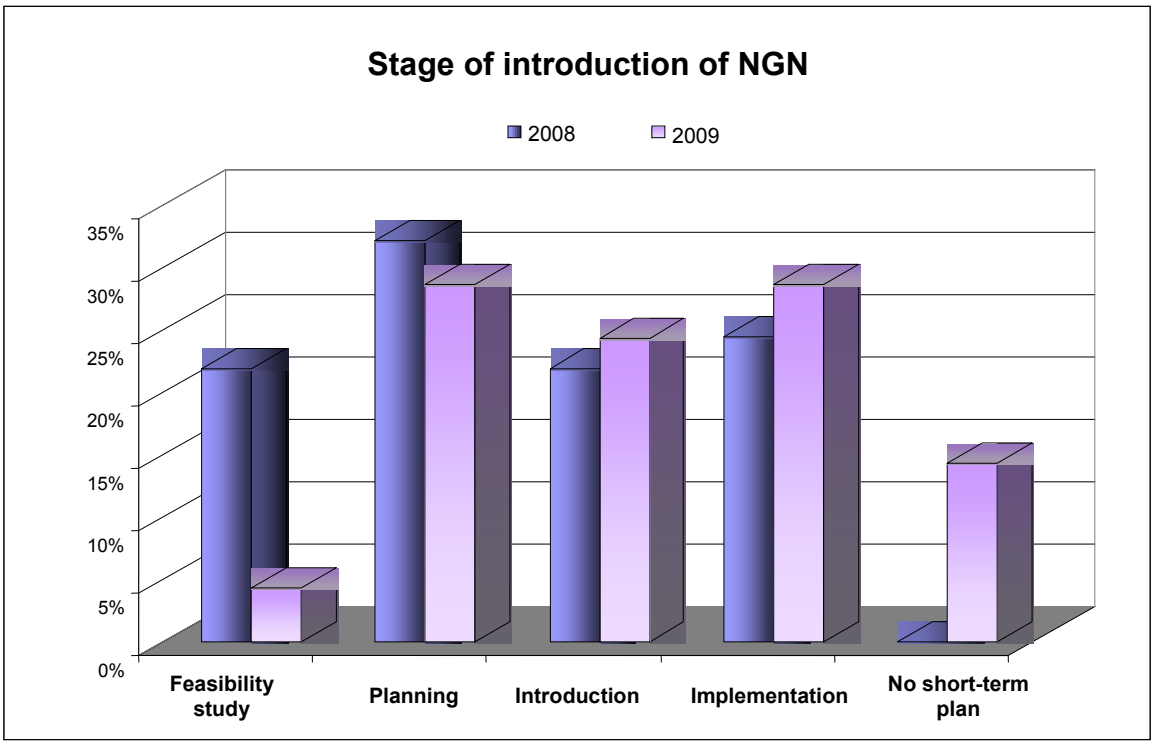
5 Trends in telecommunication reform: The road to next-generation networks (NGN), 8th edition, 2007, p. 203-4, http://ww.itu.int/ITU-D/treg/publications/index.html.

Chart 4: Stage of introduction of an NGN system - 2008 and 2009



Source: ITU-BDT tariff policies survey, 2008-2009

It was observed that countries with high income (in terms of GDP) are those in the implementation phase of the establishment of NGN networks, which is the situation prevailing in the advanced countries.

The challenges identified for the introduction of NGN generally relate to investment costs and problems related to the regulatory framework, including interconnection (see Question 6-2/1[6]). Most countries do not have any applicable legislation. There is often no appropriate regulatory framework offering investors at least a minimum degree of protection.

The question of return on investment also arises. For many countries, particularly developing countries, migration to NGN networks requires significant investment and the return on investment can be long. Moreover, demand for the new NGN-generated services is relatively low, and the market is in its infancy.

Nevertheless, most countries with a high standard of living have made significant progress in the implementation or introduction of NGN. On the one hand, demand puts pressure on the market and on competition and, on the other, for such countries, it is much easier to mobilize the substantial funding required to invest in NGN networks.

Migration to NGN: cost elements

Investment in NGN requires account to be taken of at least four cost elements:

1. core transport costs (core network):

   As the very concept of NGN is both network and application resource mutualization, the operator's core network has to migrate in order to allow all kinds of services to be carried.

   It should be noted that many operators, above all from developed countries, have already successfully migrated their core networks to NGN. Those countries are currently in the process of

6 See: www.itu.int/ITU-D/study groups/SGP 2006-2010/SG1Quest.html.

migrating their access networks, for which investment costs are higher. The boxes below describe a few cases.

2. costs of installing an adequate access network: FTTx, xDSL, Ethernet ...

   If they are to make converging services available to end users, operators must also invest in access technologies in order to attain the maximum number of subscribers.

3. costs of services (VoIP, IPTV, VoD, etc.)

   This involves investment in softswitches, multimedia services platforms, etc.

4. cost of adapting terminals: compatible terminals must be made available to users.

Example:

– conventional xDSL CPE to IMS-compatible xDSL CPE
– voice CDMA terminals EVDo CDMA terminals
– first or second-generation mobile terminals (GSM) to 3G and 4G mobile terminals ...

Financing costs will depend on the state of the existing network and the deployment objectives which operators have set themselves or the obligations imposed by regulators. In some countries, the investment cost may be estimated at hundreds of millions of Euros over a relatively short period.

The time-frame for making investments generally depends on the obligations imposed by the operator or on competitor pressure. Financing may be shared between several providers or borne by a single operator, depending on countries.

It is to be noted that the cost structure of investment depends on the impact of network infrastructure costs, which represent at least 60 per cent of total costs in newly covered areas, of which at least 70 per cent is for network access.

Box 1: Investment cost and financing model: case of Austria

Telekom Austria (Austria's incumbent operator):

– began its first NGN installations in the core subsystem in 2004,
– by the end of 2004, the company had already invested ***EUR 780 million, or USD 1 011.6 million, and has planned investing a similar amount over the period 2005-2009***,
– for several years already has offered national long-distance voice traffic, using ATM and IP telephony,
– plans to deploy an FTTC infrastructure in cooperation with various municipalities and public utility services,
– adopted the ***"wait and see"*** strategy for deployment of the NGN access network.

Wienstrom

– offers an optical fibre access wholesale service to other operators,
– already has 10 000 households connected by FTTH and plans to reach 50 000 households by the end of 2009,
– the plan is to cover a total of 960 000 households, with the investment cost estimated at around **EUR 10 million or USD 12.97 millions.**

Source: ITU/BDT Programme 4[7]

7 Developments of next generation networks (NGN): Country case studies, Vaiva Lazauskaite, RME / BDT, 2009.

Box 2: Investment cost and financing model: case of Belgium

Belgacom (Belgium's incumbent operator):

– plans to go fully IP in the period 2008-2012;
– with the transition to IP technology, plans to close around 10 per cent of its exchanges. The plan to upgrade its access network is called "*Broadway";*

The project aims to cover 80 per cent of households with FTTx/VDSL by 2011 by investing **EUR 647 million, or USD 838 9 million**.[8]

At the end of 2007, 40 per cent of the project had been completed for an investment of **EUR 382 million, or USD 495.4 million**.

– Belgacom's NGN deployment strategy is based on upgrading most of the core subsystem network and access network within a relatively short timeframe.
– These developments are motivated by competitor pressure from cable operators. Cable operators hold 34 per cent of the market in Belgium, the historical operator 44 per cent.

Source: ITU/BDT Programme 4[9]

Dimensioning and cost evolve according to three successive phases:

– accessibility related to geographical coverage (physical or radio),
– proliferation of access point/user equipment as the number of customers increases,
– traffic capacity related to growth of multiservice applications.

Major savings are nevertheless possible with resource and equipment sharing within the same operator through convergence of different network layers. Such savings can be estimated at 30 per cent of the total cost of investment per operator. Further savings are also possible, thanks to cost sharing between operators from mutualization: elements such as buildings, pylons, engineering, power, etc.). These savings are estimated as representing at least 20 per cent of the total investment cost[10]

The five dimensions of economies of scale are:

- system size → the bigger the systems, the cheaper the units
- technical capacities → new technologies offer greater capacities (transmission speed)
- traffic efficiency (occupancy) → increased utilization for a given quality of service when the number of servers is increased
- user density → exponential increase vis-à-vis coverage rates
- purchase volume → logarithmic reduction.

Box 3: Investment cost and financing model: case of South Africa

– The mobile operators Vodacom, MTN and Neotel SA, which is the second national operator, have decided to co-finance the construction of 5 000 km of optical fibre long-distance national network at a cost of around ZAR 2 billion, or USD 197 million.
– They reached agreement to share the costs of project implementation (trenching) and management. However, each of them is to implement its own optical fibre transmission equipment.
– **South Africa** is to host the 2010 football world cup. With this in mind, the intention is to capitalize on the progress the country has made with regard to 3G and digital migration and ensure that all mobile terminals in the country can receive television and that foreign operators from all countries can use the multimedia mobile services to send images and videos of the matches played at the South African stadiums.

Source: ITU/BDT Programme 4[11]

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8 Exchange rate as at 20 April 2009: EUR 1 ≈ USD 1.29.

9 Developments of next-generation networks (NGN): Country case studies, Vaiva Lazauskaite, RME / BDT, 2009.

10 "Next-generation networks (NGN) - NGN services and business planning" by Mr González Soto. ITU-BDT Regional Seminar on costs and tariffs, Midrand, 2005: www.itu/int/ITU-D/finance/work-cost-tariffs/events/tariff-seminars/south-africa-05/index-results.

11 Developments of next-generation networks (NGN): Country case studies, Vaiva Lazauskaite, RME / BDT, 2009.

Box 4: Investment cost and financing model: cases of several other countries[12]

Germany

In 2005, Deutsche Telecom announced the deployment of an FTTC + VDSL optical fibre network costing at least EUR 3 billion.

Netcologne, Cologne's local operator, plans to cover the entire city with an FTTH network in five years. The investment cost is EUR 250 million over three years.

Australia

The project consists in the deployment of an NGN core network, replacement of the CDMA mobile network by a 3G GSM network, and construction of an FTTN network. From 2005 to 2008, migration to NGN cost AUD 18 billion, or USD 13.2 billion.

Spain

Telefonica the incumbent operator, has announced an NGN deployment plan covering both the core subsystem and access network. The FTTH network should cost at least EUR 1 billion.

United States

AT&T and Verizon announced the deployment of an FTTH global network in 2004. Their annual investments have increased from USD 17.1 billion to USD 24.6 billion since 2004. Cable operators have also invested considerably in broadband network infrastructures. Investments by the three leading cable operators have increased from USD 5.6 billion to USD 10.1 billion since 2004.

France

Operators in France have already migrated their core subsystem network to NGN. They announced an FTTH network investment plan in 2006. The cost of investment for operators would fall between EUR 10.4 and 11.3 billion in order to provide 40 per cent of the French population with FTTH network coverage. France Telecom planned to invest EUR 270 million in 2008, followed by EUR 3-4.5 billion up to 2012. Free planned to invest EUR 160 million in 2008, followed by EUR 1 billion up to 2012. Neuf Cegetel planned to invest EUR 300 million in 2008.

Great Britain

Since 2004, BT has been implementing its "NGN:21 CN" project. The project aims to achieve full migration to NGN by the end of 2011. Its overall cost is evaluated at GBP 10 billion. The investment cost announced for deploying a complete FTTH network is GBP 15 billion.

Japan

Migration to NGN involves the construction of an FTTH optical fibre access fully IP network. The project is to cover 30 million households in 2010 at a cost of JPY 2 000 billion per year.

Sweden

Virtually all operators have changed their core subsystem to NGN. In terms of NGN access, of all non-Asiatic countries Sweden has the most extensive optical fibre network connecting households. The FTTx network covers two-thirds of households for a cost of over EUR 2 billion.

Switzerland

Announcement of plan for full migration to NGN by Swisscom in 2005. At the end of 2008, Swisscom announced an investment of CHF 8 billion (USD 8.3 billion) for deployment of an FTTH network.

Source: ITU/BDT Programme 4

12 Developments of next-generation networks (NGN): Country case studies, Vaiva Lazauskaite, RME / BDT, 2009.

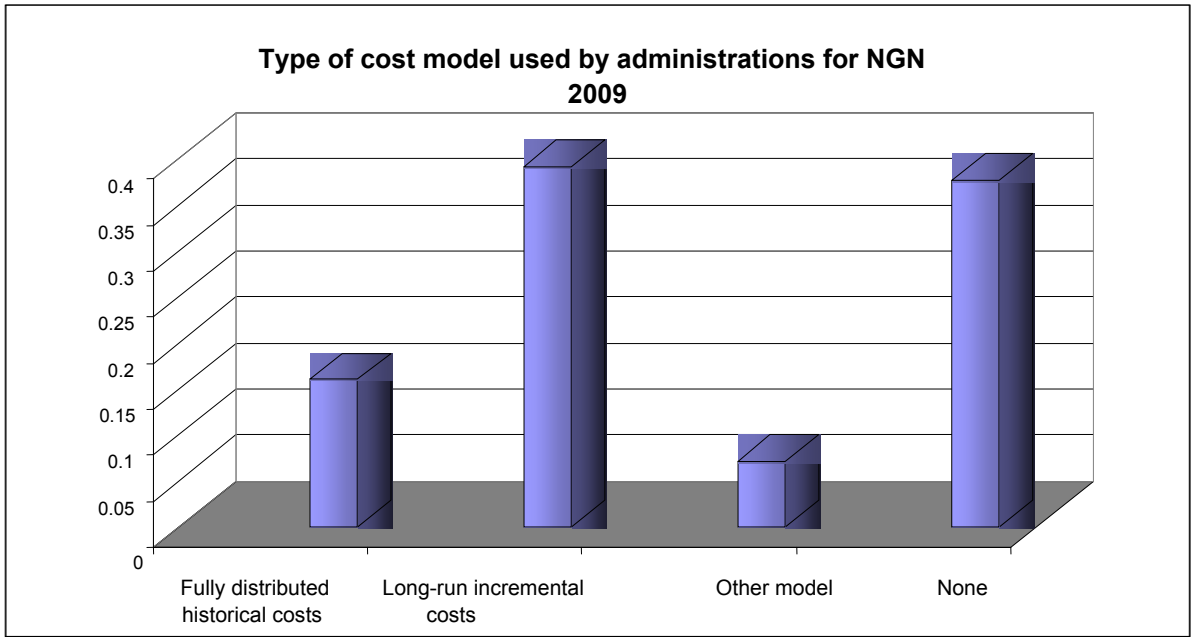
In the summary, the cost of investment depends to a large extent on the size of the country (surface area, population, density, etc.) and its level of economic development. The cost borne by an operator, however, depends also on the extent of cost sharing or mutualization agreed to by the operators, and on regulatory obligations. Any duplication of investment for example for the FTTH access network tends to increase investment costs.

Regulation should provide strong incentive for mutualization and co-financing for NGN investment and operation.

2.7.2 Cost models used in setting tariffs for new services carried by NGN and tariffs for services offered

It is important to note that NGN implies decoupling or separation of the transport layer of the network from the services and applications layer that lies on top of that transport. The independence of the service and transport layers has significant implications for competition and pricing. For example, by separating the transport and service layers, a provider can enable new services by defining them directly at the service layer without considering the transport layer.[13]

Chart 5: Type of cost model used by administrations for NGN – 2009



Source: ITU-BDT tariff policies survey, 2009

Over and above this particularity, which may imply changes to the cost models used for setting tariffs, there are also changes in the way new services are made available on NGN. Indeed, NGNs are vectors for new services, and a catalyst for multiservice convergence[14]. The following examples may be given:

Residential services

13 Developments of next-generation networks (NGN): Country case studies, Vaiva Lazauskaite, RME / BDT, 2009.

14 "Next-generation networks (NGN) - NGN services and business planning" by Mr González Soto. ITU-BDT Regional Seminar on costs and tariffs, Midrand, 2005: www.itu/int/ITU-D/finance/work-cost-tariffs/events/tariff-seminars/south-africa-05/index-results.

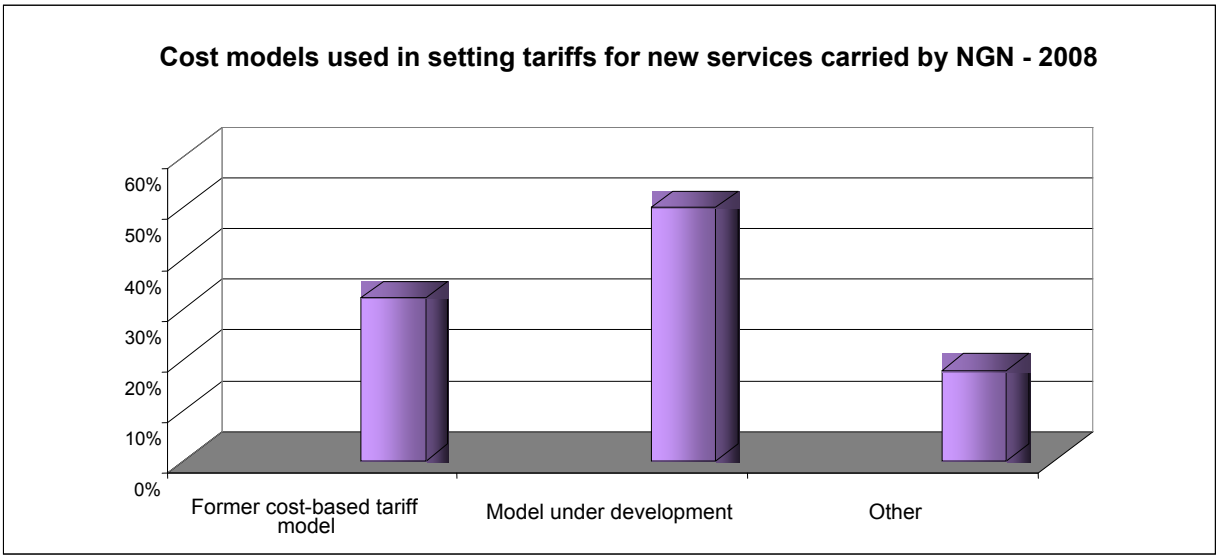
- **VoIP**: Access to conventional telephone services with different levels of quality of service using a data line (e.g. DSL or wireless) or computer-to-computer, user-to-computer, user-to-user.
- **Content provision**: Paid or free access to content with different levels of quality.
- **Video on demand (VoD)**: Access to films on demand using a DSL or wireless line (VoD, NVoD, iTV).

Business services

- **Virtual private network (VPN)**: A set of means of communication provided over a private network using a common telecommunication infrastructure shared by several businesses.
- **IP centrex**: Provides businesses with CTI/voice services identical to those provided over PABXs.
- **Multiparty shared conference** held in a room via computer, involving the use of several services (document exchange, instant messaging, ...). Possibility for users not equipped with IP to participate using the voice service. Same quality as for a conference held in a room with NetMeeting-type services and user-friendliness.
- **Unified messaging**: Consultation of any kind of message anywhere: e-mail, voice message, SMS, MMS, fax.
- **ASPs** (application service providers) provide a contractual service for deploying, hosting and managing access to an application located elsewhere than on the customer's site.

The results of the tariff policies questionnaire show (see Chart 6) that at least half of those administrations that replied regard the former, cost-based tariff models as having been supplanted by models under development more suited to the new services carried by NGN.

Chart 6: Cost models used in setting tariffs for new services carried by NGN: all replies from regulators and operators – 2008



Source: ITU-BDT tariff policies survey, 2008

The results of a mini forum organized during the rapporteur group's meeting in Geneva, Switzerland, on 31 March 2009 indicate that the tariff models have not yet been clearly determined, especially in the developing countries that have already embarked on NGN implementation.

The situation in several different countries is presented below.

Country	Plan for migration of networks to NGN	Tariff methods or models	Legal and regulatory framework applicable to offer of new services
Saudi Arabia	The operators are currently implementing NGN systems - commencing with the metropolis and the installation of access points - the backbones have already been built.	LRIC for national and international interconnection - the interconnection tariffs on the NGN networks have still to be determined. At present, the same tariffs are being maintained using benchmarking.	
Bangladesh	At planning stage.	The financial aspects are not yet available.	
Brazil	The NRA is endeavouring to ascertain what the operators are doing, and a coordination meeting has been organized with all operators. The case of one operator that has decided to effect migration, adapt to the new phase and propose new services will be presented as a case study.		The regulations are structured, and the licensing legislation is being checked. Regulation of services, not of technologies. No need to change the legislation with regard to convergence.
Cameroon	Awareness of an embryo of NGN deployment with the historical operator - gradual replacement as equipment comes to the end of its lifetime.		Actions conducive to the establishment of NGN networks, a new, service-oriented draft law is to be drawn up - including the issue of multiservice licences.
Côte d'Ivoire	No data yet on implementation on the part of operators.		Review of regulations: study of possibility of issuing WIMAX and 3G licences, with consultancy firm.
Gambia	An operator has already initiated the introduction of NGN networks.	No mechanism for calculating the costs of the services provided over NGN.	No policy prepared for transition to NGN.
Ghana	Following the granting of 3G licences to five (5) GSM operators, two (2) of them have commenced providing voice and data services on 3.5G platforms.	No defined cost calculation mechanism. A consultant is working with the regulator to develop a model.	The NRA is adopting a technology-neutral policy with respect to both conventional and NGN-based services. The provision of NGN services is covered in the current national telecommunication policy adopted in 2005 and the new law on electronic communications (Law 775 adopted in 2008).
Kenya	Operators use IP and 3G technologies for data and voice as well as WiMAX.	There is no cost calculation model for these services. LRIC is used for interconnection.	Draft law being studied.

Country	Plan for migration of networks to NGN	Tariff methods or models	Legal and regulatory framework applicable to offer of new services
Mali	Introduction of NGN networks in largest urban area.	No tariff tool at present.	A regulatory policy is under development for the introduction of 3G.
Nepal	There is no NGN network in Nepal at present - the only service provider follows the example of other experienced countries.		No defined NGN policy, but the regulatory authority is preparing itself with regard to tariff policies.
Paraguay	NGN is used for fixed telephony, IP, Internet ADSL, IPTV.	Tariff studies are based on benchmarking. The regulator proposes LRIC as the methodology for interconnection charges. The regulator is seeking a new, more transparent charging method. Consultants are working on it.	The regulator sets a price cap and the operators submit their tariffs. The NRA supervises/controls the data. Regarding interconnection, operators have to reach agreement while respecting the ceiling established by the regulator.
Tanzania		The tariffs are not covered by the existing regulations.	In 2005, the legislative framework did not take account of NGN. It is currently under revision to incorporate regulatory policies for NGN.
Zambia	No migration plan because: 1) there is no real regulatory framework; 2) the gateway licence costs are very high; 3) there is a tribunal problem with regard to the issue of licences for an operator, and this is depriving the other operators.	No cost model established yet - a consultant has been taken on to determine the costs and for revision of the legislation.	Legislation under review.

The experiences of countries that have implemented NGN point to the fact that cost models depend on several factors, including:

- volume of users by category,
- demand for bandwidth according to place of origin/destination,
- packet handling rates for control-related functions,
- range of applications/services and related platforms,
- storage and location of content on network,
- rental of physical or communication resources.

Thus, user tariffs no longer depend intrinsically on the actual use of the network components in terms of duration of use. Tariffs are increasingly based on the portions of the network reserved for the user in terms of bandwidth.

A combined fixed/traffic-dependent charging rate is applied, in the form of a lump sum for voice, DSL and Internet. The traffic-dependent part of the payment is based on a threshold for voice traffic, a threshold for downloads, and bandwidth on demand.

Other considerations

Regarding interconnection and access to the NGN network, charging principles must also evolve, as there is a school of thought that: "...IP traffic does not lend itself easily to per minute charging and it is technically complex to separate one kind of traffic (e.g. voice) from another (e.g. http traffic) where many different types of traffic may be carried simultaneously across the same interconnection link".

The question thus arises as to how service providers should bill interconnection. The problems are particularly complex when traffic is to be routed from a circuit-switched network to an IP environment or vice versa.

In this respect, it is interesting to consider the case of South Korea described below:

Box 5: Interconnection charging scheme for VoIP in South Korea

The computer-based IP telephony system ("dial-pad") launched in South Korea by Saerom in 2000 did not really enter into commercial service until May 2004, when guidelines on IP telephony were published. Since October 2004, IP telephony is considered as an ordinary telecommunication service from the regulatory standpoint and has been assigned the service identification number "070". In view of the increase in portability of numbers allocated to VoIP services, the number of subscribers is likely to grow spectacularly. Two different methods are applied for interconnection. For VoIP calls to a fixed network or a mobile network, the interconnection fee charged to VoIP service providers is the same as for calls set up from a circuit-switched network to a fixed or mobile network. There is no agreement on interconnection fees between VoIP service providers. For calls set up from fixed or mobile networks to VoIP service users, the fixed or mobile network operators also pay an interconnection fee to the IP telephony service provider. This fee covers use of the VoIP service provider's network equipment that affords access to the network.

Table 2: Interconnection charge for VoIP services in South Korea

Type of interconnection	Interconnection charge
Call from a VoIP system to a fixed network	VoIP service provider pays the same amount of interconnection fee to the fixed network operator
Call from a VoIP system to a mobile network	VoIP service provider pays the same amount of interconnection fee to the mobile network operator
Call between VoIP systems	No regulation
Call from a fixed network or a mobile network to a VoIP system	Fixed or mobile operator concerned pays an interconnection fee to the VoIP service provider, to cover use of the network equipment affording access to the network
The method governing interconnection charges for VoIP services currently applied in South Korea is not cast in stone. As IP telephony services are developing, the differentiated method may be challenged. In the long run, interconnection should be considered in the context of all-IP networks. The manner in which the transition will be made will also need to be addressed. In this process, the standard principles underlying the goals of telecommunication policy, namely user interests, fair competition, network expansion and technological development, must be taken into account.	

The question of charging for interconnection in an "all-IP" or NGN environment is thus not wholly settled.

It should be recalled, however, that the Rapporteur Group for Question 6-2/1 of ITU-D Study Group 1, which took these aspects of the subject into account in its work, proposed four main principles for interconnection charges in the NGN environment, as follows:

- The calling party's network pays principle, with charging based on the number of packets transferred rather than call duration.
- Bill and keep: no termination charge. The operator billing its clients keeps all income.
- The model of compensation based on quality of service.
- Bulk model: charging based on bulk.

3 Results of study on business strategy for transition to NGN

The 2007 publication by ITU "Trends in telecommunication reform - The road to next-generation networks (NGN)"[15]

"The information and communication technology (ICT) sector is on the cusp of a new era: the migration to next-generation networks (NGN). It heralds the shift from a "one network, one service" approach, to the delivery of many services over a single network, based on the Internet Protocol (IP). The move to NGN builds on the expansion of broadband networks worldwide and the rise of Voice over IP (VoIP) and fixed-mobile convergence. NGN represents a massive investment in infrastructure that promises significant benefits. These new networks can be developed using a number of technologies, including wireless and mobile, fibre and cable, or by upgrades to existing copper lines. Some operators are focusing on upgrading their *core*, or transport, networks to NGN; others are first tackling their access networks which reach the end user. Some market analysts predict that not all countries will move at the same pace, and not all operators within a given country will necessarily move to NGN. This means that legacy PSTN, second-generation mobile and Internet networks will co-exist with NGN for quite some time to come. Still, a number of traditional fixed-line operators have begun to deploy next-generation networks, mainly to offer the triple-play bundled package of IP television (IPTV), voice calls and higher-speed broadband Internet access. In addition, operators increasingly seek to collect advertising revenue from the range of user-generated, social-networking and other content running on their broadband networks. Indeed, the transitions under way are changing the very way we communicate and conduct business in the ICT sector. Developing countries seek to join the NGN band wagon. The bottom line for developing countries is not necessarily to adopt the same NGN experience as developed countries, but to harness the potential of new technologies to meet their ICT development goals."

In most developing countries, the issue of NGN migration presents itself in terms of necessity, time-frame and cost. If NGN migration is not yet a necessity for some developing country operators, it will become one in years to come as the technology will impose itself. Such operators will then be obliged to migrate, as it will not be easy to maintain non-NGN exchanges.

Moreover, in most developing countries economic activities are concentrated in the capital, making other localities within the country less profitable in regard to the significant investments required for the establishment and gestion of new telecommunication technologies/ICTs.

The purpose of this part of the study is neither to describe nor lay down the concepts of NGN, which are covered by the ITU study groups and working parties of ITU, and by other international bodies such as the European Telecommunications Standards Institute (ETSI).

This part of the study is devoted to aspects of migration as well as elements that can influence costs.

It thus addresses the motivations that lead operators to migrate, how migration strategies can be influenced by the competitor environment - which varies from one country to another - and, lastly, cost elements.

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15 Trends in telecommunication reform - The road to next-generation networks (NGN), 8th edition, 2007: www.itu.int/ITU-D/treg/publications/index.html.

It also focuses on operators in developing countries, and the dilemma they face.

3.1 Migration to multiservice networks (NGN): motivations

Why migrate to NGN?

Migration to NGN is motivated by at least one of the following:

- competitor pressure (national and international),
- new standards offering operators numerous opportunities in terms of services,
- technological advance, which has created new uses for telecommunication services,
- CAPEX/OPEX cost reductions,
- new services for which existing TDM equipment was not foreseen,
- significant gain in inter-PoP service links.

3.2 Migration to NGN: strategy[16]

The strategy adopted by the operator or provider of Internet services depends to a large degree on the nature of the operator's or provider's core business. A wire operator (fixed telephony) will adopt a strategy based both on the hierarchy of his network of telephone switches and the new, additional services.

Seen from this angle, the cost elements to be taken into account will vary according to the core business of the provider or operator and the basic services each offers.

Table: Competition, core business and operator's strategy

Competition							
Operator and strategy	**Fixed**	**3G**	**4-Play**	**ISP**	**Cable**	**3-Play**	**Satellite**
1 - Fixed (case of incumbent operators)	Price Quality Brand	Variety of services: VoIP Videocalls Multiple play MVNO	VoIP Video call, 3-Play	VoIP 3-Play	IPTV, Bundled with mobile	Low prices Migration to 3-Play	TV, rural and isolated areas
2 - 3G (mobile operators)	Any service on mobile Migration to 3G, HSDPA	Price Quality Brand	Low prices Passband	GPRS, UMTS	Mobility Mobile TV	Multiservice over GPRS, 3G, HSDPA	TV
3 - Quadruple play	Convergence Fixed + Mobile	Convergence Fixed + Mobile	Price Quality Brand	Fixed/Mobile integration Divert calls to VoIP fixed via Wifi	Fixed/Mobile integration	Differentiated with mobile: 4 play	TV channels
4 - ISP	VoIP call less expensive	VoIP call less expensive	VoIP call less expensive	Price Quality Brand	VoIP call less expensive	VoIP call less expensive	TV channels

16 cf. "Migration vers NGN: enjeux et éléments de coût" [NGN migration: challenges and cost elements], June 2009 by Azimaré DJOBO, Associate Consultant AZIMCONSULTING™, Azimare.djobo@azimconsulting.com.

5 - Cable	Include voice and broadband	Bundling all services	HDTV, Bundling all services	TV channel	Content Price Brand	TV quality, number of channels	Content
6 - Triple play	Multiple service Simplified billing Variety of content	Simplified billing Variety of content	Multiple service Simplified billing Variety of content	Content Multiservice VOD	Focus on prices, support	Content, number of channels simultaneously Brand	Multiple play and sVOD

Regarding the table, only cases 1, 2 and 4 are currently applicable to most operators in the developing countries.

3.3 Aspects of migration

In general terms, migration to NGN involves the following stages:

- Migration of core network: transformation of transport infrastructure to carry the different services (targeted by the convergence)
- Migration of access networks: deployment of multiple play access networks
- Deployment of multiservice platforms: migration of voice services for fixed operator, addition of new services
- Organizational impacts, which also generate costs.

A few examples:

In France, Free and Neuf Cegetel do not have the same approach for migration to full convergence as Bouygues or SFR, which are basically mobile operators.

In Belgium, Belgacom, which is historically a fixed operator, and which is gradually investing in broadband, to be followed subsequently by full convergence, has adopted an approach which is not the same as a cable operator's. Belgacom's approach may thus be described as follows:

- Initially, investment to boost broadband [access+core]
- Subsequently, bundling of voice service with broadband: both commercial and technical bundling (both services supported by the same access, but accessible by different terminals) → gradual migration of voice services
- Subsequently, addition of new services such as IPTV
- Accessibility of different services regardless of terminals.

3.4 Dilemma of operators in developing countries

Operators are not only confronted by pressure from their customer base, but also by national and international competition for converging services. They also have to meet obligations related to the extension or geographical presence of their networks.

Indeed, operators have to manage:

- Pressure from the customer base to offer converging services
- Universal service obligations: extension of geographical coverage of existing telephone and data networks

Should they first invest in converging networks in the main towns, or first ensure the maximum availability of existing services in the country?

The strategy for operational migration would consist, for example, in proceeding with gradual migration, replacing equipment at the end of its lifetime with NGN solutions. However, migration of the transport layer, as the first phase, remains fundamental in moving towards "full-IP".

Whereas networks for the transmission of voice services have remained separate from IP backbones (initially devoted to Internet access), migration to NGN calls for the mutualization of all telephone services and Internet over IP. Moreover, most next-generation telephone service equipment is "full-IP", whether it be mobile or fixed telephony.

3.5 Constraints regarding migration to NGN

Evolution to NGN imposes enormous requirements in terms of quality and security which may have existed in networks in the past but are amplified as a result of the technological leap they imply for certain operators.

These are some of the constraints to be taken into account as from the stage at which the migration strategies are defined:

- Call routing must be optimized using advanced engineering → resources
- Account must be taken of security issues
- Quality of user services: this is very important in the design and implementation of architecture. Tools for the mass deployment of services and terminals with virtually no intervention on the customer's premises or by the customer. Whereas with TDM a telephone required virtually no configuring, deployment of a VoIP terminal or an IPTV/VoD STB requires programming and configuring, and subsequently remote diagnostic
- Interconnection service level agreements (SLA) with operators: bottlenecks with an impact on the quality of links if not taken into account very early on. With TDM, for example, an interconnection between voice operators may previously have involved no mention of codecs. Now, it is essential to take account of different codecs, protocols, etc.
- Adaptation of customer billing model
- Impact on human resources: training and reassignment of resources following reduction of the network's physical nodes.

3.6 Factors, principles and choices regarding migration to NGN

The optimum degree of migration depends on each country and the following criteria:

- Demand
- The state of the existing network, notably the amortization time-frames and degree of obsolesence of equipment
- Funding and investment capacities and extent of mutualization
- Regulatory framework.

The case studies outlined in the boxes above have shown that the business strategy for migration is based on the investments to be made with regard to the core network, access network and service platforms, and organizational aspects.

Operators draw up their migration plan based on the need to adapt to market requirements, competitor pressure and regulatory constraints.

The situation may nevertheless not be the same in all developing countries if the operators themselves fail to act preemptively by establishing a migration plan. There is indeed the risk that migration in such countries is forced upon them as a result of technological obsolesence. Under such conditions, operators may well not have sufficient time to assess carefully the profitability of investments in NGN.

Box 6 below gives an example of migration in a developing country. A three-phase migration based on investments for the core subsystem network, the access network and gradual redeployment of the old exchanges from the highly profitable urban areas to the poorer, rural areas. In all events, the basic motivation for migration will remain either of demand or technological obsolesence.

Box 6: Migration to NGN: An example for the developing countries[17]

Migration of the telecommunication networks of developing countries may take place in several phases (3-4 maximum) depending on current investments in the networks, the situation regarding technology, and the financial profitability of the investments, with full migration being spread over several years, as it will depend on the financial capacities of the operators. It could be as much as ten years for some operators.

Given the generally high costs of migration from existing networks to NGN, the operator is concerned with the profitability of investments, with priority on economically viable areas.

Phase I: Migration in the capital and main towns

This stage will see the full NGN migration of the existing network in the capital and main towns. The basic aim will be to provide broadband services to a customer base that has sufficient financial means.

It is proposed during this phase that those exchanges in the capital and main towns that are not at the end of their lifetime should be redeployed to the rural areas based on their economic importance.

Phase II: Migration in the most economic rural areas

This phase will begin at the end of the third or fourth year. It will involve those rural areas that are economically viable. Those exchanges that are not at the end of their lifetime will be redeployed to the most remote rural areas.

This phase should see the deployment of the access network, with stress on high-speed wireless as being less costly to deploy than wire.

Phase III: Migration in other localities

This will take place based on customer requirements. It will begin in the fifth year, and may be spread over ten years.

In terms of strategy, the following principles are to be noted.

- **Continuity of economic activity** required to maintain dominant services and hold on to customersthat require an "operator" quality of service
- **Flexibility** in order to integrate existing new services and react rapidly to new developments in real time (main advantage of IP mode)
- **Plan architecture and capacity** for end-to-end quality of service and interoperability of domains
- **Security of services and maintenance of networks** over all periods.

The strategy to be adopted for the migration must represent a **gradual approach**, based on segment by segment economic appraisal of the infrastructure. The global strategy adopted must take account of **network ageing, growth in demand and degree of competition.**

Ultimately, several scenarios must be envisaged and their consequences analysed, notably: architecture, start-up, number of phases, chronology, investment rate, charging, rate of return or net present value, etc.

4 Guidelines for growth in data communication in developing countries[18]

The development of NGN networks presupposes a growth in data traffic and content services/applications. Rapid migration from existing networks to NGN in the developing countries depends to a large extent on demand, and is closely linked to data communication growth and operators' financing capacity. Factors conducive to data communication growth include:

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17 Contribution by Togo Telecom.

18 "Migration vers NGN: enjeux et éléments de coût" [NGN migration: challenges and cost elements], June 2009, by Azimaré DJOBO, Associate Consultant AZIMCONSULTING™, Azimare.djobo@azimconsulting.com.

- The production of content locally in each country.
- The introduction of Internet exchange points (IXPs), which can allow the developing countries to significantly and less expensively increase data exchange at the national and regional[19] levels. Indeed, IXPs allow the direct interconnection of national networks, using exchange points rather than one or more third-party networks. The IXPs reduce the share of the Internet access providers, traffic that has to be delivered by their upstream traffic providers, thus lowering the average cost per bit transmitted of their service. In addition, the IXP's use of a significant number of routes enhances routing efficiency and fault tolerance. Thus, the IXP makes it possible to relieve congestion in international traffic while at the same time offering operators (and thereby the public) lower communication costs. The new generations of IXP offer the possibility of routing VoIP traffic. Indeed, IP communications offer major cost benefits and a broad range of enhanced services, including videoconferencing, integrated presence, fixed/mobile convergence, mobility and new multimedia functions that are not possible with PSTN[20].

In addition to the development of IXPs as evoked above, account must also be taken of:

- Integration/adoption of new uses in the economy:
  - E-banking
  - Mobile marketing, equally applicable as part of conventional business marketing, or reflecting the communication habits of the peoples: mass messages, announcement over mobile, collective thank-you over mobile following a family event, etc.
- Development of services adapted to the informal economy, which is extremely widespread in most developing countries. Example: platform for the interactive consultation of the prices of foodstuffs, platform for event services ...
- Customer billing model: Adapt the existing pricing model to:
  - allow the circulation/recycling of terminals
  - encourage voice/data package offers and other combinations.
- Content provider service platforms: In the developing countries, network operators (ISPs, telcos) must regard this as an entirely separate profession. It must be outsourced or created in association with other parties within that domain, in particular companies specializing in the provision of multimedia content.
- Technological choices: It is clear today that, leaving aside national network backbones, the widespread availability of data networks in the developing countries will only be possible if the most appropriate technologies are retained. Statistics show that the penetration rate and territorial coverage of mobile networks are higher than those of networks using wire technologies, making it necessary to establish a national strategy for the construction of backbone and massive deployment of access networks using x.G., CDMA-EVDO, WiMAX, etc.
- Developing fixed/mobile complementarity:
  - service roaming
  - access to fixed operators' service platforms by mobile customers
  - access to content by nomad customers belonging to the fixed operator: WiFi, WiMAX, CDMA.
- Regulatory aspects: The concept of universal service should be made to evolve, with the data access service (Internet) considered as a universal service.

5 Conclusion

This report provides a link between economic and tariff policies based on conventional networks, and those set to lead to the effective establishment of next generation networks in different countries. Indeed, the

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19 I.e. with border countries.

20 Contribution by the Regulatory Council, ARTP, Senegal, to the meeting of the Rapporteur Group on Question 12-2/1 on 31 March 2009.

subjects dealt with relate largely to the costs of investment in NGN projects and strategies for NGN migration. Some aspects have been well developed so as to provide answers to the concerns of operators and regulators in the developing countries. Other aspects of the Question should be further looked into and developed.

It is also important to tackle subjects that will help to formulate guidelines defining an effective economic and tariff policy adapted to the new NGN environment. The following questions would merit study:

- The impact or benefits of NGN migration for all involved, including consumers
- The cost structure of NGN services compared with that of services provided over conventional networks
- The new pricing methods for services provided over NGN networks and case studies
- Tariff regulation for telecommunication/ICT services provided over NGN networks
- Further studies on the economic investment plan models for transition to NGN as applied in countries that have already undertaken NGN migration, to provide guidance to the developing countries
- Further study of the financial and tariff implications of site sharing for terrestrial mobile services, and extension of the scope of this study to all telecommunication infrastructures.

The question of site sharing and the mutualization of investments and infrastructure in general should also be tackled, but within a more global framework of next-generation networks.

ANNEXES

Annex 1 – List of abbreviations and acronyms

Annex 2 – Questionnaire on tariff policies

Annex 3 – Statistics of replies to the questionnaire on tariff policies (available on the website at: www.itu.int/ITU-D/finance/work-cost-tariffs/sg1/Results_tariff_policies/index.html)

Annex 4 – Best practice guidelines on innovative infrastructure sharing strategies – Global Symposium for Regulators, 2008 (GSR-08)

Annex 1: Glossary and abbreviations

3G:	*Third-generation mobile network or service.* Generic term for the next generation of broadband digital mobile cellular systems, which has expanded broadband capabilities for mobile data applications.
4G:	*Fourth-generation mobile network or service.* Mobile broadband standard offering both mobility and very high bandwidth.
ADSL:	*Asymmetric digital subscriber line.* A technology that enables high-speed data services to be delivered over twisted pair copper cable, typically with a download speed in excess of 265 kbit/s, but with a lower upload speed (see ITU-T Recommendation G.992.1).
Analogue network:	A telecommunication network in which information is conveyed as a continuously varying electronic signal (see also *Digital network*).
Analogue:	Transmission of voice and images using electrical signals. Analogue mobile cellular systems include AMPS, NMT and TACS.
ARPU:	*Average revenue per user*. Usually expressed per month, but also per year.
ATM:	*Asynchronous transfer mode.* A transmission mode in which the information is organized into cells; it is asynchronous in the sense that the recurrence of cells from an individual user is not necessarily periodic.
BDT:	*Telecommunication Development Bureau.*
Bill and keep:	Unlike in the CPNP system, this is an interconnection arrangement whereby operators exchange traffic on the basis of negotiated conditions and do not generally pay any termination charges. Each operator bills its own customers for routing the traffic and keeps the resulting income. This arrangement is also known under the name "*sender keeps all*".
BTS:	*Base transceiver station.*
CAGR:	*Compound annual growth rate.*
CDMA:	*Code-division multiple access.* A technology for digital transmission of radio signals based on spread-spectrum techniques where each voice or data call uses the whole radio band and is assigned a unique code.
CDMA-EvDO:	*Code-division multiple access - evolution data only.*
Competition:	Refers to the introduction of competition between national and/or foreign service providers, without restriction. For the cellular mobile service, the number of licence holders depends on the available spectrum. Therefore, for the purposes of this report, all countries authorizing more than one operator are considered as being open to competition.
CPE:	*Customer premises equipment.*
CPNP:	*Calling party's network pays.* In a CPNP arrangement, the called party's operator bills the calling party's operator a given pre-determined rate per minute for terminating the call, while the called party's operator pays nothing.
CPP:	*Calling party pays.* Billing option under which the call is paid for by the caller. Conversely, in a "called party pays" system, it is the called party who bears all the charges.
CTI:	*Computer telephony integration.*

Ethernet:	A local packet-switched network protocol.
ETSI:	*European Telecommunications Standards Institute.*
EU:	*European Union.*
FDC:	*Fully distributed costs.*
FTTH:	*Fibre-to-the-home.* A high-speed fibre-optic Internet connection that terminates at a residence. See FTTx.
FTTx:	*Fibre-to-the-x*, where *x* is a home (FTTH), building (FTTb), curb, cabinet (FTTC), or neighbourhood (FTTN). These terms are used to describe the reach of an optical fibre network.
GDP:	*Gross domestic product*. The market value of all final goods and services produced within a nation in a given time period.
GMPCS:	*Global mobile personal communications by satellite.* Non-geostationary satellite systems that are intended to provide global communication coverage to small handheld devices.
GPRS:	*General packet radio service.* This is a mobile data service available to users of GSM mobile phones. It is often described as "2.5G", that is, a technology between the second (2G) and third (3G) generations of mobile telephony. It provides moderate-speed data transfer, by using unused TDMA channels in the GSM network.
GSM:	*Global system for mobile communications*. Digital mobile standard developed in Europe, and currently the most widespread 2G digital mobile cellular standard. GSM is available in over 170 countries worldwide. For more information, see the website of the GSM Association at: www.gsmworld.com/index.html
HDTV:	*High-definition television.* A new format for television that offers far superior quality to current NTSC, PAL or SECAM systems. The resolution of the picture is roughly double previous television signals and the pictures are displayed with a screen ratio of 16:9 as compared with most of today's TV screens, which have a screen ratio of 4:3.
HSDPA:	*High-speed downlink packet access*. This is a mobile telephony protocol, also called 3.5G (or "3½G"). High-speed downlink packet access is a packet-based data service with data transmission up to 8-10 Mbit/s (and 20 Mbit/s for MIMO systems) over a 5 MHz bandwidth in W-CDMA downlink. HSDPA implementation includes adaptive modulation and coding (AMC), multiple-input multiple-output (MIMO), hybrid automatic repeat request (HARQ), fast scheduling, fast cell search, and advanced receiver design.
ICT:	*Information and communication technologies.* A broad subject concerned with technology and other aspects of managing and processing information, especially in large organizations.
IMS:	*IP multimedia subsystem.* A standardized next-generation networking (NGN) architecture for telecom operators that want to provide mobile and fixed multimedia services. It uses a Voice-over-IP (VoIP) implementation based on a 3GPP standardized implementation of SIP, and runs over the standard Internet protocol (IP). Existing phone systems (both packet-switched and circuit-switched) are supported.
Incumbent:	The major network provider in a particular country, often a former State-owned monopoly.
Interconnection charge:	The charge – typically a per-minute fee – that network operators levy on one another to provide interconnection.

Interconnection:	The physical connection of separate ICT networks to allow users of those networks to communicate with each other. Interconnection ensures interoperability of services and increases end users' choice of network operators and service providers.
Internet:	Interconnected global networks that use the Internet protocol (see IP).
IP telephony:	*Internet protocol telephony.* IP telephony is used as a generic term for the conveyance of voice, fax and related services, partially or wholly over packet-based, IP-based networks. See also *VoIP*.
IP:	*Internet protocol.* The dominant network layer protocol used with the TCP/IP protocol suite.
IPTV:	*Internet protocol television.* A system where a digital television service is delivered by using Internet protocol over network infrastructure, which may include delivery by a broadband connection.
ISP:	*Internet access provider.*
IT:	*Information technology.*
ITU:	*International Telecommunication Union.* The United Nations specialized agency for telecommunications. See: www.itu.int/.
ITV:	*International television.*
IXP:	*Internet exchange point.* A central location where multiple Internet service providers can interconnect their networks and exchange IP traffic.
LAN:	*Local area network.* A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a wide-area network (WAN). See also *WLAN*.
LDCs:	*Least developed countries*. These are the 50 least developed countries recognized by the United Nations.
Line sharing:	A form of network unbundling that allows a competitive service provider to offer ADSL using the high-frequency portion of a local loop at the same time that an incumbent continues to offer standard switched voice service over the low-frequency portion of the same loop.
LLU:	*Local loop unbundling.* The process of requiring incumbent operators to open the last mile of their legacy networks to competitors. Similar reference to ULL (unbundled local loop).
LRAIC:	*Long-run average incremental costs.* Costing model based on an analysis of long-run incremental costs, whereby the total costs incurred by the two interconnected operators supporting the traffic are divided by total demand; this formula then replaces the assignment of specific costs to each operator.
LRIC:	*Long-run incremental costs*. Additional costs of providing a service over the long term.
Mobile:	As used in this report, the term refers to mobile cellular systems and to mobile phones.
MVNO:	*Mobile virtual network operator.* A company that does not own a licensed frequency spectrum, but resells wireless services under their own brand name, using the network of another mobile phone operator.

NGN:	*Next-generation network.* A broad term for a certain kind of emerging computer network architectures and technologies. It generally describes networks that natively encompass data and voice (PSTN) communications, as well as (optionally) additional media such as video.
NRA:	*National regulatory authority.* The regulatory agency or official service at the central or federal government level that is charged with implementing and enforcing telecommunication rules and regulations.
NVoD:	*Near-video on demand.*
OECD:	*Organisation for Economic Co-operation and Development.*
OPEX:	*Operational expenses.*
Packet:	Block or grouping of data that is treated as a single unit within a communication network.
PCS:	*Personal communication services.* In the United States, this refers to digital mobile networks using the 1 900 MHz frequency. In other countries, it refers to digital mobile networks using the 1 800 MHz frequency. The term personal communications network (PCN) is also used.
PSTN:	*Public switched telephone network.* The public telephone network that delivers fixed telephone service.
SLA:	*Service-level agreement.*
SMP:	*Significant market power.* In this report, also considered as "dominance".
SMS:	*Short message service.* Service available on most digital mobile telephones enabling the sending of short messages (also called text messages, messages or, colloquially, SMS or texts) between mobile telephones, other portable devices and even wired telephones (although it appears that in the United States the SMS service is not available on wired telephones). Text messaging can also be used to order ringtones and wallpapers, or to take part in competitions.
Softswitch:	A type of telephone switch that uses software running on a computer system to carry out the work that used to be carried out by hardware.
STB:	*Set-top box.* A device connected to a television that receives and decodes digital television broadcasts and interfaces with the Internet through the user's television (IP or hybrid).
TCP/IP:	*Transmission control protocol/Internet protocol.* The suite of protocols that defines the Internet and enables information to be transmitted from one network to another.
TCP:	*Transmission control protocol.* A transport layer protocol that offers connection-oriented, reliable stream services between two hosts. This is the primary transport protocol used by TCP/IP applications.
TDM:	*Time-division multiplexing.*
Teledensity:	Number of fixed telephone lines per 100 inhabitants.
Triple play:	A term referring to the bundling of fixed and/or mobile voice, video and broadband Internet access services.
ULL:	*Unbundled local loop.* See LLU.
VAN:	*Value-added network.*
VDSL:	*Very high-speed digital subscriber line.*

VoD:	*Video on Demand* (ITU-T Recommendation J.127 (04), 3.3). Programme transmission method whereby the programme starts playing after a certain amount of data has been buffered while receiving subsequent data in the background, where the programme is completely created by the content provider. Using this system, users are able to select and watch video and multimedia content over a network as part of an interactive television system. VoD systems either "stream" content, allowing viewing in real time, or "download" it, in which the programme is brought in its entirety to a set-top box before viewing starts.
VoIP:	*Voice over IP*. A generic term used to describe the techniques used to carry voice traffic over IP (see *also IP telephony*).
VPN:	*Virtual private network*. A method of encrypting a connection over the Internet. VPNs are used extensively in business to allow employees to access private networks at the office from remote locations. VPNs are especially useful for sending sensitive data.
Wi-Fi:	*Wireless fidelity*. A mark of interoperability among devices adhering to the 802.11b specification for wireless LANs from the Institute of Electrical and Electronics Engineers (IEEE). However, the term Wi-Fi is sometimes mistakenly used as a generic term for wireless LAN.
WiMAX:	Fixed wireless standard IEEE 802.16 that allows for long-range wireless communication at 70 Mbit/s over 50 kilometres. It can be used as a backbone Internet connection to rural areas.
WLAN:	*Wireless local area network.* Also known as wireless LAN. A wireless network whereby a user can connect to a local area network (LAN) through a wireless (radio) connection, as an alternative to a wired local area network. The most popular standard for wireless LANs is the IEEE 802.11 series.
WLL:	*Wireless local loop.* Typically, a phone network that relies on wireless technologies to provide the last kilometre connection between the telecommunication central office and the end user.
WTDC:	*World Telecommunication Development Conference.*
x.G:	*2G, 2.5G, 3G, 4G series.*
xDSL:	While DSL stands for digital subscriber line, xDSL is the general representation for various types of digital subscriber line technology, e.g.: **ADSL**: *Asymmetric digital subscriber line* - A technology that enables high-speed data services to be delivered over twisted pair copper cable, typically with a download speed in excess of 265 kbit/s, but with lower updoad speed (see ITU-T Recommendation G.992.1). **ADSL2**: *Asymmetric digital subscriber line 2* - Extension of the initial ITU-T Recommendation, with higher data speeds, new power-saving elements and broader specifications (see ITU-T Recommendations G.992.3 and G.992.4). **ADSL2+**: *Asymmetric digital subscriber line 2+* - Revised version of ADSL2 in which data speeds are increased using higher frequencies on copper lines (see ITU-T Recommendation G.992.5).

Annex 2

INTERNATIONAL TELECOMMUNICATION UNION

Telecommunication Development Bureau

ITU SURVEY ON TARIFF POLICIES 2009

Instructions

It is recommended to use the online version of this survey available on the ITU ICT EYE at http://www.itu.int/ITU-D/icteye/. If for some reason you are unable to fill in the survey on line, then feel free to use this file.

You will find two types of data entry in this survey:

☐ **Several possible replies**
❍ **Only one possible reply**

When you see these boxes, click the response you wish. If you select the wrong box, you may deselect it by just clicking again on the box. Please remember that the button ❍ means only one possible response.
This questionnaire is addressed to National Regulatory Authorities only, and should be returned no later ***than 30 April 2009*** to***:***

Regulatory and Market Environment Division (RME)
Phone: +41 22 730 6350 - Fax: +41 22 730 6210
E-mail: tariffs@itu.int

In the Web site address*: http://www.itu.int/ITU-D/finance/work-cost-tariffs/* you will find more information, as well as the electronic version of this survey.

Please provide your contact information.

Country: _____ *Date of response* _____

Administration _____

Section 1: Contact Information

Person completing the questionnaire

Mr/Ms.: _____
Family name: _____
First name: _____
Title: _____
Company: _____
Address: _____
City: _____
WEB Address: _____
Telephone: _____
Fax: _____
E-mail: _____

No.	Question	Possible answers		
Section 2: Telecommunication services				
			With price control	**Without price control**
2.1	Please indicate which **retail** telecommunication services provided in your country are subject to price control and which are not?	**Fixed communications:** 1. Access to network (monthly line rental/ subscription fee) 2. Local voice services 3. National long distance voice services 4. International voice services 5. IP telephony 6. Internet access (Internet connection) & data services 7. Provision of links (leased lines) 8. Other, please specify: _____ **Mobile communications:** 9. Access to network (monthly subscription fee) 10. Voice services 11. SMS 12. National voice roaming 13. International voice roaming 14. Internet access (Internet connection) & data services 15. Other, please specify: _____ **Broadcasting services:** 16. IPTV 17. Mobile TV 18. Terrestrial TV 19. Cable TV 20. Satellite TV 21. Other, please specify: _____	☐ ☐	☐ ☐

			With price control	**Without price control**
2.2	Please indicate, which **wholesale** telecommunication services provided in your country are subject to price control and which are not?	1. Interconnection: 1.1 Fixed origination 1.2 Fixed termination 1.3 Mobile origination 1.4 Mobile termination 2. National wholesale voice roaming 3. International wholesale voice roaming 4. Unbundled local loop (ULL) 5. Wholesale broadband access/ bistream access 6. Wholesale line rental 7. Wholesale leased lines 8. Access to Internet exchange points (IXPs) 9. Access to International gateways 10. Other, please specify: _____	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

			Retail services	Wholesale services
2.3	How are the prices of regulated services determined in your country?	1. Price ceilings set by the State 2. Cost orientation (using cost models) 3. Benchmarking of tariffs 4. Retail minus approach 5. Rate of return regulation 6. Price cap 7. Other, please specify: _____	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Section 3: Cost and tariff models				
3.1	Do you use a cost model to determine prices of regulated services?	❍ Yes (if yes, please complete Section 3 below) ❍ No (if not, please go to Section 4)		
			Retail services	**Wholesale services**
3.2	Please indicate the type of costs on which it is based.	1. Historical costs 2. Current costs 3. Other, please specify: _____	☐ ☐ ☐	☐ ☐ ☐
3.3	Which concept do you use as the basis for calculating telecommunication service tariffs?	1. Fully distributed costs (FDC) 2. Long-run Incremental costs (LRIC) 3. Other, please specify: _____	☐ ☐ ☐	☐ ☐ ☐
No.	**Question**	**Possible answers**		
3.4	Which approach do you use to calculate telecommunication service tariffs?	1. Top-down 2. Bottom-up 3. Hybrid 4. Other, please specify: _____	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
3.5	Please indicate whether this cost model depends on cost accounting data.	❍ 1. Yes ❍ 2. No		
3.6	Is Accounting separation applied in your country?	❍ In place ❍ Planned ❍ No plans for the time being		
Section 4: Tariff rebalancing of fixed telephony services				
4.1	Has your country implemented tariff rebalancing?	❍ 1. Yes ❍ 2. No If not, why?_____ ❍ 3. Planned		
4.2	What is the time-period given to fixed line operators for absorbing the access deficit (tariff rebalancing)?	❍ 1. Less than three years. ❍ 2. Between three and seven years. ❍ 3. Over seven years. ❍ 0. Not determined.		

Section 5: Interconnection issues							
			LRIC cost model	FDC cost model	Bench-marking	Other, please specify _____	None
5.1	Please indicate which approach to regulate interconnection prices do you use:	☐ 1. Fixed termination ☐ 2. Fixed origination ☐ 3. Mobile termination ☐ 4. Mobile origination ☐ 5. National transit ☐ 6. Other, please specify: _____	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐
5.2	How many time bands are used for charging purposes?	❍ 1. One ❍ 2. Two ❍ 3. Three ❍ 4. More than three ❍ 0. None					
No.	**Question**	**Possible answers**					
5.3	How many national tariff zones are there in your country?	❍ 1. One ❍ 2. Two ❍ 3. Three ❍ 4. More than three					
5.4	What kind of interconnection charging principle has been adopted by your country?	❍ 1. Symmetric ❍ 2. Asymmetric					
	5.4.1 If asymmetric, on what basis is asymmetry decided? E.g. number of subscribers, amount of revenues, universal access policy, etc.	Please specify _____ _____ _____ _____ _____					
5.5	How often are the interconnection charges reviewed?	❍ 1. Quarterly ❍ 2. Semi-annually ❍ 3. Annually ❍ 4. Less frequently. Please specify _____					
5.6	Please indicate which charging regime for interconnection services is applied in your country:	❍ 1. Calling Party's Network Pays (CPNP) ❍ 2. Receiving Party's Network Pays (RPNP) ❍ 3. Bill and Keep (Sender Keep All)					
5.7	Please indicate currently applicable prices in local currency for the following services in your country (average rate per minute during peak hours, in local currency, VAT excluded):	1. Terminating calls on incumbent's fixed network: a. Local level b. Single transit (metropolitan) c. Double transit (national) 2. Terminating calls on other fixed networks: a. Local level b. Single transit (metropolitan) c. Double transit (national) 3. Terminating calls on mobile networks: a. Fixed to mobile b. Mobile to mobile					
	5.7.1 Please indicate the website, where interconnection prices are publicly available	WWW._____					

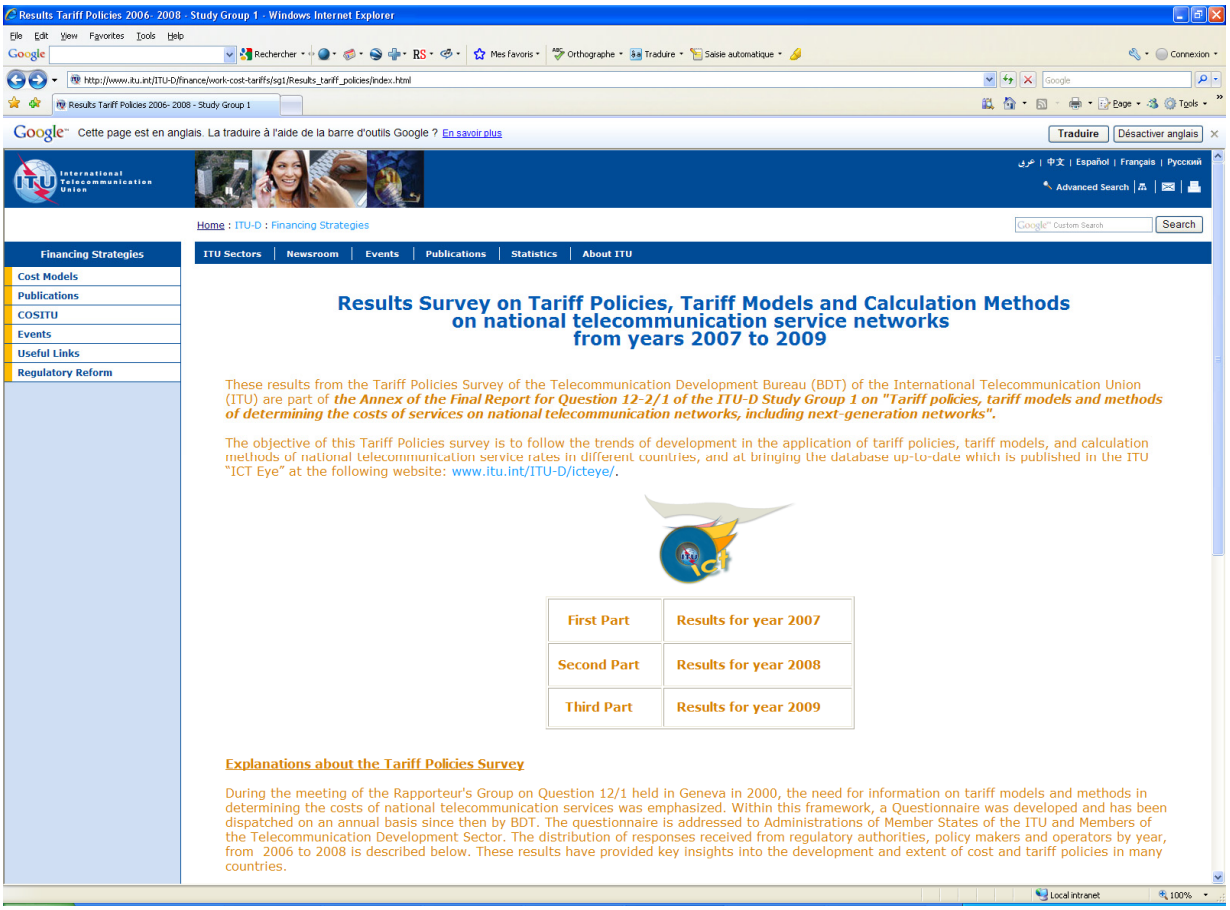
	Section 6: Concept of dominance	
6.1	Is the concept of "dominance" defined in your country?	❍ Yes ❍ No If not, will it be defined and when? _____
6.2	What is the definition given to this concept in your country?	_____ _____
No.	**Question**	**Possible answers**
6.3	In what legal instruments (legislation in force) is the concept defined? Please indicate the relevant website, where it is made available	Website: _WWW._____
6.4	What criteria are used in determining "dominance"?	☐ 1. Geographical ☐ 2. Market share in terms of number of subscribers (or revenues) for the type of market in question (specify, in %) _____ ☐ 3. Control of essential facilities allowing access to the end user ☐ 4. Easy access to financial resources ☐ 5. The strength of the countervailing power of consumers ☐ 6. Economies of scale and scope ☐ 7. Barriers to entry ☐ 8. Potential competition ☐ 9. Other, specify: _____
6.5	What ex ante obligations are imposed on operators or providers most commonly?	☐ 1. Transparency (e.g. publishing RIO and RUO) ☐ 2. Non discrimination ☐ 3. Interconnection and access obligations ☐ 4. Regulatory accounting ☐ 5. Accounting separation ☐ 6. Price control ☐ 7. Other, specify: _____
6.6	If the status of "dominance" is periodically reviewed, how often does such review take place?:	❍ Every 1 year ❍ Every 2 years ❍ Every 3 years ❍ More that three years ❍ Other, please specify:_____
	Section 7: Economic aspect of investment projects of next-generation networks (NGN)	
7.1	Is any operator in your country planning or currently introducing an NGN system? If YES, at what stage are they?	☐ 1. Feasibility study ☐ 2. Planning ☐ 3. Introduction ☐ 4. Implementation ☐ 5. No plans to introduce an NGN system in a short run ☐ 6. Other, please specify:_____

No.	Question	Possible answers		
7.2	Please indicate if there are (or are planed) any regulations governing the use of networks based on IP.		**Voice Service**	**Data Service**
		1. Regulatory arrangements subject to universal service obligations.	☐	☐
		2. Regulatory interconnection arrangements with networks using switching circuits.	☐	☐
		3. Prohibition of offer of services based on IP.	☐	☐
		4. No regulatory arrangements defined at present.	☐	☐
		5. Other, please specify:_____		
7.3	What sources of finance could be used to deploy IP networks?	☐ 1. Operators funds ☐ 2. State subsidization ☐ 3. Joint venture (private sector and public sector) ☐ 4. Financed by a financial institution or private bank ☐ 5. Special telecommunication development fund ☐ 6. Other, please specify: _____		
7.4	What is the role of the incumbent operator in the provision of IP for voice service?	☐ 1. Permit interconnection with an IP provider. ☐ 2. The incumbent operator is the only entity authorized to provide IP. ☐ 3. No role. ☐ 4. Other, please specify:_____		
7.5	What cost model is used (or planned) to calculate costs/ tariffs of new services supported by NGNs?	☐ 1. Fully distributed historical costs model ☐ 2. Long run incremental cost model ☐ 3. Under development ☐ 4. Other, please specify: _____		
	Section 8: Site sharing for terrestrial mobile services			
8.1	Is there a regulatory obligation to share sites, or is site sharing agreed directly between the operators of mobile networks?	☐ Regulatory obligation (mandatory site sharing) ☐ Agreement between operators ☐ None		
8.2	Does the site sharing result in lower prices for end-users?	☐ Yes ☐ No If YES, please indicate how much (%)._____ If NO, please indicate reasons. _____ _____		
8.3	Please indicate the website, where regulatory obligation on site sharing are publicly available	WWW._____		

Annex 3: Statistics of replies to the questionnaire on tariff policies

The statistics of replies are available on the website at:

http://www.itu.int/ITU-D/finance/work-cost-tariffs/sg1/Results_tariff_policies/index.html



Annex 4

Best practice guidelines on innovative infrastructure sharing strategies to promote affordable access for all[21]

Over the last decade, the telecommunication sector worldwide witnessed a first wave of reforms resulting in the establishment of a regulator in the vast majority of countries, introduction of competition in some or all service segments and at least partial privatization of the incumbent operators (among other measures). The result has been unprecedented take-up of mobile voice services in developing countries. However, despite these impressive gains, much of the world's population still remains without access even to voice services, and very few citizens in developing countries have access to multimedia broadband services including Internet. Regulators around the world are considering infrastructure sharing as a tool to promote infrastructure deployment, in particular IP backbones and broadband access networks. Today, a second wave of regulatory reforms is necessary.

We, the regulators participating in the 2008 Global Symposium for Regulators, have identified and proposed best practice guidelines for innovative infrastructure sharing and open access strategies to promote affordable broadband access.

A. Promoting an enabling environment

1. Appropriate Regulatory framework

We recognize the need for an appropriate regulatory framework fostering broadband access including Internet, to enable the development of infrastructure-based competition, in addition to service-based competition, and the emergence of new innovative players at the national level.

Certain sharing options can deliver specific benefits while others could pose risks, in particular by reducing competition, and these need to be carefully balanced in the light of specific national circumstances when designing the most appropriate regulatory strategy.

In doing so, regulators recognize the importance of holding public consultations with all stakeholders on the various strategies and regulations that deal with infrastructure sharing.

2. Competition and investment incentives

We recognize the potential benefits of infrastructure sharing, whether mandatory or optional, in situations where competition and investment incentives are not undermined, bearing in mind the need to safeguard competition and investment incentives. We recognize that offering of shared facilities must not be biased towards any specific service provider or types of services.

Where capital and operating expenditures are likely to be reduced by the joint deployment, management and maintenance of certain facilities (for example, by tower sharing), such sharing can bring about long-term efficiencies, which may in turn enable more investment in innovative products and services and ultimately benefit consumers.

We recognize the importance of ensuring that regulatory policy does not restrict competing market players installing their own independent facilities, and that it promotes open access to international capacity and international gateways (for example, collocation and connection services at submarine cable landing stations).

We believe that the establishment of Internet Exchange Points could also encourage shared and more affordable access to national and international broadband capacity for Internet service providers willing to enter the market.

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21 See: GSR-08 best practices at: http://www.itu.int/ITU-D/treg/bestpractices.html.

B. Innovative regulatory strategies and policies to promote infrastructure sharing

We also recognize that successful infrastructure sharing may be facilitated by the introduction of regulatory obligations and regulatory policies that include:

1. Reasonable terms and conditions

It is important that implementation of sharing takes into account the necessity to protect the value of existing investment in infrastructures and services. However, price and non-price terms and conditions should not act as an artificial barrier to sharing.

2. Pricing

Pricing for shared facilities should provide the right economic signals to market players, assisting them in making reasonable and commercial "build-or-buy" decisions (i.e., is it more commercially reasonable to self provision facilities or to lease existing ones). At the same time pricing should provide for the right incentives for investments in infrastructure (in a form of reasonable return on investment), but should not be used as an artificial barrier to entry for new market players. Commercially negotiated pricing should prevail, except where market power exists.

3. Efficient use of resources

Non-replicable resources such as towers, ducts and rights of way can be shared for installations that serve a similar purpose, which allows for optimal use and can be offered on a first-come firstserved basis subject to commercial agreements under fair pricing conditions.

4. Scarce resources

Shared-use bands could be promoted as long as interference is controlled. Spectrum sharing can be implemented on the basis of geography, time or frequency separation.

5. Licensing

Regulators could consider licensing or authorizing market players that only provide passive network elements, but which do not compete for end-users, such as mobile tower companies, public utilities companies with rights of way access, and fibre backhaul providers.

6. Conditions for sharing and interconnection

Regulators recognize that infrastructure sharing can only take place on a neutral, transparent, fair and non discriminatory basis and that interconnection frameworks can ensure that all licensed operators are granted the right to interconnect as well as encourage the sharing of essential facilities and guarantee that network security and quality of service are not compromised.

7. Establishing an infrastructure sharing one-stop-shop

Establishing a one-stop-shop would facilitate the coordination of trenching and ducting works between telecommunications service providers as well as between telecommunications service providers and those of other utilities.

Regulators recognize the key role local authorities could play in fostering the deployment of broadband access and development of competition and the importance of close cooperation to simplify administrative proceedings and ensure timely response to requests for infrastructure sharing.

8. Improving transparency and information sharing

Regulators recognize the need for transparent processes to facilitate infrastructure sharing, and market players need to know what is available for sharing under clearly established terms and conditions, in order to avoid unfair actions. Regulators could require publication on websites of the details of existing as well as

future infrastructure installations available for sharing by other service providers, such as the availability of space in existing ducts, planned deployment or upgrading works and interconnection.

9. Dispute resolution mechanism

We believe that regulators should introduce necessary enforcement tools to ensure compliance and successful adoption of infrastructure sharing regulations. As an infrastructure sharing relationship between service providers involves elements of both cooperation and competition, the regulators recognize the need to first explore alternative dispute resolution mechanisms which are speedy and simplified to encourage negotiated outcomes while maintaining the certainty of an adjudicated decision where necessary.

10. Universal access

To encourage infrastructure sharing in support of its universal access goals, regulators can consider the introduction of incentives for service providers that share infrastructure as part of their efforts to deploy to rural and underserved areas. Such incentives may, for example, take the form of regulatory exemptions (ensuring that such exemptions do not lead to re-monopolization of the market and do not unreasonably restrict consumer choice) or financial subsidies taking into account the need to minimize distortions to competition.

11. Sharing with other market players and industries

Regulators also recognize that sharing should be encouraged not only within the boundaries of the Telecommunications/ICT and Broadcasting industry, but together with other infrastructure industries (such as electricity, gas, water, sewage, etc.) as well. In the context of technological development, joint infrastructure building (with other market players and with other industries) may be encouraged, providing for timed, organized opportunities for access to ducts and conduits (for example, for the joint laying of fiber) to distribute the cost of civil works among service providers and reduce the inconvenience for traffic in towns and cities. This would also provide for a positive environmental (including aesthetic) impact, in particular by reducing the number of mobile masts and towers.

12. Sharing of regulatory practices

Regulators recognize the need for an appropriate level of international and regional harmonization to ensure that best practice regulatory policies on sharing are widely spread, and regional organizations have an important role to play in this regard. This is even more important in areas where a specific regulatory issue has a significant cross-border effect and thereby cannot be tackled by a national regulator.

GSR-2008: http://www.itu.int/ITU-D/treg/bestpractices.html .

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