

Economic aspects of spectrum management

Guidelines for SM assessment and NTFA

SM Master Plans



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ROLE OF SPECTRUM MANAGEMENT

Spectrum

YES

YES

YES

YES

NO

NO

YES

INSTITUTIONAL BEST PRACTICES (I)

- ✘ **Setting up efficient SM organization:**
 - + Achieving streamlined and efficient SM on both short-term and long-term basis, allocating spectrum in an economic and efficient manner, and by relying on market forces, economic incentives and technical innovations
- ✘ **Transparency of SM operations:**
 - + Promoting transparent, non-discriminatory, economically efficient and effective SM policies, that provide regulatory certainty
- ✘ **Technological neutrality and flexible spectrum use:**
 - + Promoting wireless innovation, by creating conditions for the development of new services, reducing investment risks and stimulating competition among different technologies, including facilitating entry into market of new competitors

INSTITUTIONAL BEST PRACTICES (II)

- × **Timely availability and efficient use of spectrum:**
 - + Facilitating timely introduction of new applications and technology, while protecting existing services from harmful interference; ensuring most efficient use of radio spectrum
- × **International harmonization:**
 - + Aligning domestic spectrum policies with internationally recommended, in order to achieve faster take-up of new bands and economies of scale
- × **Affordable and fair spectrum access:**
 - + Reducing financial barriers for new wireless entrants to the market and promoting development of wireless technologies, especially in less developed areas
 - + Ensuring that all wireless players have equitable and fair access to spectrum resources

LICENSING TOWARDS 2020

- ✘ NRAs shall retain principal use of both auctions and “beauty contests” as main tools for awarding of *operating* licenses
- ✘ Similarly, the existing *radio apparatus licensing/authorization* schemes will all retain their value and use depending on the circumstances of specific bands and services
- ✘ Moreover, the NRAs’ authorization toolbox shall be enriched by further additions of licensing schemes that will allow various arrangements and degrees of shared use of spectrum resource

ECONOMIC ASPECTS OF SM

- ✘ Various economic SM tools are by now well established and tested
- ✘ Can be invoked in three different stages of the spectrum use cycle:
 - + to increase efficiency of initial spectrum distribution in the licensing process (cf. auctions)
 - + to increase efficiency of spectrum use by the license holder (cf. Administrative Incentive Pricing)
 - + to increase timeliness and efficiency of re-distribution of inefficiently used spectrum (cf. AIP and re-farming tools)

ITU-R Report SM.2012(-5)

- Modern environment requires supporting technical measures of spectrum management by economic tools, most notably through appropriate pricing of spectrum access and use fees.
- ITU-R Report responds the following issues:
 - Strategies for economic approaches to national spectrum management and their financing
 - Assessment, for spectrum planning and strategic development purposes, of the benefits arising from the use of the radio spectrum
 - Alternative methods of national spectrum management

ITU-R Report SM.2012(-5)

The report includes information on:

- Economic Considerations
 - Need for spectrum economic approach
 - Requirements for national spectrum management
 - Goals and objectives
 - Structure and coordination
 - Functional responsibilities
 - Performance of spectrum management functions
- Strategies for spectrum financing mechanisms
 - Basic principles for financing national spectrum management
 - Economic approaches used to promote efficient national spectrum management
 - Factors that could affect various economic approaches
 - Managing a change in spectrum management funding
- Assessment of the benefits of using the radio spectrum
 - Methods of assessing the spectrum's economic benefits
 - Potential uses for economic assessment
 - Factors affecting benefits
- Guidelines on methodologies for the establishment of spectrum fees formula and system
 - Formula development
 - Guidelines for the establishment of administrative fees (or administrative charges)
 - Guidelines for the establishment of spectrum fees
 - Examples of formulas for fee calculation
 - Spectrum fees for frequencies used in the provision or marketing of services intended for a consumer market
 - An analytical model for calculating license fees on the basis of specified incentives that are designed to promote efficient spectrum use
 - Procedures and examples of used spectral resource calculations in application to different radio services
 - Guidelines on applying new fee systems
- Experience of different administrations regarding the economic aspects of spectrum management.

Utilization of market mechanism

- In general, the employment of market mechanism is not a universal panacea, SM always has to establish a careful balance between the complex combination of technical, economic and societal aspects.
- Well designed economic tools of SM are essential, such as auctions, transferable and flexible spectrum rights, and well-designed spectrum fees.
- They may provide intrinsic incentives for spectrum users to pursue most efficient use of this valuable resource.
- They can also help to establish solid funding for NRAs to carry out their SM duties.

Using of economic SM tools

- The economic spectrum management tools can help in three different stages of the spectrum use cycle:
 - to increase efficiency of initial spectrum distribution in the licensing process;
 - to increase efficiency of spectrum use by the licence holder;
 - to increase timeliness and efficiency of re-distribution of inefficiently used spectrum.
- Each of these phases may require use of different economic tools.
- For initial spectrum distribution, the choice typically lies between auctions and administrative selection (beauty contest)

Using of economic SM tools

- Auctions and transferable (tradable) & flexible spectrum usage rights appear best-designed to promote and ensure efficient use of spectrum when there are several competing applicants.
- The auction may be particularly bad choice in cases of frequency assignments for:
 - services with limited public demand and/or limited market competition;
 - non-commercial/socially oriented services, dealing with safety of life, emergency service provisioning, etc.
- When spectrum is assigned using traditional methods of administrative spectrum assignment, it should be still possible to establish certain economic mechanisms that would provide for more efficient use of spectrum in the possession of licence holders.
- The introduction of incentive pricing provides a means by which licences can be priced to reflect the true market value of the spectrum used. This is implemented by the mechanism called Administrative Incentive Pricing (AIP).
- This term means that the prices charged to spectrum licensees are set by the administration depending on usage type/frequency band of licensed spectrum and are intended to reflect the opportunity cost of spectrum use (and thereby provide effective incentives for efficient use of spectrum).
- An Economic Study to Review Spectrum Pricing. Study for UK Ofcom by Indepen, Aegis Systems and Warwick Business School, February 2004. Available from Ofcom website at: www.ofcom.org.uk

Using of economic SM tools

- Where spectrum is in heavy demand, prices may be set higher. This will encourage efficient usage.
- Where spectrum is under-utilized, prices may be lowered to encourage more use. Prices may also be lowered to aid the introduction of more competition of services.
- The use of higher pricing may by itself also stimulate innovation. The AIP mechanism should provide adjustable spectrum pricing that is aimed at promoting particular aspects of efficient spectrum use.
- When considering how to apply AIP, various considerations should be taken into account and Report ITU-R SM.2012 could provide useful guidance, as well as regional guidance documents, e.g.
 - CEPT ERC Report 76. The Role of Spectrum Pricing as a Means of Supporting Spectrum Management (Marbella, September 1999). Available online at: www.erodocdb.dk/
 - CEPT ERC Report 53. Introduction of Economic Criteria in Spectrum Management and the Principles of Fees and Charging in the CEPT (Manchester, May 1998). Available online at: www.erodocdb.dk/

ITU-D Resolution 9

2006-2010: Guidelines for the establishment of a coherent system of radio-frequency usage fees (separate publication to Resolution 9 report)

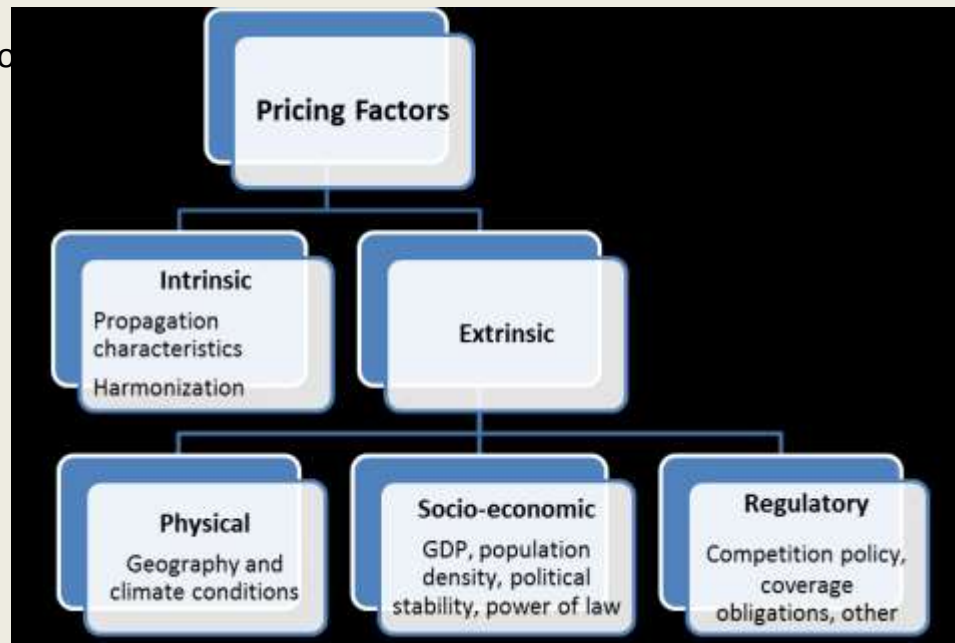
<http://www.itu.int/pub/D-STG-SG02.FEES-1-2010>

- The Guidelines, which reflect the practical experience of a number of administrations, are aimed at the setting up of a coherent fee system that takes into account:
 - the financing of spectrum management;
 - the budgetary and development objectives of State authorities;
 - the objectives of efficient spectrum management and effective frequency usage.
- Basic principles:
 - legal, economic, reality
- General approaches for the establishment of spectrum fee:
 - Budgetary and economic objectives of the authority
 - Benefits of spectrum occupancy
 - Spectrum management tool

ITU-D Resolution 9

2014-2017: Final report (under preparation)

- Experiences of Administrations with respect to spectrum pricing, licensing fees, and auctions
 - methodologies adopted by different administrations for valuing the spectrum fees. There is no one method that fits all; rather, an administration can come up with its own criterion or adopt a hybrid of different known methods.
- *Spectrum Pricing Steps*
 - a) Setting general rules: any developed rules should be a function of the type of application (commercial/non-commercial, civilian/non-civilian, exclusive/shared-use,...)
 - b) Identifying pricing factors



ITU-D Resolution 9

2014-2017: Final report (under preparation)

- Pricing factors can be in general intrinsic or extrinsic.
 - Intrinsic factors relate to the type and characteristics of the band under consideration.
 - Extrinsic ones cover different aspects including physical (e.g., geography), socio-economic (GDP, population density, etc.), and regulatory (competition policy, etc.) factors.
- *Spectrum Pricing Methodologies*
 - Administrative Fees Recovery (Cost based): fees are calculated to recover different administrative costs including
Cost of issuing, processing and renewing licenses; Spectrum planning; Spectrum monitoring; International Coordination; Personnel, training and overheads,..
 - Market-based:

Spectrum valuation is based on market needs and demands. Auctioning is the most adopted method reflecting real need and valuation of spectrum.
 - Formulas (Incentive Pricing):
 - An administration can use certain formulas to approximate the market value of the spectrum. To do so, many parameters and factors need be incorporated and carefully assigned numerical values.
 - Examples of such parameters include:
Amount of spectrum (BW); Type of band (Band Factor); Band congestion factor (related to the opportunity cost); Population density; Coverage area; Financial coefficient

EXAMPLE: SPECTRUM RE-FARMING IN FRANCE

One of global success stories in applying economic tools to increase efficiency of spectrum use, French administration succeeded in timely re-allocation of more than 1 GHz of spectrum over a decade since 1998

Source: ANFR, 2011

System	Spectrum amount	Tranfered from
GSM 900	50 MHz	Defense
GSM 1800	150 MHz	Defense
UMTS 2 GHz	140 MHz	Defense (partly)
Wifi 2.4 GHz	83 MHz	Defense
Wifi 5 GHz	455 MHz	Defense, Meteo, Space, Telecom (shared)
LTE 2,6 GHz	190 MHz	Defense
LTE 800 MHz	32 MHz 40 MHz	Defense Broadcasting
Total MHz	1140 MHz	

ECONOMIC METHODS TOWARDS 2020

- ✘ Economic tools and methods will continue providing crucial basis for transparent award of frequencies in highly contested bands and for subsequently creating incentives for most efficient utilisation of spectrum resource
- ✘ The auctions are likely to get more widespread use, especially for flexibly termed frequency assignments (spectrum usage rights)

Guidelines on Spectrum Management Assessment and NTFA

Spectrum Management Assessment

- ITU developed “A Standard Approach for Assessing the Spectrum Management Needs Of Developing Countries” (SM Assessment Guidelines) which provide a standard approach for national governments to self-assess national spectrum management development needs.
- <http://www.itu.int/en/ITU-D/Spectrum-Broadcasting/Documents/Publications/Administration%20Assesement-E.pdf>

SM Assessment Guidelines

Key elements of national spectrum management for review and assessment

- 1 Country background
- 2 Legal Framework for Spectrum Management
- 3 Organisational Structure of Spectrum Management
- 4 Current Spectrum Allocation & Usage as well as Future Trends
- 5 Spectrum & Apparatus Assignment/Licensing Processes/Mechanisms
- 6 Financing of Spectrum Management and Spectrum Pricing Mechanisms
- 7 Spectrum Quality Control, Interference Management & Enforcement
- 8 Spectrum Management Data Bases and Computer Assisted Assignment
- 9 Application of spectrum engineering in spectrum management and assignment
- 10 Radio Equipment Standardization, Type Approval & Related Certification
- 11 Participation in International Spectrum Planning and Co-ordination activities
- 12 Participation of Stakeholders in the Spectrum Management Process
- 13 Research Collaboration with Institutions of Higher Learning and Industry
- 14 Public Information; Websites; licensing

National Table of Frequency Allocations (NTFA)

- There are many competing demands to use valuable spectrum resource for different radio services, from government, public and private users to international systems such as maritime and aeronautical services, global or regional terrestrial and satellite telecommunications systems that require a degree of frequency harmonisation for cross-border interoperability.
- One of the most important tools to address the competing demands is a carefully prepared National Table of Frequency Allocations (NTFA).
- The NTFA will have several levels of detail.
 - The top level should define clearly how frequency bands have been allocated in conformity with the Radio Regulations to radiocommunications services in the country concerned.
 - The next level should define how these “service bands” are divided or shared between major uses, in particular government and non-government uses.
- ITU has developed guidelines which focus on the detailed preparation of an NTFA

<http://www.itu.int/en/ITU-D/Spectrum-Broadcasting/Documents/Publications/Guidelines-NTFA-E.pdf>

NTFA Guidelines

- 1 Introduction
- 2 The ITU Radio Regulations Article 5: Definition of Terms and Table of Frequency Allocations
- 3 International and National spectrum management frameworks
- 4 The Essential Requirements for effective National Spectrum Management
- 5 National Spectrum Planning and the National Table of Frequency Allocations
- 6 National Table of Frequency Allocations (NTFA) - structure
- 7 National Frequency Use Information
- 8 Practical steps to develop a country's first NTFA
- 9 Publishing the NTFA and National Frequency Use Tables
- 10 Regional co-operation in presenting National Frequency Allocation Tables

Spectrum Management Master Plan

ITU-REPUBLIC OF KOREA Projects

Background

- **Increasing need of efficient spectrum management**
 - Many countries adopted new approaches: unified licensing, market based spectrum allocation, technical neutrality, cognitive radio systems
 - Requires resources and skills to update national spectrum management frameworks
- ***WTDC-14 Dubai Action Plan Objective 2:***
 - To foster an enabling environment for ICT development and foster the development of telecommunications/ICT networks, including enhancing awareness and capability of countries in the fields of spectrum planning and assignment, spectrum management and radio monitoring
- Republic of Korea fund for SM Master Plan developments
 - ASP: 2 phases (3+3 countries)
 - Caribbean: 3 countries

Objectives and Targets

- To assist governments and regulators of developing countries in the Americas Region (in particular on Caribbean Countries) and in Asia-Pacific region in developing **national spectrum management master plans**
- At least for **3 beneficiary countries (6 now for ASP)**
 - **Assessment** of the spectrum management scheme: spectrum policy, spectrum use, authorization, spectrum sharing, spectrum monitoring...
 - **Provision of advices** concerning each beneficiary country's development of relevant policies, legislations and regulations based on request and interest of the countries
- **Human capacity building [3 seminars, 60 participants in total]**
- **Provision of guidance** during implementation of the master plans, where requested by beneficiary country and agreed by ITU

Roles and Responsibilities

➤ ITU

- Selection of beneficiary countries, recruitment of experts, provision of staff resources for overall project management, approval of the report
- Organizing the Seminars

➤ MSIP (Republic of Korea)

- Cash contribution
- Collaborate with ITU in the selection of countries and experts

➤ CTU (for Americas region only)

- Recommend beneficiary countries and experts
- Comments on the scope of the reports, seminars and the contents of the reports

➤ Beneficiary Countries

- Designate a qualified counterpart work with ITU
- Provide access to the relevant information and materials
- Provide administrative support including staff, visa, premises for the interview and training, etc.

Report Framework (1)

Executive summary

1. Introduction

- 1.1 The context and scope for the study
- 1.2 Report contents

2. Global trends in Radio Spectrum Management

- 2.1 Administrative processes
- 2.2 Existing and new licensing policies (including DSA, LSA, white space)
- 2.3 Fees
- 2.4 Market mechanisms
- 2.5 Policy in respect of non-commercial use

3. Current Spectrum Management Framework

- 3.1 Legislative framework
- 3.2 Process (including internal coordination with stake-holders)
- 3.3 Licensing
- 3.4 Spectrum fee

Report Framework (2)

3.5 Monitoring, type approval and enforcement

3.6 Cross-border frequency coordination

3.7 Spectrum policy, management issues and strategy (if exists)

4. Current spectrum demand and issues - by sector/service

4.1 Data sources used in analysis

4.2 NTFA (National Table of Frequency Allocation)

4.3 Analysis of current spectrum use

4.4 Issues identified by Stakeholders in relation to frequency use

4.5 Conclusions, issues to deal with during the assistance

5. Future demands for spectrum

5.1 Spectrum Demand Trends by Sector/Service

6. Recommendations and Key issues

6.1 Allocation Policy

6.1.1 Improving information on spectrum allocations and policy

6.1.2 Making allocation decisions

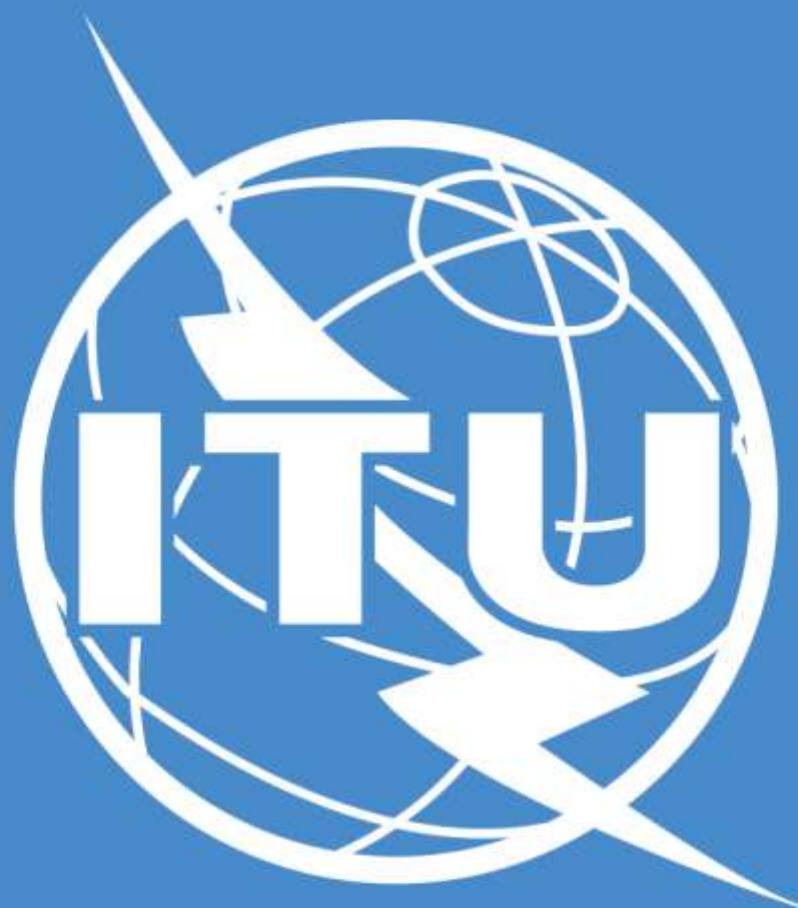
Report Framework (3)

- 6.1.2.1 Role of ITU and other international and regional organizations
- 6.1.2.2 Role of local investors and spectrum users
- 6.1.2.3 Unique needs of the country
- 6.1.2.4 Cross-border frequency coordination agreements
- 6.1.3 Consultation arrangements
- 6.1.4 Balance between government and commercial allocations
- 6.2 Assignment , licensing, monitoring and enforcement
 - 6.2.1 Policy principles
 - 6.2.2 Licensing policy and fees
 - 6.2.3 Planning and licensing processes
 - 6.2.4 Monitoring, type approval and enforcement processes
- 6.3 Spectrum management strategy
- 6.4 Capacity building

Annexes

Abbreviations

Thanks you!



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