



**International Telecommunication Union**

# **REGULATORY ACCOUNTING GUIDE**

**Telecommunication Development Bureau**

**March 2009**



This guide on the elaboration on regulatory accounting was written by Mr. Antonio G. Zaballos and Mr. Jose Monedero under the direction of BDT's Regulatory and Market Environment (RME) Division. The comments and suggestions made by ITU officials, in particular Ms. Vaiva Lazauskaite and Ms. Carmen Prado-Wagner were a very useful input to the report's preparation.

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## INTRODUCTION

These guidelines on the implementation of regulatory accounting in the telecommunication sector were prepared by Antonio G. Zaballos and Jose Monedero on behalf of the International Telecommunications Union (ITU).

The objective of this guide is to help National Regulatory Authorities (NRAs) in the implementation of cost accounting models and in the development of regulatory policies. This guide is based on best practices and shows the steps to be followed by each NRA to build a cost accounting model. Since cost accounting models and accounting separation are *ex ante* obligations imposed on Significant Market Power (SMP) operators, this guide also provides a methodology to identify markets, SMP operators and the different typologies of anticompetitive behaviour which should be analysed prior to the imposition of *ex ante* regulation.

The findings and recommendations of the present guide aim to assist ITU members in their ongoing activities in this field, in particular, with regard to the requirements of cost accounting and accounting separation, to pave the way for a regulatory policy that encourages investment in infrastructure and reaches a sustainable level of competition. In this regard, it is important from a regulatory perspective, as well as from a business perspective, that prices reflect the costs incurred to provide services.

The document is divided into the following Sections:

Section 1 describes the legal framework that the NRAs need in order to properly implement the guide and to support the information requirements of SMP operators to Impose cost accounting and accounting separation obligations.

Section 2 describes the methodology to analyse markets and services, and define SMP operators on which the cost accounting and accounting separation obligations might be imposed.

Section 3 defines the objectives of cost accounting models.

Section 4 presents the main parameters of cost accounting models, including:

- i) accounting principles,
- ii) services included within the accounting separation obligation,
- iii) accounting periods,
- iv) criteria for assets valuation,
- v) accounting standards, (vi) types of accounting models, and
- vi) internal transfer charges.

Section 5 describes the two approaches to costing (bottom-up vs top-down models) and the steps to be followed for implementation.

Section 6 deals with the key parameters of costing models which are the Weighted Average Cost of Capital (WACC) and asset life span.

Section 7 shows the steps and templates for cost allocation in a top-down model to determine the costs, revenues and margins attributable to the aforementioned defined services.

Section 8 presents cost accounting uses.

Section 9 includes final conclusions and specific recommendations.

Sections 10, 11, 12 and 13, include the Bibliography, Glossary, Abbreviations and Acronyms, and the list of Tables and Figures.

Figure 1 illustrates the step-by-step structure of this guide in order to provide NRAs with a useful tool for the implementation and further use of cost accounting models in regulatory policies.

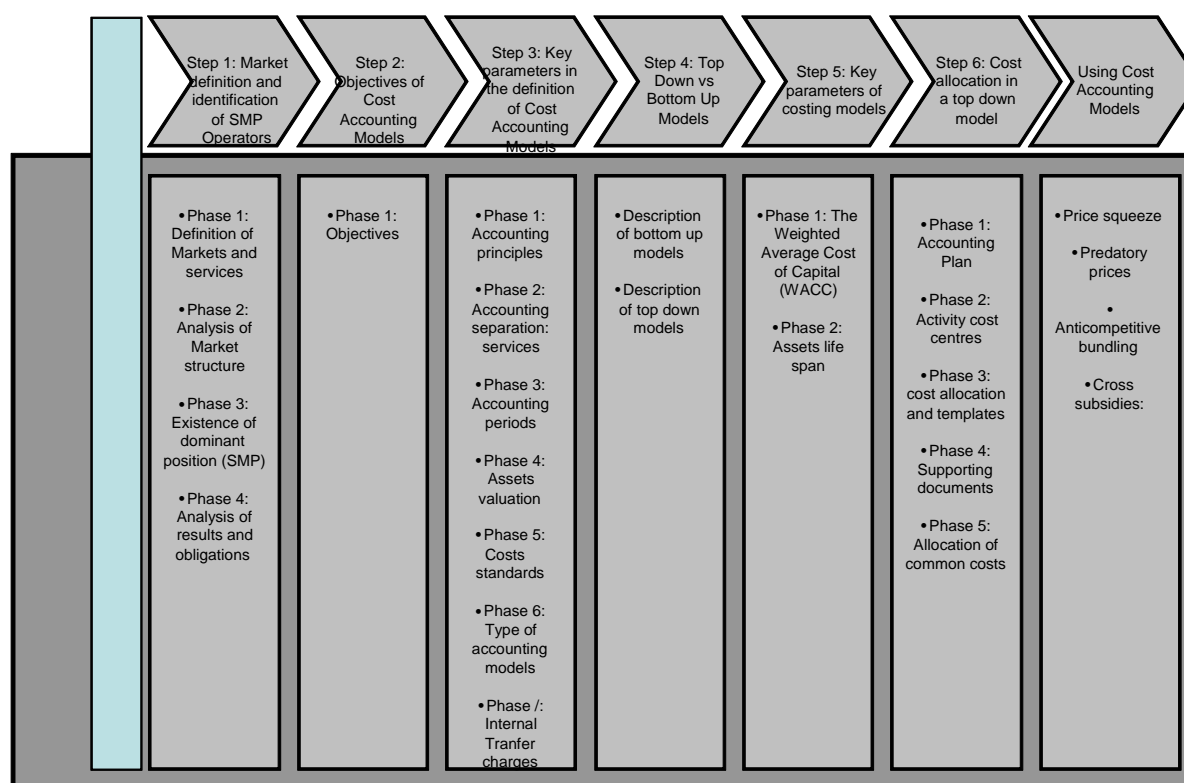


Figure 1: Contents of the Regulatory accounting guide

It is important to highlight the activities involved in Step 4 and Step 6. *Step 4: Top-down vs Bottom-up models* provides a detailed description of the different phases and stages that each NRA should follow in the definition and implementation of these models. *Step 6: Cost allocation in a top-down model* provides an applied example with templates for the fulfilment and implementation of the different stages that characterise a top-down model.

## 1 Regulatory framework and country case studies

The imposition of cost accounting and accounting separation obligations on SMP operators by the NRA should be based on a comprehensive regulatory framework. The framework should provide clear criteria to assess and decide whether the obligations for cost accounting and accounting separation are balanced and suitable measures in a specific situation.

In order to facilitate compliance with obligations of transparency and non-discrimination by SMP operators, the national regulatory framework should empower NRAs to ask SMP operators, and other stakeholders, to provide information.

### Approach of European Union Member States

In the case of countries from the European Union (EU), the European Commission (EC) continuously adjusts the Directives and Recommendations to provide harmonised accounting systems and methodologies throughout the EU. Consequently, most of the countries chosen in the present guide as best practice are EU countries considering the advanced use of this methodology by policy makers.

The EU Regulatory framework regarding cost accounting systems is presented below, which provides a first hand view of the regulatory actions on this matter that each NRA should carry out.

Article 13 from the Access Directive (2002/19/EC) in relation to price control and cost accounting obligation states:

1. *“A national regulatory authority may, in accordance with the provisions of Article 8, impose obligations relating to cost recovery and price controls, including obligations for cost orientation of prices and obligations concerning cost accounting systems, for the provision of specific types of interconnection and/or access, in situations where a market analysis indicates that a lack of effective competition means that the operator concerned might sustain prices at an excessively high level, or apply a price squeeze, to the detriment of end-users. National regulatory authorities shall take into account the investment made by the operator and allow a reasonable rate of return on adequate capital employed, taking into account the risks involved.*
2. *National regulatory authorities shall ensure that any cost recovery mechanism or pricing methodology that is mandated serves to promote efficiency and sustainable competition and maximise consumer benefits. In this regard, national regulatory authorities may also take account of prices available in comparable competitive markets.*
3. *Where an operator has an obligation regarding the cost orientation of its prices, the burden of proof that charges are derived from costs including a reasonable rate of return on investment shall lie with the operator concerned. For the purpose of calculating the cost of efficient provision of services, national regulatory authorities may use cost accounting methods independent of those used by the undertaking. National regulatory authorities may require an operator to provide full justification for its prices, and may, where appropriate, require prices to be adjusted.*
4. *National regulatory authorities shall ensure that, where implementation of a cost accounting system is mandated in order to support price controls, a description of the cost accounting system is made publicly available, showing at least the main categories under which costs are grouped and the rules used for the allocation of costs. Compliance with the cost accounting system shall be verified by a qualified independent body. A statement concerning compliance shall be published annually”.*

From the above paragraphs, it is evident that NRAs need specific competences not only to design the cost accounting model, but also in order to impose *ex ante* cost accounting obligations on specific operators.

Therefore, NRAs must have a legal framework which authorizes them to:

- Approve the accounting principles of the cost accounting system that every SMP operator must fulfil.
- Analyse market competition; identify SMP operators and the set of obligations/remedies that could be imposed.
- Approve the cost accounting model presented by each SMP operator once the accuracy of the principles defined therein has been verified.
- Approve the external key parameters, such as asset life span and the Weighted Average Costs of Capital (WACC)<sup>1</sup>.
- Validate the accounting results.

Figure 2 shows the procedural flow that NRAs should follow to define the cost accounting system and the process of approval and audit, to set wholesale prices, identify anticompetitive behaviour or estimate the net cost of universal service obligations (USO).

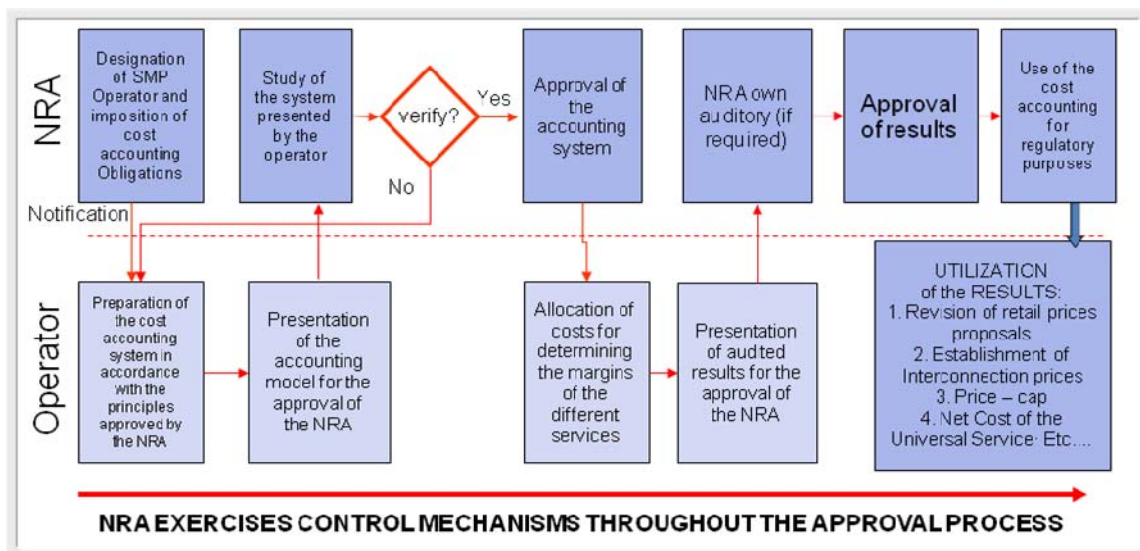


Figure 2: Process of definition and approval of the cost accounting system

Initially, NRAs should define the principles, criteria and conditions that the SMP operator accounting system must fulfil. Once these principles and criteria for asset valuation are defined, the SMP operators should propose an accounting system that fits the NRAs requirements. When the NRA considers that the proposed system fulfils the principles and criteria then the accounting system should be approved and the accounting information should be completed.

<sup>1</sup> See section 6.1 for a detailed explanation



## **Approach of Inter-American Telecommunication Commission Member States**

To complete this European view, alternative examples of Inter-American Telecommunication Commission Member States (CITEL) are given from a variety of sources, including; Technical Notebook and answers to the questionnaire on regulatory accounting, as well as practical cases of application and use of regulatory accounting from Argentina, Ecuador, Mexico and Nicaragua. This corresponds to a survey sent by CITEL on Regulatory accounting issues. The questionnaire is of an introductory nature and seeks to combine legal, financial, and accounting aspects that arise when regulation in telecommunication service provision is implemented. In general, this yields a reliable and easy-to-use database structured around shared criteria that helps to determine, for example, efficient service provision costs; anti-competitive practices; or the existence of cross-subsidies.<sup>2</sup> Some of the results from this survey are presented below.

### Argentina

Since the licenses for service provision were granted, the licensees have been obliged to present economic and accounting information to the regulatory authorities, establishing basic principles to define a Plan and Manual of Accounts, an Assignment Manual of Revenues and Costs and to present information every three months. Later, in 1997, a Plan and Manual of uniform Accounts was approved for those Licensees working under exclusive conditions.

At present and with the deregulation of the telecommunication market in the year 2000, the authority information requirements also include the following:

- Accounting separation of services,
- Cost accounting,
- Separation of accounts for activities related to interconnection.

The two dominant market companies present their accounting and financial results divided into three sectors: local, long distance and public telephony. The licensees must deploy different procedures from their own accounting registers in order to obtain: assignment of positions (“transfers”), assignment of responsibility areas or cost centres, and the assignment of processes to products.

So far, this document has presented the basic conceptual aspects related to a regulatory accounting system, as well as cases of countries where there are different levels of development in relation to the use of this subject-matter. This background information will support the guidelines developed later for the implementation and structuring of accounting systems and protocols associated with audits and certification.

### Ecuador

Ecuador has not formally developed a regulatory accounting system. In this regard, telecommunications service providers are only required to submit audited financial statements, which do not show in detail the service break-down. However, they do believe it is necessary to adopt the concept of Regulatory Accounting and to incorporate it into Ecuadorian legislation.

### Mexico

In Mexico, public telecommunication network licensees are obliged to keep separate accounts for each service for regulatory purposes, as is established in the Resolution regarding the method of separate

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<sup>2</sup> For more information contact CITEL at <http://www.citel.oas.org/>.

accounting by service, under which Teléfonos de México S.A. de C.V. and Teléfonos del Noroeste S.A. de C.V. must provide the accounting information referred to in Condition 7-5 of the modifications to their respective Licenses, and in the Resolution establishing the method of providing accounting information by service of public telecommunication networks in accordance with the Federal Telecommunications Act.

The objectives of the regulatory accounting system are:

- To gain in-depth knowledge of the characteristics of the operation and exploitation of different licensed public telecommunication services, analyze the profitability of public telecommunication network licensees, and formulate in a timely manner, with the assistance of the information generated in this area, development policies consistent with the corresponding sector program.
- To monitor strict compliance with the legal provisions, licenses and other applicable legal, regulatory, and administrative provisions, such as prohibitions from adopting discriminatory practices in applying tariffs and cross-subsidies in services provided under competition.
- To monitor the fulfilment of interconnection obligations, and to ensure that public telecommunication network licensees providing this public service assign disaggregated and non-discriminatory tariffs for the different services provided to themselves and their subsidiaries and affiliates.

In this country, there is one model for fixed networks and another for mobile networks, both of which have been used to resolve interconnection tariff disputes. The tariff review and cost model are only applicable to interconnection tariffs. The results obtained from the cost model have been used to resolve interconnection disputes.

### Nicaragua

Even though Article 29 of the *Ley General de Telecomunicaciones y Servicios Postales* establishes the obligation of accounting separation for the different services provided, there is no defined cost accounting model, nor is there a specific decree which defines the rules that must be followed by a cost accounting model.

## **2 Defining the markets and services and identifying SMP operators (Step 1)**

Cost accounting and accounting separation are *ex ante* obligations imposed on SMP operators. Accounting separation deals with the identification of the regulated services for which the SMP operators should provide accounting information. On the other hand, cost accounting deals with the process of allocation of the different cost categories to regulated services.

In this regard, it is important to begin the guide with the steps that NRAs should follow to designate SMP operator status and thereafter impose (if necessary), among other things, the obligations of cost accounting and accounting separation.

NRAs should guide by the principle of minimum intervention. In this respect, *ex ante* regulation should be imposed on those SMP operators if at least one the following three criteria is satisfied:

- 1 The market shows high and non-transitory barriers to entry.
- 2 The market structures do not tend towards effective competition in a relevant time horizon, and

3 The application of competition law alone does not adequately address market failure.

The methodology that it is presented below will allow NRAs to determine the typology of markets and services, which define the telecommunication sector, and identify SMP anticompetitive behaviour. Subsequently, NRAs may impose *ex ante* obligations such as cost accounting and accounting separation. The main steps to develop this methodology are described below.

## 2.1 Phase 1: Defining the markets and services

It is important to stress that market definition is drawn from two areas of analysis:

### Service/Product

NRAs must analyse the following variables:

- list of identifiable services available in the market
- demand-side and supply-side substitutability among the different services, using quantitative or qualitative techniques such as the Hypothetical Monopolist Test.

### Geographic scope

NRAs must identify where the services are provided. This analysis is of particular importance because competition conditions might be different depending on whether a national scope or a smaller geographic scope is considered.

By performing this analysis, NRAs will be able to define the relevant market and the services included in such a market. However, as previously stated, *ex ante* regulation developed using the analysis of the stages defined below will be subject to the fulfilment of the three aforementioned test criteria.

## 2.2 Phase 2: Analysing the market structure

One of the main steps towards the identification of SMP operators is to analyse the market structure. To do so, it is crucial to study variables, such as<sup>3</sup>:

- i. The supply side and demand side characteristics
- ii. The existence of closely related markets
- iii. Entry analysis
- iv. Market share
- v. Vertical integration
- vi. Concentration

To carry out this analysis, NRAs must rely on a legal framework which allows them to require the regular collection of information.

This phase concludes with a list of potential dominant operators that may or may not leverage such a dominant position. It is important to point out, that *ex ante* regulation should be imposed whenever NRAs think that the dominant operator might make use of the dominant position, thus, if the NRA

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<sup>3</sup> See [http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l\\_344/l\\_34420071228en00650069.pdf](http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_344/l_34420071228en00650069.pdf) for a detailed explanation.

concludes that the dominant operator cannot make use of the dominant position, or the use will not breach competition law, then no *ex ante* intervention will be required.

### 2.3 Phase 3: Determining the existence of a dominant position

Once the NRA determines potential dominant operator/s for each of market defined, the following variables should be defined:

- i. Dominant position and of the possible scope for spreading/leveraging the dominant position to other markets by means of anticompetitive behaviour such as: predatory prices, margin squeeze, dilatory strategies, cross subsidies, etc<sup>4</sup>.
- ii. Identity of SMP operator/s by service and markets.

### 2.4 Phase 4: Analysing the results achieved

In view of the conclusions from previous analysis, NRAs and/or National Competition Authorities (NCAs) must guarantee a level field of competition by means of introducing *ex ante* or *ex post* regulation.

The categories of *ex ante* remedies could be<sup>5</sup>:

- i. Obligation of transparency: based on the publication of a Reference Interconnection Offer (RIO), Reference Unbundling Offer (RUO), Wholesale Line Rental (WLR), etc.
- ii. Obligation of non-discrimination
- iii. Cost accounting and accounting separation
- iv. Obligation of access (essential facilities)
- v. Obligation of price control

The next sections will focus on the steps to be followed by a NRA when an obligation of accounting separation and cost accounting has been imposed on a SMP operator.

In order to implement these obligations correctly, policymakers in general and NRAs in particular, require a regulatory framework which supports their actions. In particular, they need to develop at least the following laws:

- General Telecommunication Law which provides NRAs with the legal basis to require information to carry out market analyses.
- Access and Interconnection decree which guarantees the interoperability between the different networks.
- Cost accounting decree which guarantees the cost based principles of the different wholesale services.
- Universal access/services decree which guarantees price feasibility and a greater penetration of the electronic communication services.

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<sup>4</sup> Depending on the market defined the anticompetitive behaviour might be different.

<sup>5</sup> Depending on the market defined the anticompetitive behaviour might be different.

In addition, and in order to make the NRAs' regulatory policy reliable, they should have the power to make inspections and to impose fines. These two tasks should be captured in the General Telecommunication Law.

### **3 Specifying and defining the objectives of cost accounting (Step 2)**

This section deals with the objectives that regulatory cost accounting must achieve and the regulatory framework that should be at NRAs disposal in order to guarantee successful regulatory intervention.

#### **3.1 Objectives of regulatory cost accounting**

Effective regulatory cost accounting can be divided into the following six main objectives:

##### Objective 1: Cost accounting as a mechanism of price control

Indeed, cost accounting allows NRAs to set cost based prices of wholesale services in such a way that they are not so high as to prevent the entrance of new operators but also not so low as to invite the entrance of inefficient operators.

In addition, cost accounting can be defined as a “barometer” of the success in the implementation of regulatory policies. For instance, if the NRA is implementing a regulatory policy to reduce high margins and the cost accounting figures show that the margin of that specific service is increasing or just keeping constant, it will be a measure of the ineffectiveness of the associated regulatory policy.

##### Objective 2: Cost accounting as a legal guarantee

Whenever wholesale prices are cost based, alternative operators can be sure that there is a clear relationship between the prices charged by the owner of the infrastructure and costs of providing the wholesale services that they offer.

##### Objective 3: Cost accounting as a tool to prevent anticompetitive behaviour

As shown in section 8, a cost accounting model gives NRAs the necessary inputs to determine the existence of anticompetitive behaviour which are undermining the existing competition.

##### Objective 4: Cost accounting as a tool for guaranteeing transparency

Cost accounting information is a key instrument for NRAs to form an opinion of the level of competition and identify anticompetitive behaviour.

##### Objective 5: Cost accounting as a tool for estimating the Universal Services Cost

Cost accounting models are crucial not only to estimate Universal Service Obligations (USO) but also in the process of assigning contributions to the Universal Service Fund (USF).

##### Objective 6: Cost accounting as a tool for policy makers

NRAs as well as National Competition Authorities (NCAs) might use cost accounting in cases of disputes and to encourage competition.

Thus, by means of cost accounting models, NRAs might:

- Set the wholesale prices of different services included in the Reference Interconnection Offer (RIO) and the Reference Unbundling Offer (RUO).
- Set the termination charges for mobile operators

- Control the existence of anticompetitive behaviour as predatory prices, margin squeeze and cross subsidies.
- Estimate the cost of providing Universal Service Obligations (USO)
- Ease the solution of disputes in the process of interoperability between the different networks operators.
- Control the success or failure of the regulatory policy that they are implementing by looking at the margins of the different regulated and non-regulated services.

In summary, regulatory cost accounting provides information about the margins achieved by each category of service either wholesale or retail, residential or business which is critical for policy makers in two ways: firstly, to identify the existing competition level, and secondly, to form an opinion of the level of market competition and of any need for further regulation.

## **4 Key parameters to define a cost accounting model (Step 3)**

As can be seen from Figure 2, prior to the approval of the cost accounting model, NRAs should define the accounting principles that must guide the model.

### **4.1 Phase 1: Accounting principles**

The accounting principles defined by the NRAs as guidelines for the correct allocation of costs to the different services must include, at least, the following:

#### Principle 1: Causality

The income and costs allocation to the different activities and services must be done based on causal drivers.

#### Principle 2: Objectivity

The cost drivers must be objective, quantifiable and based on allocation criteria and statistical samples which could be contrasted and verified by NRAs within the auditory process.

#### Principle 3: Transparency

The costs allocated to the different services must be decomposed according to its nature and by applying Activity Based Costing (ABC) methodologies or justified cost volume relationship. To guarantee transparency, the SMP operators should provide the technical documents that support the proposed costs allocation.

#### Principle 4: Auditability

The accounting system must be easily reconciled with the financial accounting and be based in specific systems and internal reports which support the results.

#### Principle 5: Consistency

The criteria used to value assets must be maintained annually to make the results comparable.

#### Principle 6: Disagreeability

All the costs allocated to the different services must have their own activity cost centre as shown in section 7.2.

#### Principle 7: Neutrality

The cost accounting must show the internal transfer costs in separate accounts to allow NRAs to distinguish and compare the margins obtained when the operator sells to other companies with the margins obtained when the sale is with intragroup companies.

#### Principle 8: Sufficiency

The information contained in the cost accounting system must be sufficient for NRA purposes.

#### Principle 9: No compensation (Avoid cross-subsidization)

The income and costs of one service cannot be compensated with those from another service.

#### Principle 10: Reconciliation

The cost accounting system must be based on financial accountancy.

### **4.1.1. Best practice in accounting principles**

The ten accounting principles above can be summarised in the following three key principles (keeping the other seven in mind) that cost accounting systems must follow:

- **Causality:** Revenue (including transfer charges), costs (including transfer charges), assets and liabilities should be allocated to cost components, services and businesses or disaggregated businesses in accordance with the activities which cause the revenues or the costs.
- **Objectivity:** The allocation of revenues and costs shall be objective and not intended to benefit the SMP operator or any other operator, product, service, component, business or disaggregated business.
- **Transparency:** The allocation methods used should be transparent. Costs and revenues, which are allocated to businesses or activities, shall be separately distinguished from those that are apportioned.

## **4.2 Phase 2: Accounting separation: services included in the cost accounting model**

According to the paper “Reference Guideline on Accounting Separation”<sup>6</sup>:

“An accounting separation system is a comprehensive set of accounting policies, procedures and techniques that can be applied to the preparation of financial information that demonstrates compliance with non-discrimination obligations and the absence of anticompetitive cross-subsidies. The outputs from such a system must be capable of independent verification (auditable) and fairly present the financial position and relationship (transfer charge arrangements) between product and service markets. Using accounting separation, a National Regulatory Authority (NRA) imposes on the notified operator a set of rules on how accounting information should be collected and reported”.

Accounting separation should provide a systematic disaggregation of costs, revenues and capital employed for the different services included in the accounting model. It should also ensure that each

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<sup>6</sup> NATP-II Project Team, part of EU-funded project “New Approaches to Telecommunications Policy”: [http://www.natp2.org/ref\\_harm\\_reg/eng/Reference%20Guideline%20on%20Accounting%20Separation%20January%202007.pdf](http://www.natp2.org/ref_harm_reg/eng/Reference%20Guideline%20on%20Accounting%20Separation%20January%202007.pdf)



financial report includes only costs, revenues and capital employed that are relevant to the regulatory entities and services.

The availability of detailed, separated accounting information is important either to enable the auditor to provide an opinion as required by the NRA or for the NRA to carry out its own validation exercise.

When the NRAs conclude that the operator can make use of the dominant position, and clearly identify the potential anticompetitive behaviour in the specific market where the operator has a SMP position, then, *ex ante* obligations can be imposed, including cost accounting and accounting separation.

Accounting separation must respond to the market analysis carried out in the step 1 described above. That is to say, the accounting separation will affect the markets which compose the telecom sector of the specific country, and within them, it will affect the services included in each specific market<sup>7</sup>.

Table 1 shows the different categories of services that might be included in a cost accounting model of a fixed and mobile SMP operator.

| Fixed SMP Operator   | Mobile SMP Operator                     |
|----------------------|---|
| Access Services:     | Retail Services                         |
| Retail               | Wholesale Services                      |
| Wholesale            | National/International Roaming Services |
| Traffic Service      |   |
| Retail               |   |
| Wholesale            |   |
| Leased Lines         |   |
| Retail               |   |
| Wholesale            |   |
| Broadband Services   |   |
| Retail               |   |
| Wholesale            |   |
| Value Added Services |   |
| Retail               |   |

Table 1: Main business units<sup>8</sup> of a fixed and a mobile SMP operator

To facilitate compliance with obligations of transparency and non-discrimination by SMP operators, the national regulatory framework should empower NRA's to ensure that all accounting records, including data on revenues received from third parties, are provided on request.

<sup>7</sup> The current list of markets identified and recommended by the European Commission are:

Market 1: Retail fixed access

Market 2: Wholesale fixed call origination

Market 3: Wholesale call termination on individual fixed networks

Market 4: Unbundled local loops

Market 5: Wholesale local-tandem broadband access

Market 6: Terminating segments of leased lines excluding those of high capacity

Market 7: The termination of incoming calls on individual mobile networks

<sup>8</sup> It is important to point out that each business unit might include several services.



It is important to highlight that the *ex ante* obligation imposed on SMP operators will depend on the market definition and the typology of services included in each market previously defined in the market analysis.

### 4.3 Phase 3: Accounting period

The cost accounting models should use information from the previous fiscal year. Therefore, every year, the SMP operators should provide the income, costs and margins attributable to the different services. Moreover, the accounting results should be accompanied by the technical studies which guarantee the reliability and transparency of the allocation process. For instance, the allocation of fixed costs to the different services by means of a routing factor matrix (Table 2), calculated from an annual sample that provides the usage of each service in each network component.

|           | Network component 1 | Network component 2 | (...) | Network component N |
|-----------|---------------------|---------------------|-------|---------------------|
| Service 1 |                     |                     |       |                     |
| Service 2 |                     |                     |       |                     |
| (...)     |                     |                     |       |                     |
| Service N |                     |                     |       |                     |

Table 2: Example of a Routing Factor Matrix

### 4.4 Phase 4: Criteria for assets valuation

Prior to asset valuation, NRAs must verify that all assets which are causing the allocation of cost are in use and properly inventoried<sup>9</sup>.

Assets can be valued in the following ways:

- **Historic Costs:** Assets are valued at purchase price.
- **Indexation:** Appropriate indices are applied to historical costs values to express asset valuation in current terms. This type of valuation criterion is applied for instance to land and buildings, and as can be inferred, the critical variable is the identification of the correct index.
- **Absolute Valuation:** This is achieved by multiplying the existing number of assets by the current acquisition price; therefore, an inventory of existing assets is required for the auditory process. This valuation method is accurate when there is a technological change or large difference between the current value of the assets and the purchase value exists.
- **Modern Equivalent Asset (MEA):** This valuation criterion is accurate when besides a technical change, the asset with the same functionalities is no longer being marketed. Therefore, the aim is to calculate the cost of an analogous (replacement) asset.

As a consequence of the different criteria for valuation, different accounting models may be considered, as will be shown in section 4.6.

<sup>9</sup> The validation can be done by means of an external auditory

#### 4.4.1. Best Practice in assets valuation

There is not a best practice regarding asset valuation since, depending on the typology of the asset, one criterion could be more appropriate than another. Nevertheless, the following points can be taken into account:

- Historical cost can be used when:
  - i. The assets do not have significant value,
  - ii. The assets are not subjected to significant price variations,
  - iii. There is no technological change associated to the asset or the change is not significant, and/or
  - iv. The effect of revaluation would be immaterial.
- Indexation can be used when:
  - v. There has been no technological change regarding the asset or the change is not significant,
  - vi. The operator's databases deliver sufficient and accurate information about the asset subject to valuation, and
  - vii. The asset group is homogenous in relation to price changes.
- Absolute valuation will be used when:
  - i. The asset group is not homogenous in relation to price changes,
  - ii. There has been significant technological change regarding the asset or the asset group, and
  - iii. The operator's fixed asset information does not provide accurate data about the asset or asset group subject to MEA as a basis for valuation.
- Modern Equivalent Asset (MEA) should be used whenever it is possible, as it is the most accurate valuation criterion to reflect the cost of an efficient operator, since it will capture the associated costs (and efficiencies) that an entrant/alternative operator would face, if entering into the market at a specific time.

#### 4.5 Phase 5: Cost Standards

There are different methods for assessing the cost of individual services/products depending on the scope and type of costs to be taken into account (Figure 3). The implementation of one particular cost standard will have a significant impact on the costs of a service/product and, therefore, on the regulated wholesale prices as well.

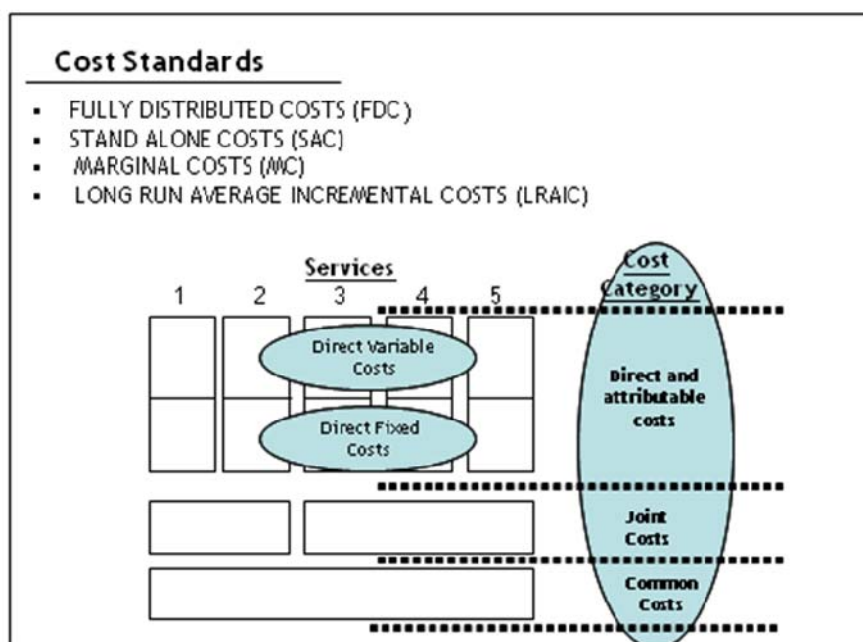


Figure 3: Cost Standards and Categories

Before describing the cost standards, the *categories of costs* that might be considered in each standard must be defined:

- Directly Attributable Cost

Directly attributable costs are incurred as a direct result of the provision of a particular service. There are two types of directly attributable costs:

- Direct variable costs are generated by input/output variation, so that, even if the output of more than one service requires input, the extent to which a single service causes the costs can be calculated.
- Direct fixed costs are assets and operating costs which are fixed with respect to the level of output but are service specific.
- Joint Costs

Joint costs are the cost of an input that produces outputs for two different increments in fixed proportions. It occurs when the production of one service requires that another be produced at the same time. Reducing the output of a single activity will not reduce joint costs; reducing the output of all activities will reduce these costs. In telecom there are joint costs among different time periods, so the creation of capacity to meet demand at the peak period automatically creates the same capacity for off-peak periods. Fixed common costs and joint costs make up common costs.

- Common Costs

Common costs refer to the cost of those inputs necessary to produce one or more services, which cannot be directly assigned to specific services. For example, transmission costs are common to all the services that use and share transmission capacity.

#### 4.5.1 Fully Distributed Costs (FDC)

This standard consists in allocating categories of costs, which can be directly or indirectly attributed to services. These categories of costs are: direct volume-sensitive costs, or direct variable costs, direct fixed costs, and a share of the joint and common costs (Figure 4).

In this regard, and as referred to in section 7.6, the proportion of joint and common costs must be allocated according to the causality principle. The main limitation of this cost standard is the subjectivity associated to the allocation of unattributable costs.



Figure 4: Accounting Standard: *Fully Allocated/ Distributed Costs*

#### 4.5.2 Stand Alone Costs (SAC)

SAC is a cost standard that measures the cost of providing a service by the operator in isolation to other services of the company. SAC comprises all directly attributable costs and all shared cost categories related to production of the service, thus it includes direct variable costs, direct fixed costs, common and joint costs. Under this allocation method, the shared costs are totally supported by the service that is to be provided in isolation (Figure 5).

The SAC cost standard does not lead to economic efficiency if used for pricing and resource allocation decisions. Clients of this service bear the burden of the total cost of resources that are used in the production of other services, thus creating cost discrimination among services and therefore among customers. However, it provides useful information about the highest costs that NRAs might consider in the wholesale price regulation, since the cost obtained by means of this standard will define the upper limit of the attributable costs.



Figure 5: Accounting Standard: *Stand Alone Costs*

### 4.5.3 Marginal Costs (MC)

This standard calculates the costs of increasing output by one additional unit. Therefore, the marginal costs includes only the direct variable costs excluding any other cost category, such as common and/or joint costs which should be recovered by means of specific mark-ups. In contrast to Stand Alone Costs, MC provides the lower limit in the wholesale price regulation (Figure 6).

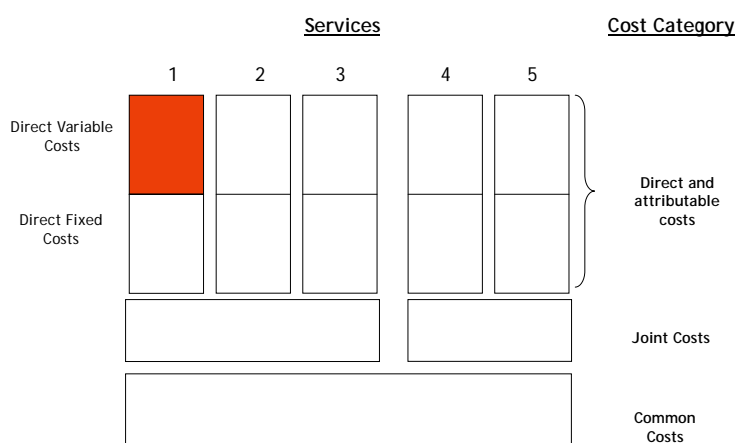


Figure 6: Accounting Standard: *Marginal Costs*

#### 4.5.4 Long-Run Average Incremental Costs (LRAIC)

LRAIC associates a long-term horizon with incremental costs. Incremental cost measures the cost variance when the production output increases or decreases in a discrete increment. In the particular case where the increment considered is a single unit, incremental costs equal marginal costs. Therefore, as mentioned for Marginal Costs, the LRAIC requires a mark-up to recover the joint and common costs in order to guarantee financial viability.

When the increment is substantial, not only the volume sensitive costs (direct variable costs) but other directly attributable costs are taken into account. Some capital and fixed costs are also incorporated into the cost of the service. In the long-term, all costs are treated as variables since the production capacity is no longer a constraint. Therefore, LRAIC include capital and direct variable costs related to substantial change in production (Figure 7).

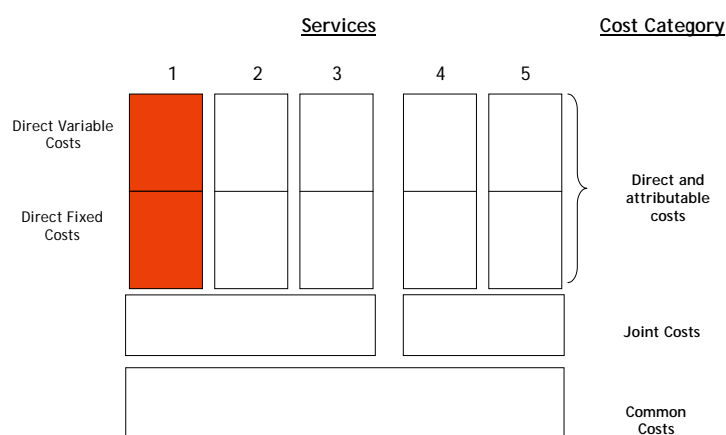


Figure 7: Cost Standard: *Long-Run Average Incremental Costs*

It is important to stress that this cost standard is recommended by the European Commission in Article 3 of Recommendation 98/195/EC, and most of the European NRAs have decided to transpose it.

In the telecommunications sector, the gap between LRAIC and SAC is particularly important. Indeed, most network elements are shared between several services, and hence the fixed common costs<sup>10</sup> represent large parts of the network (i.e. access network, core network, international network, etc.). Usually, different approaches are used to narrow the gap by adding some part of the joint and common costs by means of methodologies such as:

- Distributed LRAIC or mark-ups, and
- Consumption-based allocation.

Distributed LRAIC calculates the LRAIC cost of each component within a fixed common cost category, and distributes the difference between the cost category LRAIC and the sum of the components of

<sup>10</sup> Common costs can be either fixed common costs or variable common costs.

LRAIC on the components using an Equal Proportionate Mark-up (EPMU) (see section 6.6 for a more detailed explanation). In the same way, applying the opposite reasoning can reduce the SAC.

Consumption-based allocation consists in allocating the costs of fixed and common costs to products according to their consumption of resources. This approach follows principles close to FDC, using activity-based costing and network costing techniques.

#### 4.5.5 Best Practice in accounting methodology

Figures 8 and 9 show the distribution of accounting methodologies used in the European Union (EU-25) in the regulation of wholesale price, for the setting of fixed and mobile termination rates.

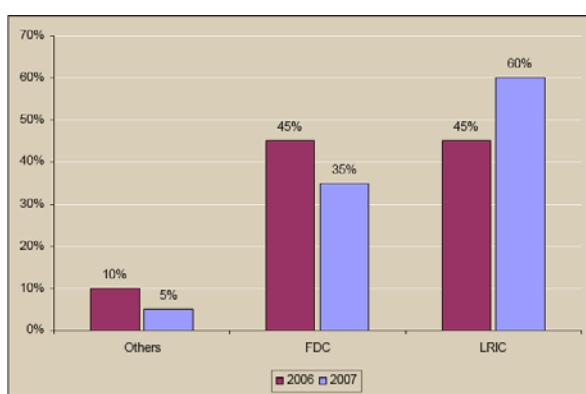


Figure 8: Accounting methodologies used by EU-25 in the setting of fixed termination rates

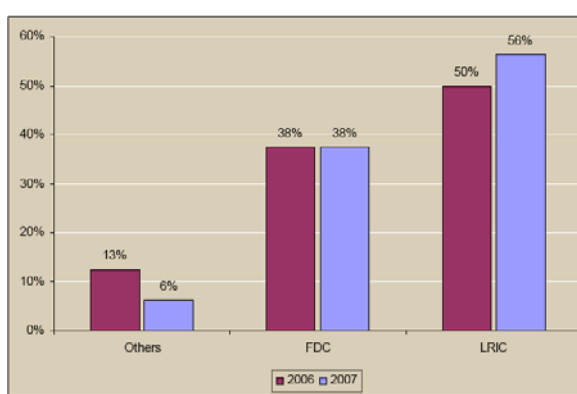


Figure 9: Accounting methodologies used by EU-25 in the setting of mobile termination rates

Source: ERG RA-PT 2007

As can be seen from Figure 8, from 2006 to 2007, there was a significant increase in the percentage (from 45% to 60%) of countries using LRIC to set fixed termination rates. As a consequence of this trend, a sharp reduction in the percentage of countries using FDC and “other methodologies” has been registered, FDC fell from 45% to 35% and “other methodologies” fell from 10% to 5%.

Regarding the market of mobile termination rates, the most used accounting methodology is the LRIC (Figure 9). The percentage of countries using this methodology passed from 50% in 2006, to 56% in 2007. During the same period, while the percentage of countries using FDC remained stable, the percentage of countries using other methodologies decreased by 50%.

#### 4.6 Phase 6: Types of cost accounting models

Cost accounting models require cost standards to properly allocate the different costs to the services included within the model. However, and due to the fact that the Telecommunication Sector is very capital intensive, the assets valuation becomes crucial. Thus, cost accounting models deal with the criteria used in asset valuation.

Figure 10 shows the different cost accounting models that can be defined by NRAs and that will be described in this section. It is important to highlight that, since telecommunications networks are characterised by economies of scale and scope, regulators and governments need to avoid any unnecessary duplication of network infrastructure that increases the cost base of the industry as a whole.

In fact, the role of regulators should be to take the necessary steps to replicate a competitive market where, for example, interconnection charges should be based on current costs to reflect Build-Buy decisions faced by new entrants.

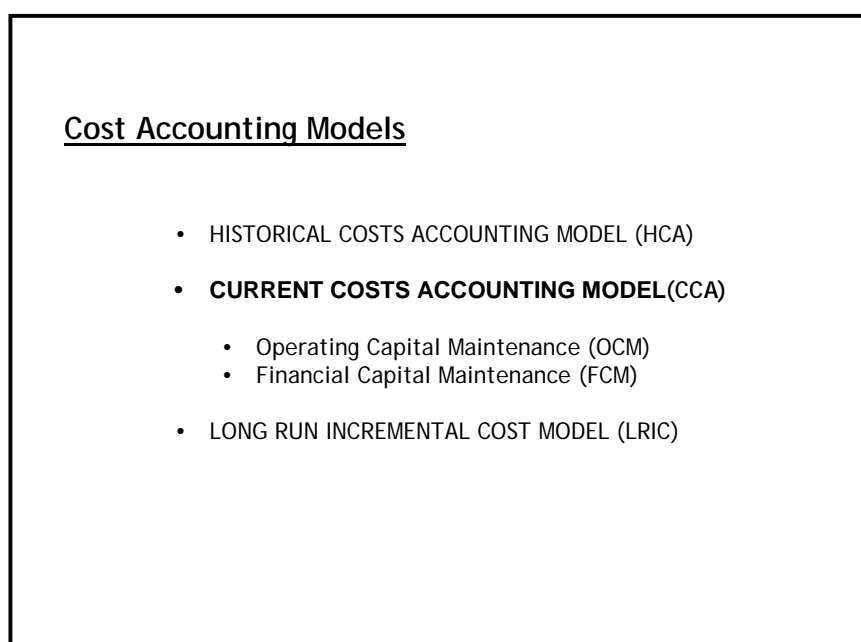


Figure 10: Cost Accounting Models

#### **4.6.1. Historical Cost Accounting Models (HCA)**

In the past, most cost models were based on Historical Cost Accounting (HCA). Such models use historical information provided by statutory accounting systems. However, some flaws are apparent when considering this model, such as:

- The valuation of assets may not consider the evolution in price of equipment over time, where purchase prices can significantly increase or decrease. This would affect the value of assets, and the setting of wholesale prices, which could be based on a cost structure that is different to the one that entrant operators could face at the real moment of entry.
- Historical accounts cannot incorporate the impact of continuously evolving technologies; therefore, since this model focuses on the past, it reflects all inefficiencies (i.e. regarding the company processes or organization) that result from past decisions taken by the operator. Hence, HCA cannot ensure that costs are those of an operator employing modern technologies.

As a consequence of these limitations, if NRAs decide to use HCA models to set wholesale prices, the reference costs do not take into account the technological changes and the improvement in the production process. Since a new entrant willing to build a network would be paying the current price and not the historical price, existing assets should be reassessed at their current value. Therefore, HCA captures all the inefficiencies.



#### 4.6.2. Current Cost Accounting Models (CCA)

CCA models provide reliable costs relative to the existing reality of the market. In particular, CCA considers the costs that an operator would have incurred in the past by using current prices and technology. This implies that all resources be reassessed at their current cost and that the assets that are not longer available in the market should be evaluated by the Modern Equivalent Asset (MEA) valuation criterion (Section 4.4). Theoretically, CCA captures the efficiencies from innovation and price evolution.

There are two alternative approaches for CCA depending on the treatment of the capital which is required to be maintained before profit is recognized, i.e. capital expenditure (CAPEX). This issue is of great importance for the measurement of profits available for distribution in the Profit and Loss account, but it also affects the division between capital and retained profits in the balance sheets:

- Operating Capital Maintenance (OCM). This approach is concerned with ensuring that the physical output capability of the assets of the company (i.e. the operating capability or production capacity) at the end of the year should be the same as at the beginning of the year. In this approach, revenues become profits after a sufficient amount has been provided to maintain the physical capability of the assets. Therefore, under OCM, profit is only measured after provision for replacing the output capability of a company's physical assets has been made. Generally, this would require the application of specific inflation index to the values of the company's assets. The Profit and Loss account only includes adjustments derived from additional depreciation for the period determined on the current value of assets. The adjustments considered are:
  - i. Under OCM the gross book value of assets is revaluated to take into account the specific price changes in the price of assets and changes in technology. One way of calculating the current cost of assets is to apply specific price indices to the existing gross book value of assets. These may be derived from the company's procurement department. Alternatively, MEA valuation methods may be used; this methodology calculates the value of assets on the current cost of modern equivalent assets subject to cost abatements.
  - ii. The depreciation charge for the year is calculated on the basis of the new asset valuations. Then, a supplementary depreciation must be considered which can be defined as the difference between historical cost depreciation and current cost depreciation charges. It may be positive or negative depending on whether the value of assets is rising or falling.
- Financial Capital Maintenance (FCM). This approach is concerned with maintaining the real financial capital of the operator and with its ability to continue financing its functions. Capital is assumed to be maintained whenever shareholders' funds at the end of the period are maintained in real terms at the same level as at the beginning of the period, i.e. the operators maintain their purchasing power. Under this approach, profit is, therefore, only measured after provision to maintain the purchasing power of operating financial capital has been made; therefore, inflation rates need to be taken into account.
- Under FCM the Profit and Loss account, on top of considering the adjustment related to additional depreciation for the period year-on-year variation in net current value of an asset, the inflationary effect (either on own funds or on net value of individual assets valued at current costs) is assumed as well.

The use of the OCM concept may systematically incorporate insufficient or excess returns into the level of allowed revenue (depending, respectively, on whether asset-specific inflation was expected to be

lower than or higher than general inflation). This is not a desirable feature of any regulatory regime, as it would not provide appropriate investment incentives. Under FCM, however, the returns to the providers of capital would equal the required return (as measured by the cost of capital) irrespective of whether replacement costs were rising or falling relative to general prices.

Hence, if current cost accounting information is used as the basis to determine interconnection charges, FCM is the preferred capital maintenance concept. In this regard, the European Commission, in its Recommendation of April 8, 1998, stated that FCM is the preferred approach:

*“The use of the OCM concept may systematically incorporate insufficient or excess returns into the level of allowed revenue (depending, respectively, on whether asset-specific inflation was expected to be lower than or higher than general inflation). This is not a desirable feature of any regulatory regime, as it would not provide appropriate investment incentives. **Therefore FCM is the preferred capital maintenance concept**”.*

#### 4.6.3. Long-Run Incremental Cost (LRIC)

On the basis of forward looking costs incurred by an efficient operator, LRIC models provide the cost of a whole service or a defined increment<sup>11</sup>. This increment can be defined as the quantity of output for which the incremental cost is being measured. An increment may be defined in terms of a product, product portfolio, intermediate products or activities, or any combination or sub-division thereof.

When the increment is of just one unit, then the incremental costs is equal to the marginal costs. Therefore, the incremental cost can be defined as the total costs associated with total production including the increment minus the total costs associated with total production excluding the increment. Thus, the LRIC increment can be defined in two complementary ways<sup>12</sup>:

- It is the additional cost a firm incurs in the long run in providing a particular service as a whole, assuming all its other production activities remain unchanged;
- It is the total cost a firm would avoid in the long run if it ceased to provide the service.

Therefore, LRIC cost modelling includes only those costs that are caused by the provision of a defined increment of output, or, alternatively, those costs that are saved when the defined increment of output is no longer provided.

The allocation of costs under a LRIC model is done by means of the so called Costs Volumen Relationships (CVR). The aim of identifying a CVR is to be able to demonstrate how costs change as the volume of the cost driver is altered.

In many jurisdictions, regulators set interconnection prices based on LRIC, for example, New Zealand, Australia, the United Kingdom, the European Community, and the United States. The most common form of LRIC is Total Service Long Run Incremental Cost (TSLRIC), known as Total Element Long Run Incremental Cost (TELRIC) in the United States.

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<sup>11</sup> The main difference between the LRIC and LRAIC is that LRIC models do not include the fixed costs whereas the LRAIC do.

<sup>12</sup> ERG COMMON POSITION: Guidelines for implementing the Commission Recommendation C (2005) 3480 on Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications.

#### 4.6.4. Best Practice in current cost accounting models

According to the European Regulatory Group (ERG) report on Regulatory Accounting in Practice for 2007, the cost based standards used by the EU-25 members in each of the following 18 markets included in the Recommendation on relevant markets susceptible to *ex ante* regulation, as shown in Figure 11, are the following:

- Market 1: Access to the public telephone network at a fixed location for residential customers.
- Market 2: Access to the public telephone network at a fixed location for non-residential customers.
- Market 3: Publicly available local and/or national telephone services provided at a fixed location for residential customers.
- Market 4: Publicly available international telephone services provided at a fixed location for residential customers.
- Market 5: Publicly available local and/or national telephone services provided at a fixed location for non-residential customers.
- Market 6: Publicly available international telephone services provided at a fixed location for non-residential customers.
- Market 7: The minimum set of leased lines.
- Market 8: Call origination on the public telephone network provided at a fixed location.
- Market 9: Call termination on individual public telephone networks provided at a fixed location.
- Market 10: Transit services in the fixed public telephone network.
- Market 11: Wholesale unbundled access (including shared access) to metallic loops and sub-loops for the purpose of providing broadband and voice services.
- Market 12: Wholesale broadband access.
- Market 13: Wholesale terminating segments of leased lines.
- Market 14: Wholesale trunk segments of leased lines.
- Market 15: Access and call origination on public mobile telephone networks.
- Market 16: Call termination on public mobile telephone networks.
- Market 17: International Mobile Roaming.
- Market 18: Broadcasting.

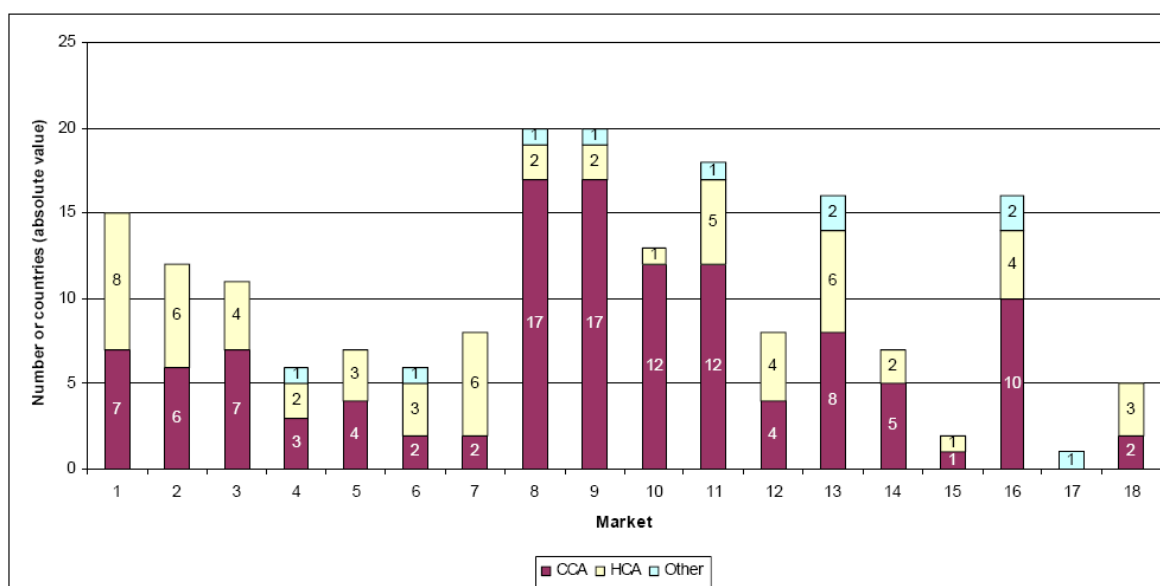


Figure 11: Cost standards used in each EU regulated telecommunication market  
Source: ERG RA-PT 07

Note: The numbers included in the above figure correspond to the above markets defined by the EC in Recommendation 2003/311/EC, of February 11, 2003.

#### 4.7 Phase 7: Internal transfer

Accounting separation can identify anticompetitive behaviour such as cross-subsidies or discrimination. In this regard, a key aspect in accounting separation is the internal transfer charge which guarantees that no discrimination occurs between the services provided within the branches of the SMP operator with respect to the same set of services provided to alternative (competitors) operators.

Therefore, cost accounting models deal with the allocation of costs to the different services. This should reflect the different internal transfer charges and allow NRAs to track the non discrimination principle between the SMP and its branches and the relationship between the SMP and the alternative operators.

In summary, accounting separation ensures transparency and no discrimination, and cost accounting models allow NRAs to see whether SMP operators charge the same prices internally and externally.

### 5 Top-down vs Bottom-up models (Step 4)

NRAs have the following two approaches to determine the cost of providing the telecommunication services that comprise the market in which the operator has been designed as SMP:

- The top-down approach starts with the company's accounts and adapts the basis of calculation to meet the cost standard.
- The bottom-up approach develops a cost accounting model beginning with the expected demand in terms of subscribers and traffic. It then assesses the network design and related costs based on the network engineering model.

Top-down models take known data while bottom-up models start with a blank page. Under identical assumptions, top-down and bottom-up models should lead to the same results. However, in practice assumptions are never identical, making reconciliation between both models incredibly difficult. Bottom-up models were initially developed as a tool to tackle the lack of information provided by the SMP operators. They are used either as a primary model by the NRA to set tariffs, or as a tool to challenge the model of the SMP operator when appropriate. However, although bottom-up models can be built with less information from the operator, the quality of such models is largely determined by the assumptions made and by the limitation of external data available.

Thus the attributable costs of the different services can be obtained either from a top-down model or a bottom-up model. In this section, the methodology for top-down and bottom-up models are presented, as well as the steps to be followed in cost allocation and further regulation on wholesale pricing. Both methodologies have strengths and weaknesses. Indeed, top-down models capture all the cost categories so that under this regime, the regulated operators will be able to recover all the costs. However, top-down models might fail in the definition of network efficiency. On the other hand, bottom-up models are very efficient in terms of network design, but are less rigorous in the allocation of the different cost categories.

Consequently, the usage of hybrid models that capture the efficiency of bottom-up models and the cost allocation criteria of top-down models is becoming increasingly popular.

### **5.1 Description of bottom-up models**

Bottom-up models are based on a theoretical approach by defining the most efficient network that an operator would choose when entering the market. Therefore, bottom-up models first theoretically define the most efficient network and then determine which would be the costs attributable to the services of that theoretical network.

Depending on the network structure used as a departing point, NRAs might consider two different approaches, as described in Figure 12.

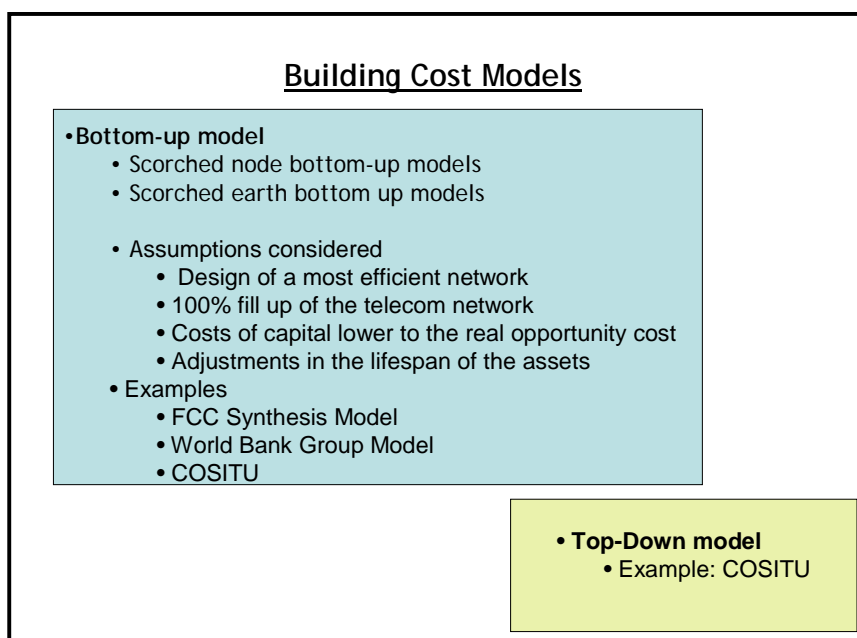


Figure 12: Top-down vs bottom-up models

### Scorched node bottom-up models

These models start with the network designs of the established operator and introduce adjustments in the node structure in order to get a more efficient network.

### Scorched earth bottom-up models

These models start with a theoretical network which is assumed to be the most efficient network, thus ignoring the node structure of the incumbent operator. Therefore, the network design has been unproven in reality and it is just an engineering approach that tries to figure out which network design would be the most cost efficient for an operator implementing the most efficient network structure.

Both approaches are made up of a list of hypotheses about the network structure and about the demand behaviour that need to be contrasted and validated.

If wholesale prices are set by means of one of these two bottom-up models, NRAs must be aware that the resulting costs can not be further reduced and a mark-up should be added to recover the joint and common costs that guarantees a reasonable rate of return and encourages investment.

### Assumptions considered

The results obtained from bottom-up models depend at least on the assumptions considered in the following variables, so that NRAs should have some control over them and must try to keep them as realistic as possible:

- Design of a most efficient network

This assumption implies that bottom-up models might not consider any buffer in the capacity or any kind of redundancy of equipment needed in the provision of the telecom services. As a

consequence, there is some equipment which is eliminated from the network dimension based on the fact that they are not needed (or efficient) from a theoretical point of view. However, in reality they have been shown to be needed to guarantee the continuity and the quality standards of the telecom services.

This assumption could also lead NRAs to a situation where, in a scenario of high investment, there is a migration of all traffic from the former technology to the new one. Moreover, the assumption also implies that the network is in use during the whole day, that is to say, there is not any type of “inefficiency” in the network dimensioning.

Therefore, the issue of most efficient operator should be based on a dynamic and a prospective approach linked to the behaviour of the demand, which eventually determines the success or failure of the undertaken investment.

- 100% fill up of the telecom network

The assumption of full usage of the telecom network is not adjusted to reality since the telecom network needs to be dimensioned, taking into account a buffer which allows the provision of peak demand. The consideration of this assumption in bottom-up models might not capture either how a peak or a drop in demand would affect the re-dimension of the network and the associated costs.

- Costs of capital lower than the real opportunity cost

As a consequence of the above mentioned assumptions, the capital expenditure (CAPEX) could be underestimated since not all equipment used in the provision of communication services would be considered. On top of that, there may be an underestimation of the risk associated to the investment and possibly, the opportunity cost recognised, measured by the Weighted Average Cost of Capital (WACC, see section 6.1 for a detailed explanation), will be set below the real opportunity cost that the operator has to face in a given investment project.

- Adjustments in the lifespan of the assets

The modifications in the lifespan of assets affect cash flow and eventually the business plan of an operator which decides to invest and deploy its own network. It is worthwhile thinking about the consequences of these modifications, taking into account the effects of technological change, which *per se*, reduces the number of years in which an operator can depreciate an asset. Thus, bottom-up models could depart from the asset life span approved by the NRAs.

Figure 13 summarises the steps to be followed in building a bottom-up model.

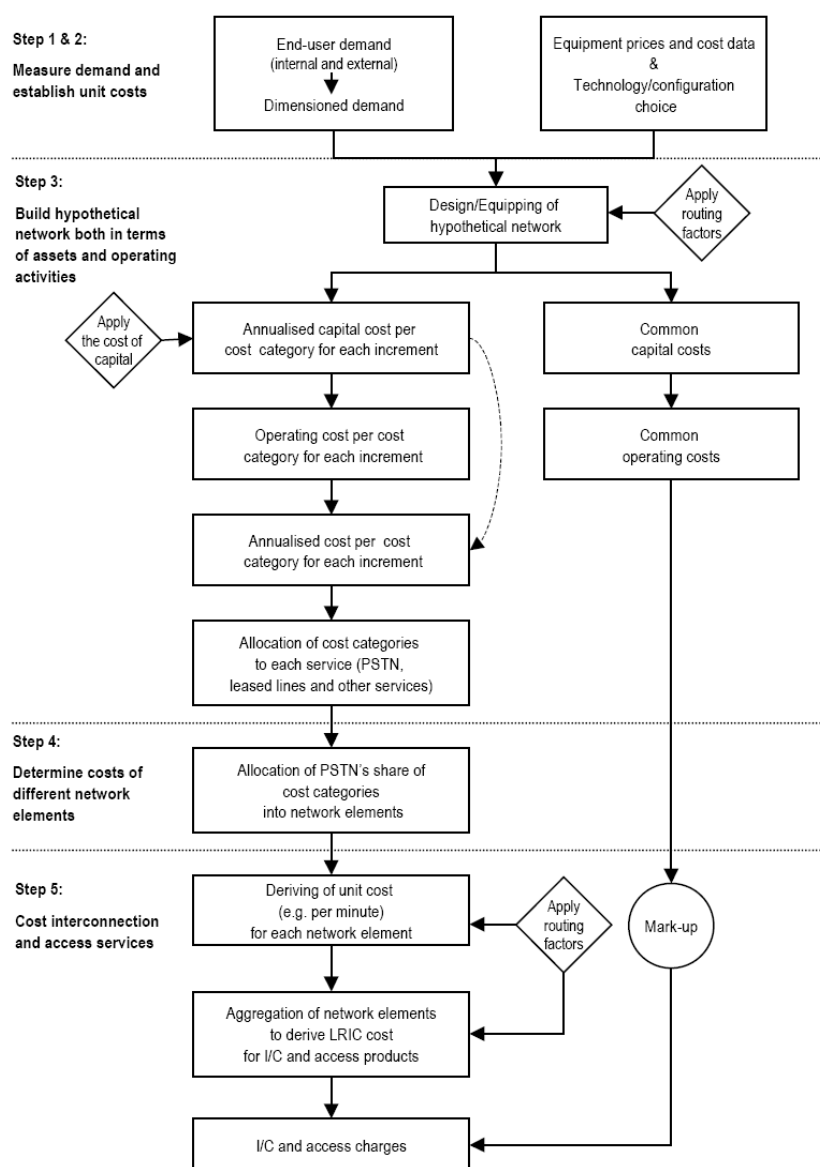


Figure 13: Steps in building a LRIC bottom-up model (Source: PTS-2002)

### Steps 1 and 2: Measure demand<sup>13</sup> and establish unit costs.

These steps set the basis of the bottom-up models since by measuring the demand, NRAs will be able to properly dimension the network and specify the equipment requirements that will allow provision of the telecommunication services. Thus, the information on demand will be crucial to determine the correct

<sup>13</sup> More detailed explanations and examples on how to assess and measure demand can be found on the ICT Regulation Toolkit website: <http://www.ictregulationtoolkit.org/en/Section.3335.html>



network dimension and equipment requirements and subsequent capital expenditure which will be an important part of the attributable costs of different services provided.

**Step 3:** Build hypothetical network both in terms of assets and operating activities

This step consists in defining the network and the efficiency criterion that will be used. As aforementioned, the hypothetical network will be different depending on whether a scorched earth or a scorched node bottom-up model is considered.

**Step 4:** Determine costs of different network elements

In this stage, the definition of four specific aspects is of particular importance:

- i) The asset valuation criteria,
- ii) The weighted averaged cost of capital (WACC),
- iii) The life span of the assets,
- iv) The depreciation criteria.

In this step, the capital expenditure (CAPEX) will be determined once the optimal equipment requirements to satisfy demand are known, as specified in step 1, by means of the efficient network built in step 3.

**Step 5:** Cost interconnection and access services

The final step in the bottom-up process will be to cost the various services to be provided. First, the sum of the capital costs and operating costs needs to be calculated to give a per-unit cost for each network element. Finally, a mark-up is added to include a share of the common costs in the cost of the service.

**5.1.1 Examples of bottom-up models: The Federal Communications Commission (FCC) Synthesis Model and the World Bank Group Model (WBG)**<sup>14</sup>

**FCC Synthesis Model**

The FCC Synthesis Model is an example of a “bottom-up” TSLRIC model. The Federal Communications Commission used this model to determine high-cost universal service support for non-rural areas in the United States. The model, that has been adapted by some regulators internationally (for example by New Zealand’s Commerce Commission), allows the user to change various inputs from their default values, to tailor the model to different requirements. The specific steps in the model are:

**Step 1:** The model starts with a database of geocoded customer locations.

**Step 2:** The clustering algorithm of the model then groups the locations into small geographic areas. This grouping must satisfy a number of constraints. For example they must be consistent with the predefined maximum length for copper cables, maximum number of lines (or households), that can efficiently be served by equipment such as remote terminals. The resulting geographic areas are intended to approximate the distribution serving areas that an engineer would design.

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<sup>14</sup> ICT Regulation toolkit: <http://www.ictregulationtoolkit.org/en/Section.2129.html#FCC#FCC>

**Step 3:** Once geographic areas are identified, the model designs facilities routes:

- Feeder routes between switches and either a remote terminal or serving area interface within the cluster,
- Distribution routes between the remote terminal or serving area interface and customer locations, and
- Interoffice routes between switch locations.

**Step 4:** The model determines the specific amounts of network facilities needed to provide service along the routes determined in Step 3. Network facilities include:

- Copper and fibre cables,
- Support structures such as telephone poles and underground conduits,
- Remote terminals, and
- Switches.

**Step 5:** Estimate the investment that would be required to build the model network. This requires unit price inputs corresponding to each type of facility. The FCC Synthesis model contains hundreds of such price inputs.

**Step 6:** The model determines the annual costs and corresponding unit costs for the form in question in the typical manner used by bottom-up TSLRIC models.

### **World Bank Group (WBG) model**

The WBG's cost model was designed to develop usage costs (including interconnection costs) for developing countries in sub-Saharan Africa. The model represents the components of a fixed (wire line) network suitable for African conditions, up to remote switching units. Unlike the FCC synthesis model, the WBG model does not depict the local loop facilities used to connect end-use customers to the first switching point. This method takes into account most features characterizing the development stage of telecommunications networks, i.e.:

- Small size of fixed network,
- Importance of rural telephony,
- Excessive reliance on microwave technology, and
- Explosive demand for mobile service.

Hence, this method is applicable to countries with telecom network development characterized by these features.

The WBG model allows the user to change various inputs from their default values. Inputs that can be changed include:

- Network equipment prices, and additional mark-ups that might apply to purchase and install equipment in developing countries,
- Traffic and demand information, such as calls per line and routing tables,

- Total lengths for important network facilities, such as metres of fibre cables of particular capacities, and metres of duct facilities, and
- Cost of capital inputs.

## 5.2 Description of Top-Down Models

Top-down models depart from financial accounting and allocate the operating costs and capital expenditure to the different services (Figure 14).

As defined by Sweden's Regulator,<sup>15</sup> the procedure to build a top-down model can be summarised in five steps:

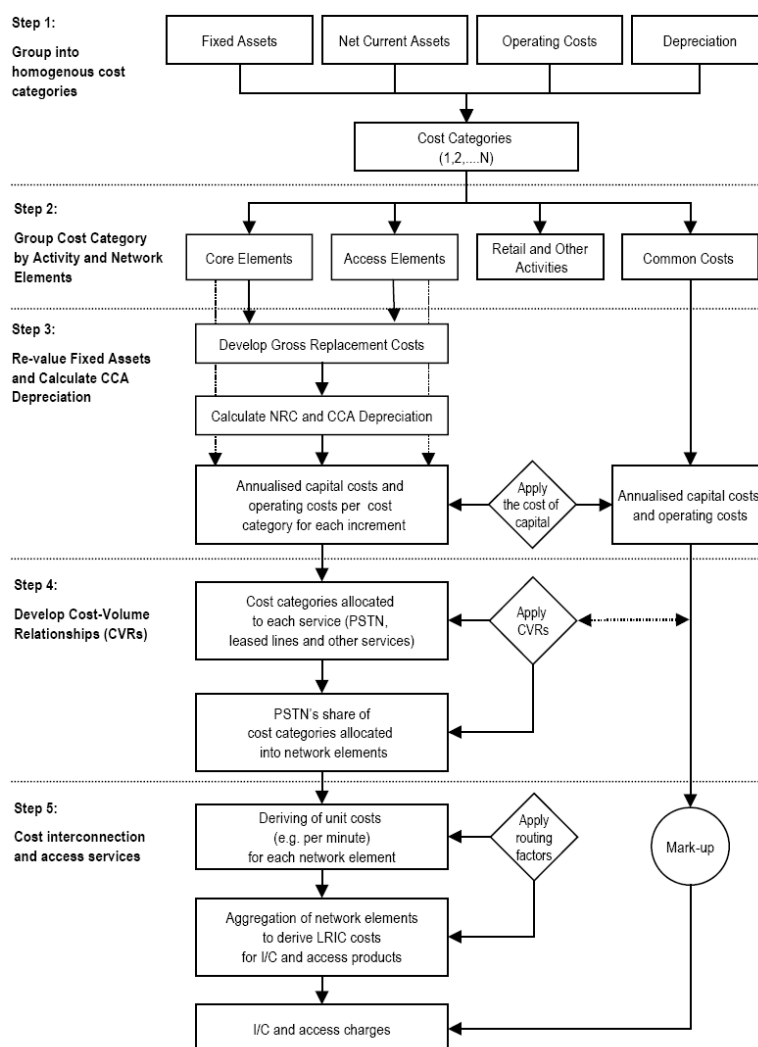


Figure 14: Steps in building a LRIC top-down model (Source: PTS-2002)

<sup>15</sup> Guidelines for the LRIC bottom-up and top-down models. 13 September 2002.

**Step 1:** Group into homogeneous cost categories

This step consists in grouping the costs with similar characteristics into individual cost categories also referred to as homogeneous cost categories.

**Step 2:** Group cost category by activity and network elements

The second step consists in identifying the different activities and allocating costs to them. It is important to stress that there will be direct costs which can be easily allocated but also cases where there is not a direct correspondence between the operating costs and the services.

**Step 3:** Re-value fixed assets and calculate current cost accounting depreciation

At this stage, the assets are revaluated according to the criteria described in section 4.4. It is important to highlight that the WACC and the lifespan associated to each category of assets should be defined in this step.

**Step 4:** Develop cost-volume relationships (CVRs)

In LRIC top-down models, CVRs trace how the individual costs vary with the volume of service or network element. Figure 15 illustrates the key parameters of the relationship between costs and volume. The greater the gradient of the curve, the larger the marginal costs whereas, the higher the cross point with the axis, the greater the fixed and common costs.

Figure 15 also shows the different typologies of CVRs that might be found in a LRIC top-down model.

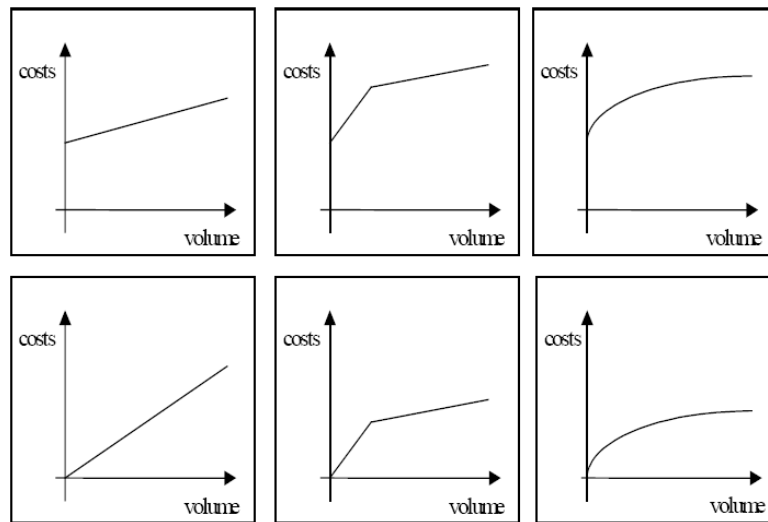


Figure 15: Types of cost-volume relationships (Source: PTS-2002)

**Step 5:** Cost interconnection and access services

Finally, this step calculates the unitary costs of each service taking into account the category of cost identified in Step 1, the set activities from Step 2, the assets valuation criteria from Step 3, and the cost allocation by means of CVRs from Step 4. A mark-up could be added to the unitary costs to allow the SMP operator to recover common costs.

### 5.2.1 Examples of top-down models: COSITU

COSITU is an example of a top-down cost model<sup>16</sup>. COSITU is based on an enhanced fully distributed cost standard, as adopted in the ITU-T D series of Recommendations.

This model requires the following input data:

- Investment and expense data from accounting systems,
- Current cost data to convert historical capital asset costs to current costs. For example, when accounting records report the purchase price of a switch, the model calculates the cost of the switch at current purchase prices,
- Inputs for depreciation and cost of capital,
- Traffic information and routing data, and
- Current tariffs.

COSITU produces unit costs and prices for international, national, sub-regional, and regional calling, both fixed and mobile and interconnection rates. By using the simulation tool, the effects of universal service funding, taxes, and any access deficit as mark-ups over current unit costs could be estimated.

To the extent that accounting and demand data are available, COSITU's basic modelling framework can be used to model interconnection costs for both fixed and mobile networks.

COSITU embodies the following principles:

- Transparency: Information used in the cost derivation process should be openly available, so that external analysts can comprehend the final rate.
- Practicality: The demands of the costing methodology with respect to data availability and data processing should be reasonable, to keep the costing exercise economical yet still useful.
- Causality: The model should demonstrate a clear cause-and-effect relationship between service delivery, on the one hand, and the network elements and other resources used to provide the service, on the other hand, taking into account relevant cost determinants (cost drivers).
- Contribution to common costs: The cost calculation should provide for a reasonable contribution to common costs.
- Efficiency: The cost calculation should provide a forecast of cost reductions that are likely to result from more efficient use of resources over time.

COSITU is a top-down model that accommodates both top-down and bottom-up models. Nevertheless, the initial stage for the application of the bottom-up model should be prepared outside the model.

### 5.2.2 Best Practice

There is not a best practice in this section. Each NRA, depending on the information and the purposes of the regulatory policy that is intended to be implemented, could have either a bottom-up, a top-down model, or even a hybrid model. Thus the FCC synthesis model and World Bank Group model are both bottom-up TSLRIC models whereas COSITU could be classified as an hybrid of both bottom-up and top-down model.

Table 3 shows the advantages and disadvantages of each alternative.

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<sup>16</sup> ICT Regulation toolkit: <http://www.ictregulationtoolkit.org/en/Section.2129.html#FCC#FCC>

### TOP-DOWN MODELS

| Advantages  | Disadvantages  |
|---|--|
| Captures the total costs associated to the provision of the different services<br>Can be easily reconciliated with financial statements | Requires a high level of confidentiality<br>It is time consuming<br>Might include inefficiencies |

### BOTTOM UP MODELS

| Advantages  | Disadvantages  |
|---|--|
| Captures the efficiency of the production process in terms of costs<br>Relatively easy to implement | Tends to underestimate or ignore important costs<br>modelled network differs from existing network |

### HYBRID MODELS

| Advantages   | Disadvantages   |
|--|---|
| Captures reality and allows the SMP Operators recovering all the cost categories<br>Captures efficiency in the network | Requires a defined timeschedule: First a bottom up model, then a top down model finally a reconciliation of both models |

Table 3: Advantages and disadvantages of top-down and bottom-up models

Table 4 shows details of accounting models used in France, Italy, Spain, UK and Germany, including operator activities, pricing and cost orientation.

| Country | Markets/activities   | Pricing rule set by NRA?  | Where cost orientation, methodology mandated by NRA         |  |  |
|---------|--|---|---|--|--|
|         |  |   | Cost base   | Cost standard  | If LRIC, bottom-up (BU), top-down (TD) or reconciliation of the two models |
| FRANCE  | Interconnection  | Cost orientation  | Current   | LRAIC  | Reconciliation   |
|         | LLU  | Cost orientation  | Economic current costs                                      | LRAIC  | Reconciliation   |
|         | WBA (at regional level)  | Reasonably efficient entrant test   | -   | -  | -  |
|         | WLR  | Retail minus (12.5%)  | -   | -  | -  |
| ITALY   | Interconnection  | Cost orientation  | Historic (access network)<br>Current (transport network)    | FDC  | -  |
|         | LLU  |   |   |  |  |
|         | Bitstream access (cost orientation of bitstream access services at DSLAM and parent switch levels only)    |   |   |  |  |
|         | Wholesale leased lines   |   |   |  |  |
|         | Fixed call termination by Alt. Network Ope.  | Cost orientation  | Research under way  | LRAIC  | BU   |
|         | WLR  | Retail minus  | -   | -  | -  |
| SPAIN   | Retail access (*)  | Cost orientation  | Historic and current costs (Telefónica has to provide both) | Multi-standard approach<br>FDC based on historic and current costs.<br>Transition towards LRIC foreseen (see next column). | Not yet applicable.  |
|         | Call origination provided at a fixed location WLR  |   |   |  |  |
|         | Call termination provided at a fixed location  |   |   |  |  |
|         | Local Loop Unbundling  |   |   |  |  |
|         | Wholesale broadband access   |   |   |  |  |
|         | Wholesale terminating segments of traditional leased lines excluding leased lines with Ethernet interfaces |   |   |  |  |
|         | Retail calls markets   |   |   |  |  |
|         | Retail market for a minimum set of leased lines  |   |   |  |  |
|         | Transit services   |   |   |  |  |
|         | Wholesale trunk segments of leased lines   |   |   |  |  |
|         | Wholesale terminating segments of leased lines with Ethernet interfaces                                    | Retail minus: Prices must allow competitors to replicate Telefónica's retail offers | -   | -  | -  |

Table 4: Accounting models used by Regulators

(\*) In Spain, in the case of Telefónica, the retail access is part of the cost accounting to guarantee the non existence of access deficit.

| Country | Markets/activities  | Pricing rule set by NRA?  | Where cost orientation, methodology mandated by NRA |               |   |
|---------|---|---|---|---------------|---|
|         |   |   | Cost base   | Cost standard | If LRIC, bottom-up (BU), top-down (TD) or reconciliation of the two |
| UK      | Fixed interconnection, terminating and trunk leased lines | Cost orientation  | Current   | FAC and LRIC  | TD  |
|         | LLU and WLR   | Price cap<br>▪ Ceiling for rental charge for fully unbundled loop based on FAC<br>▪ Ceiling for other charges based on LRIC plus mark-up for common costs | Current   | FAC and LRIC  | TD  |
|         | WBA   | Price squeeze test  | -   | -             | -   |
| GERMANY | Interconnection   | Cost orientation (based on the costs of an efficient operator).   | Forward-looking costing based on current costs.     | LRAIC         | Reconciliation  |
|         | LLU   |   |   |               |   |
|         | IP-bitstream (sub-regional wholesale conveyance)          |   |   |               |   |

Table 4 (cont.): Accounting models used by Regulators

## 6 Approval of key parameters in cost accounting models: The WACC and the life span of the assets (Step 5)

### 6.1 The Weighted Average Cost of Capital (WACC)

The WACC reflects the opportunity costs of the investment taking into account the capital structure of the operator, i.e. percentage of equity and debt.

Every year SMP operators will have to make a proposal about the WACC to be considered in the cost accounting system. Then, the NRA revises the proposal and eventually approves it. This parameter is essential for the determination of costs allocated to the different services, since it is directly related to capital expenditure (CAPEX), as shown in the following expression:

$$CAPEX = (Gross\ Value - Cumulated\ Depreciation) \cdot WACC$$

The WACC can be defined as:

$$WACC = \left[ Ke \times \frac{E}{D + E} \right] + \left[ Kd \times (1 - t) \times \frac{D}{D + E} \right]$$



Where:

**$K_e$**  is the return required by equity-holders

**$K_d$**  is the return required by debt-holders

**$E$**  is the market value of equity

**$D$**  is the market value of the debt

**$t$**  tax

The methodology to be followed by NRAs for the estimation of each parameter is defined as a continuation:

- **$K_e$** : Equity-holders expected return

The methodology used to estimate the value of this parameter is based on the Capital Asset Pricing Model (CAPM) as can be inferred from the following expression:

$$k_e = r_f + \beta \cdot (E_m - r_f)$$

Where:

$r_f$  is the return of risk less assets such as the Government Treasury Bonds<sup>17</sup>

$\beta$  represents a proxy of the perceived risk for the company. When the operator is not quoted on the stock exchange, it can be estimated by means of a portfolio of comparable operators.

$E_m - r_f$  is the market risk premium<sup>18</sup>

- **$K_d$** : Return required by debt holders

This parameter will be the result of adding to the risk free asset rate a premium related to the perceived risk of the debt that the operator holds.

- **$E$  and  $D$** : Capital structure

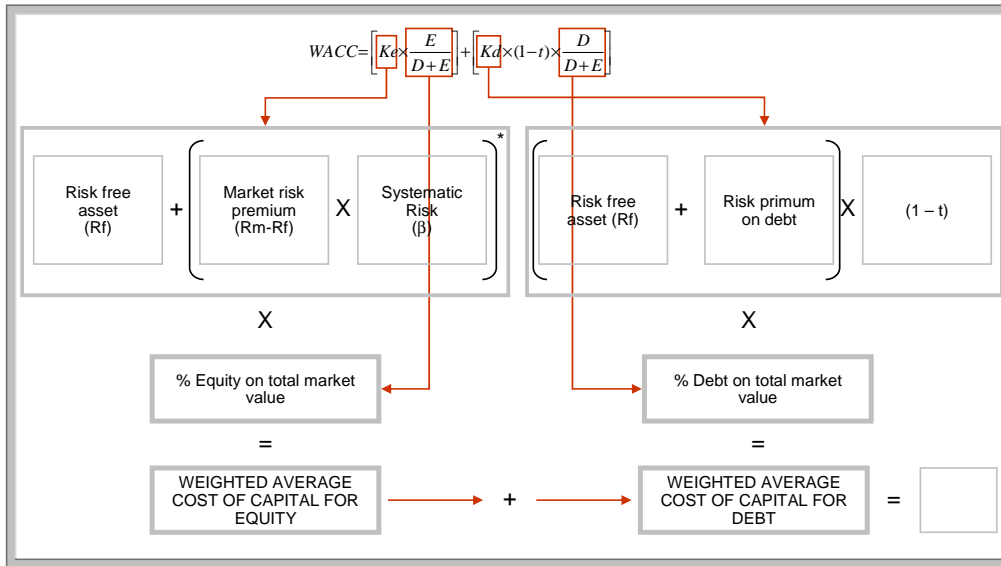
The ratios  $E/(E+D)$  and  $D/(D+E)$  represents the market value of the equity and the debt which forms the company market value.

- **$t$** : Tax

A summary of the methodology and steps to be followed in the estimation or revision of the WACC is presented in Figure 16.

<sup>17</sup> Each NRA should define the most accurate Gov. Treasury Bonds, for instance, 1 year, 3 years, 5 years, 10 years.

<sup>18</sup> Each NRA should define the most accurate index: S&P 500, FTSE 100, NYSE, IBEX 35, etc.



\* The WACC can be interpreted as the expected return of each holder either share or debt holder

Figure 16: Methodology for the estimation or revision of the WACC of a SMP operator

### 6.1.1 Best Practice in WACC

Table 5 shows the values assigned to fixed and mobile SMP operators in France, Germany, Italy, Spain and UK.

| Country | Fixed   | Mobile                     |
|---------|---|----------------------------|
|         | Rate  | Rate                       |
| FRANCE  | 10.7%   | 12.1%                      |
| GERMANY | 9.47%   | Details not published      |
| ITALY   | 10.2%   | 12.4%                      |
| SPAIN   | 10.81%  | Telefónica Móviles: 11.64% |
|         |   | Vodafone: 11.95%           |
|         |   | France Telecom: 11.06%     |
| UK      | British Telecom (BT) copper access network 10.0%      |                            |
|         | Rest of BT 11.4% (for business connectivity services) |                            |

Table 5: WACCs for fixed and mobile SMP operators (October-2008)

Regarding the approval of the WACC, the NRAs may have to carry out studies on two issues:

- The consideration of just one WACC for the whole business *vs* the approval of different WACCs for each business unit of the SMP operator.
- The way to capture the risk premium associated to the new technological change either by means of a greater value for beta parameters or by means of real option theory, which consist on estimating the wait option at alternative operators disposal before deciding to deploy their own network. For instance, due to the investment decision undertaken for the network investors they are facing an inherent risk associated to the success or failure of the technology they are intending to roll out. In this regard, alternative operators should pay for the wait option at their disposal<sup>19</sup>.

## 6.2 The life span of the assets

Every year, the SMP operators obliged to present cost accounting, need to propose different lifetimes for each specific asset. These lifetimes will be used to compute the amortisation and depreciation of each asset. Nevertheless, if there is a change in the lifetime of one particular asset, the SMP operator will have to calculate the depreciation cost taking into account the amount already depreciated, therefore, the departing point will be the existing net value of the asset.

One particular issue that NRAs need to define is the depreciation method to apply to fixed assets. Indeed, using a straight line depreciation method or a constant annuity depreciation method<sup>20</sup> has direct implications in the allocation of costs over the lifespan of the asset.

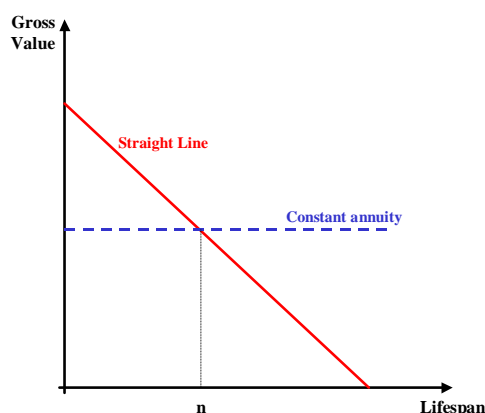


Figure 17: Depreciation methods and its implications in the costs allocation

As shown in Figure 17, depending on the depreciation moment of the asset, one method could be allocating greater costs than the other. For instance, to the left of **n**, the straight line depreciation method would allocate more costs than the constant annuity depreciation method. Therefore, the depreciation level of each category of fixed asset must be among the information that should be provided to NRAs. Table 6 gives an example of information that NRAs could require for a given asset category.

<sup>19</sup> One application of the real option theory could be the setting of wholesale prices for Next Generation Network (NGN)

<sup>20</sup> The annuity depreciation method consists in allocating the same amount *Q* in every accounting period to the different services. This amount *Q* is the sum of depreciation and capital amortization according to the following formula:

$$A = \frac{\text{Gross Value} \cdot \text{wacc}}{1 - (1 + \text{wacc})^{-n}}$$

|                  | Gross Value | Lifespan | Depreciation | Cumulative depreciation | Net Value |
|------------------|-------------|----------|--------------|-------------------------|-----------|
| Asset category 1 |             |          |              |                         |           |
| ...              |             |          |              |                         |           |
| Asset category N |             |          |              |                         |           |

Table 6: Template on the book value of the different fixed assets

## 7 Cost allocation in a top-down model (Step 6)

Step 6 includes the different stages in the allocation of costs to the different services. In particular, each stage describes the templates that allow the cost/incomes allocation to the services identified in the market analysis.

### 7.1 Description of the accounting plan

NRAs must define an accounting plan to properly allocate the costs to the different services. The structure of the accounting plan must respond to the defined structure of the accounting model.

The accounting plan must have defined accounts for:

Phase 1a: The expenses from financial accounts are allocated to OPEX and CAPEX. These costs can be grouped in different activities. For instance: network activities, activities of commercialisation, activities of structure, activities of support, costs of sales directly and not directly attributable to costs, etc.

Phase 1b: Incomes from financial accounts that, as happens with the financial expenses, they must be reconciled.

Phase 2: The costs per activity are allocated to different activity costs centres.

Phase 3: The activity costs centres are allocated to services.

Phase 4: The incomes and the costs attributable to the different services are subtracted to get the margins of each service included in the cost accounting model.

### 7.2 Activity cost centres to be considered in the cost accounting model

Activity cost centres can be defined as a collection of costs that are different in nature. The cost accounting model should contain at least the following three categories:

#### 1 Activity Cost Centre of Network Components (ACNC)

Depending on the specific activities of the network can be subdivided into the following subgroups:

- Access
- Switching
- Conveyance
- Value added functionalities

2 Activity Cost Centre Directly Attributable to Services (ACDAS)

This activity cost centre includes those costs which are directly related to the provision of the final service so that the allocation of costs can be carried out by means of objective and contrastable criteria.

3 Activity Cost Centre No Directly Attributable to Services (ACNDAS)

This activity cost centre includes those costs which are not directly related to the production of the final process. Therefore, in contrast to the previous activity costs centre, the allocation of costs cannot be done under objective bases so NRAs should fix a limit to this category of costs since they are not easily contrastable.

**7.3 Description of the model**

The cost accounting system of SMP operators should be defined according to the following phases:

*Phase 1.a) Specification of the OPEX and the CAPEX (Figure 18)*

From financial accounts, NRAs can extract the costs by nature. There are two types of costs:

- OPEX: Includes the operating expenditures taking into account the nature of the costs.
- CAPEX: Includes the fixed costs of the different assets and the costs from depreciation and cost of capital.

$$CAPEX = (Gross Value - Cumulated Depreciation) \cdot WACC$$

where :

*Cumulated Depreciation* : Sum of the depreciation

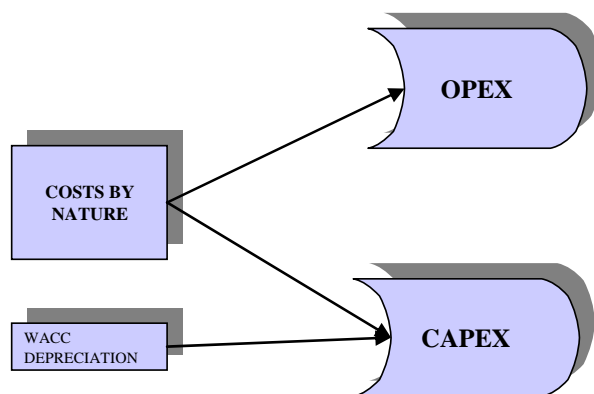


Figure 18: Allocation of costs by nature to OPEX and CAPEX

| Matrix 1     |                 | Cost attributable to the primary activities |              |                    |               |            |
|--------------|-----------------|---|--------------|--------------------|---------------|------------|
|              |                 | Maintenance                                 | Installation | Network management | Customer care | Management |
| <b>OPEX</b>  |                 |   |              |                    |               |            |
|              | Personnel       |   |              |                    |               |            |
|              | Supply          |   |              |                    |               |            |
|              | Outsourcing     |   |              |                    |               |            |
|              | etc             |   |              |                    |               |            |
| <b>CAPEX</b> |                 |   |              |                    |               |            |
|              | Depreciation    |   |              |                    |               |            |
|              | Cost of Capital |   |              |                    |               |            |
| <b>Total</b> |                 |   |              |                    |               |            |

Table 7: Template on the allocation of cost by nature to OPEX and CAPEX

*Phase 1.b) Determination of income*

This phase captures the gross incomes from financial accounts as well as discounts and other bonuses associated with the different services.

Income is directly allocated to the different services taking into account the process of invoicing (Table 8).

| Matrix 4     |                          | Revenues per service |                     |                    |                           |                    |
|--------------|--------------------------|----------------------|---------------------|--------------------|---------------------------|--------------------|
|              |                          | Short distance call  | long distance calls | Wholesale services | Intelligent network calls | Fixed mobile calls |
| Revenues     | <b>Operating Incomes</b> |                      |                     |                    |                           |                    |
|              | Basic Telephony services |                      |                     |                    |                           |                    |
|              | Leased lines             |                      |                     |                    |                           |                    |
|              | Wholesale                |                      |                     |                    |                           |                    |
|              | ...                      |                      |                     |                    |                           |                    |
|              | <b>Other incomes</b>     |                      |                     |                    |                           |                    |
| <b>Total</b> |                          |                      |                     |                    |                           |                    |

Table 8: Template on the allocation of financial incomes to incomes per service

*Phase 2) Allocation of costs to the different activity cost centres (Figure 19)*

The OPEX and the CAPEX are allocated to the different activity centres by means of an activity based cost (ACB) methodology.

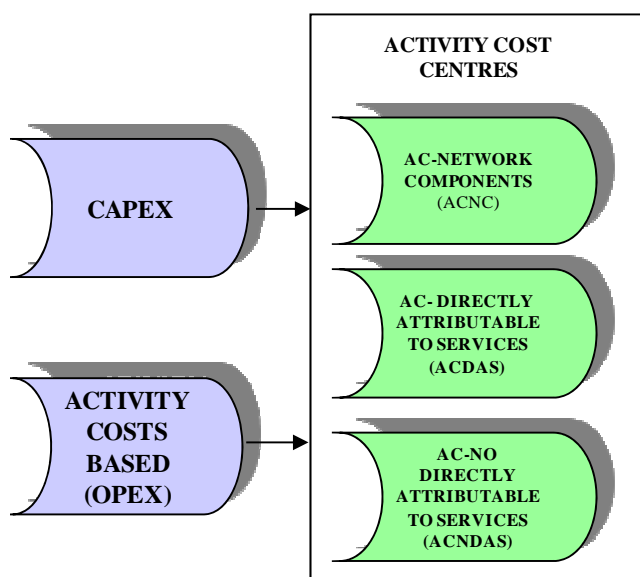


Figure 19: Allocation of OPEX and CAPEX to the activity cost centres

| Matrix 2                                    |                    | Activity Cost Centres        |           |            |            |  |            |  |            |
|---|--------------------|------------------------------|-----------|------------|------------|--|------------|--|------------|
|   |                    | Network Activity Cost Centre |           |            |            | Directly Attributable Activity Cost Centre |            | Indirectly Attributable Activity Cost Centre |            |
|   |                    | Access                       | Switching | Conveyance | Signalling | Commercialization                          | Management | Corporate                                    | Management |
| Cost attributable to the primary activities | Maintenance        |                              |           |            |            |  |            |  |            |
|   | Installation       |                              |           |            |            |  |            |  |            |
|   | Network management |                              |           |            |            |  |            |  |            |
|   | Customer care      |                              |           |            |            |  |            |  |            |
|   | Management         |                              |           |            |            |  |            |  |            |
| Total                                       |                    |                              |           |            |            |  |            |  |            |

Table 9: Template on the allocation of OPEX and CAPEX to the activity cost centres

### Phase 3) Allocation of costs to the different services (Figure 20)

The costs are allocated to the different services by means of the activity cost centres so that NRAs could have a general overview of the costs attributable to the each service.

It is important that NRAs bear in mind that allocation of costs from the network component activity centre must be done according to the routing factors matrix, which represents the usage that each service makes of the different asset.

On the other hand, the costs from the directly attributable activity cost centre are allocated taking into account the cost drivers and the usage of the different resources. Finally, the costs from the indirectly activity cost centre are allocated according to criteria as objective as possible, and NRAs can impose specific limits in the case of those unattributable costs falling under the category of indirectly allocated costs. For instance, in Spain they cannot represent more than 10%<sup>21</sup> of the other attributable costs.

<sup>21</sup> Percentage to be set by each NRAs in order to limit the arbitrary effect of these cost allocations

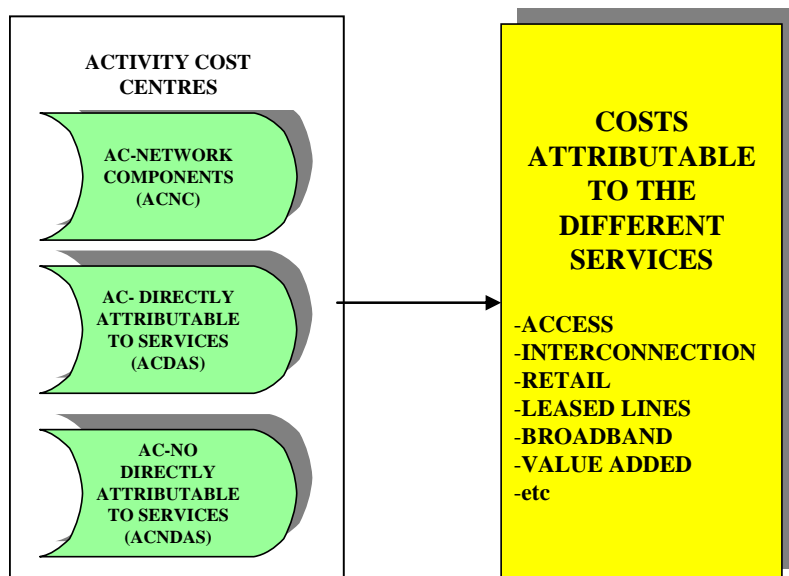


Figure 20: Allocation of costs from the activity cost centres to the different services

| Matrix 3             |  | Costs per service   |                     |                    |                           |                    |
|----------------------|--|---------------------|---------------------|--------------------|---------------------------|--------------------|
|                      |  | Short distance call | long distance calls | Wholesale services | Intelligent network calls | Fixed mobile calls |
| Activity Cost Centre | Network Activity Cost Centre                 |                     |                     |                    |                           |                    |
|                      | Access                                       |                     |                     |                    |                           |                    |
|                      | Switching                                    |                     |                     |                    |                           |                    |
|                      | Conveyance                                   |                     |                     |                    |                           |                    |
|                      | Signalling                                   |                     |                     |                    |                           |                    |
|                      | Directly Attributable Activity Cost Centre   |                     |                     |                    |                           |                    |
|                      | Commercialization                            |                     |                     |                    |                           |                    |
|                      | Management                                   |                     |                     |                    |                           |                    |
|                      | Indirectly Attributable Activity Cost Centre |                     |                     |                    |                           |                    |
|                      | Corporate                                    |                     |                     |                    |                           |                    |
|                      | Management                                   |                     |                     |                    |                           |                    |
|                      | Total  |                     |                     |                    |                           |                    |

Table 10: Template on the allocation of costs from the activity cost centres to the different services

This phase is the most important in the whole process of allocation and, in particular, the definition of the cost drivers of each activity cost centre.

The main categories of cost drivers are:

- Cost drivers for network components: The allocation of costs to the different categories of network components must be done by means of a routing factor matrix. The routing factor matrix captures the information about how each service is being carrying out by the different network elements. This matrix must be based on statistical samples that capture the use of network components on different days of the accounting period.



- Cost drivers for the directly attributable costs: They are related to the allocation of the following categories of cost: subscriber acquisition costs, marketing and advertising, handset subsidies, etc. There are different categories of cost drivers, among others the following can be highlighted: allocation according to income, subscribers, costs and minutes (in busy hours), etc.

*Phase 4) Allocation of costs and incomes to margins (Figure 21)*

The attributable cost to the different services as well as the incomes mentioned at phase 1.b) are allocated to the margin accounts.

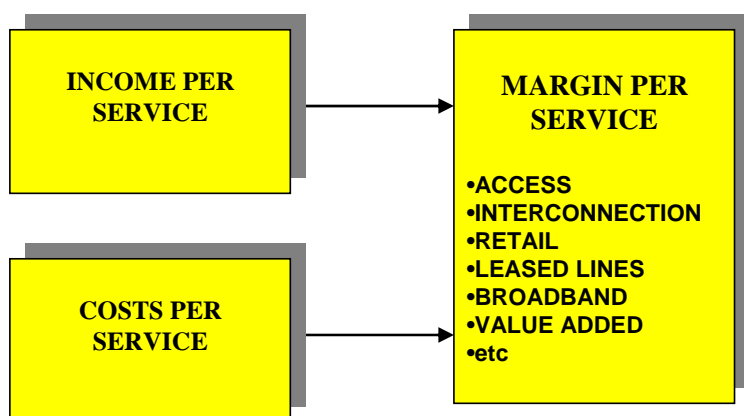


Figure 21: Allocation of incomes and costs per service to margins per service

| Matrix 5                  |                         | Costs per service   |                     |                    |                           |                    |
|---------------------------|-------------------------|---------------------|---------------------|--------------------|---------------------------|--------------------|
|                           |                         | Short distance call | long distance calls | Wholesale services | Intelligent network calls | Fixed mobile calls |
| Revenues and cost         | Revenues per service    |                     |                     |                    |                           |                    |
|                           | Attributable costs      |                     |                     |                    |                           |                    |
|                           | Network                 |                     |                     |                    |                           |                    |
|                           | Directly Attributable   |                     |                     |                    |                           |                    |
|                           | Indirectly attributable |                     |                     |                    |                           |                    |
| <b>Margin per service</b> |                         |                     |                     |                    |                           |                    |

Table 11: Template on the allocation of incomes and costs per service to margins per service

#### 7.4 Supporting documents to the proposal of cost accounting system

Accompanying the proposal of cost accounting system, SMP operators subject to this obligation must present the following documents:

- i) Cost accounting internal report (CAIR) which describes the proposed model and provides information on the following issues:
  - Lists of assets
  - Allocation criteria for each of the phases which constitutes the proposed model, description of the account movements.
- ii) Accounting plan that allows tracking of each account movement.

- iii) Description of the different services and fixed assets that are used in the provision of the aforementioned services
- iv) Description of the network and the different components used in the provision of the services

Finally, the CAIR should also include specific studies on assets valuation as well as allocation of network cost to the different services by means of a routing factor matrix, and eventually, some specific studies on the allocation of cost related to powering.

## 7.5 Costs allocation

As it has been above stated, the allocation of costs must be based on causal drivers. In this regard, the Activity Based Costing (ABC) views the services provided as a set of activities which consume resources and generates costs.

The allocation criteria vary depending on the category of costs. Thus, directly attributable costs are costs that can be directly and unambiguously allocated by NRAs. On the other hand, indirectly attributable costs are those costs which do not fall in the directly attributable category and which are caused by an internal cost driver; for example Human Resource costs could use weighted headcount, potentially weighted by average salaries.

There is a category of indirectly attributable costs, denoted by unattributable costs, for which the cost driver is difficult to identify. In this case, an alternative cost driver or method needs to be defined under fair and objective conditions.

It is important to stress that certain types of indirectly attributable costs are common to a number of activities.

According to the ERG COMMON POSITION Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications, the costs may be attributed to “Services” as follows:

Step 1: The allocation of ‘other’ functions across related functions, network components and services. (Phase 1a - CAPEX)

Step 2: The allocation of the related function costs to services and network components. (Phase 2)

Step 3: The allocation of network components to services. (Phase 3)

Step 4: The grouping of services into markets (as defined for the purposes of accounting separation) and specification of margins. (Phase 4)

Figure 22 summarises the cost allocation methodology and structure.

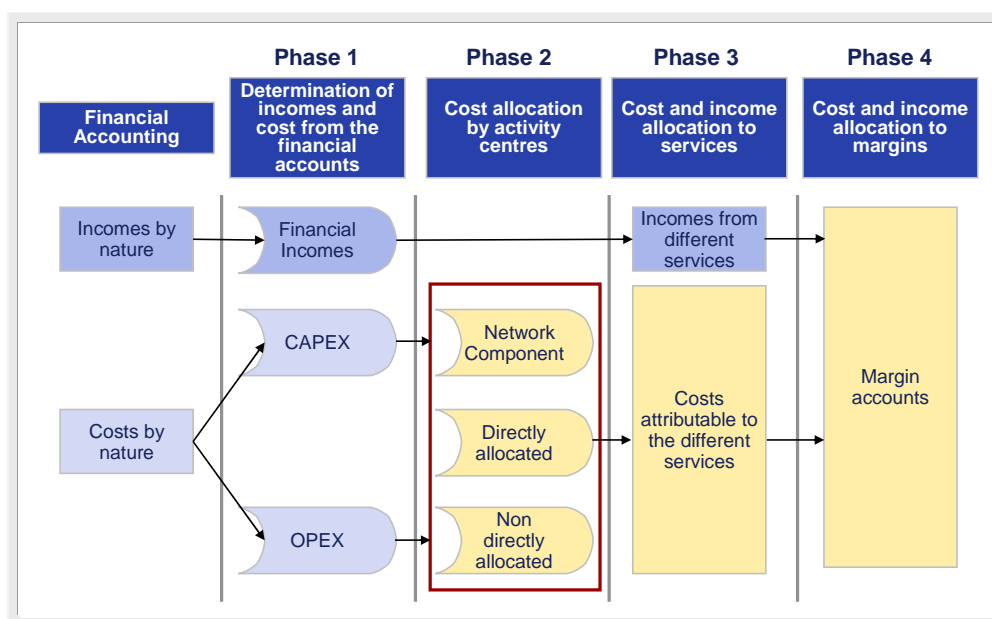


Figure 22: Structure of the cost accounting model

## 7.6 Allocation of common costs

Common costs are those costs related to the provision of more than one service. Generally, the term ‘fixed common cost’ is the term given to those common costs that are fixed with respect to volume. On the other hand, the term ‘joint common costs’ is used when an input produces two or more separable outputs in fixed proportions irrespective of the volume.

The consideration of fixed and joint common costs becomes a key issue when we are talking about incremental costs models, especially when we are setting wholesale services. In these models, the preferred method of allocating common costs is the so called *Equal Proportionate Mark-Up (EPMU)*<sup>22</sup>, which allocates common costs in proportion to the incremental cost already allocated to the separate products and services.

As can be inferred, mark-ups should be taken into account in incremental costs models to encourage investment by means of the full recovery of all the costs categories. Pure LRIC which does not consider any fixed and joint common costs would be giving a signal to the market, since those operators which decide to deploy their own network would not be recovering all the costs and, therefore, the regulatory policy would not be encouraging investment in the roll-out of infrastructure.

An alternative way to allocate common costs is by means of applying Ramsey Prices<sup>23</sup>, in which the mark-up varies with the elasticity of the demand. The greater the elasticity of the demand, the lower the mark-up. However, due to the difficulties associated with the application of Ramsey Prices, this methodology is not used very often since the information requirements to estimate the elasticity of the demand is high.

<sup>22</sup> By adding this mark-up the SMP operator will be able to recover all the typologies of costs. If this mark-up was not added, then the SMP operator will not be able to recover all the costs categories and the pricing policies could provoke anticompetitive behaviour since less real costs would be considered.

<sup>23</sup> Ramsey Prices is an alternative way to EPMU and it allows the recovery of all the costs categories by adding a mark-up which depends mainly on two parameters: (i) the elasticity of the demand and (ii) the competition level.

## 8 Using cost accounting

The results of cost accounting might be used by NRAs to identify anticompetitive behaviour such as:

i) Price squeeze

Since cost accounting models give information on the costs attributable to different services, NRAs know which network costs are associated to the different services. For instance, if the SMP operator charges so much for interconnection that alternative operators are unable to compete when its own OPEX are calculated, then there is a price squeeze problem that must be *ex ante* regulated.

ii) Predatory prices

In the same way, if the SMP operator sets a wholesale price which is below its own costs then, the alternative operator will not be able to compete with the offers launched by the SMP operator.

iii) Anticompetitive bundling

Bundling can become an anticompetitive behaviour when the alternative operators are not able to compete with the bundle launched by the SMP operator. In this regard, NRAs should define a methodology to analyse each of the offers launched by the SMP operator to make sure that all of them are replicable by any alternative operator. This methodology will be based on the information provided by the cost accounting model.

iv) Cross-subsidies

Another possible anticompetitive behaviour implemented by the SMP operator concerns cross-subsidies, which consist in offsetting the losses in one specific product/service with the extra benefits achieved from a profitable product/service.

Moreover, cost accounting models are crucial for wholesale price setting when the NRAs intend to set these prices under a cost based approach. Figure 23 illustrates the price control methods in force in EU regulated markets.

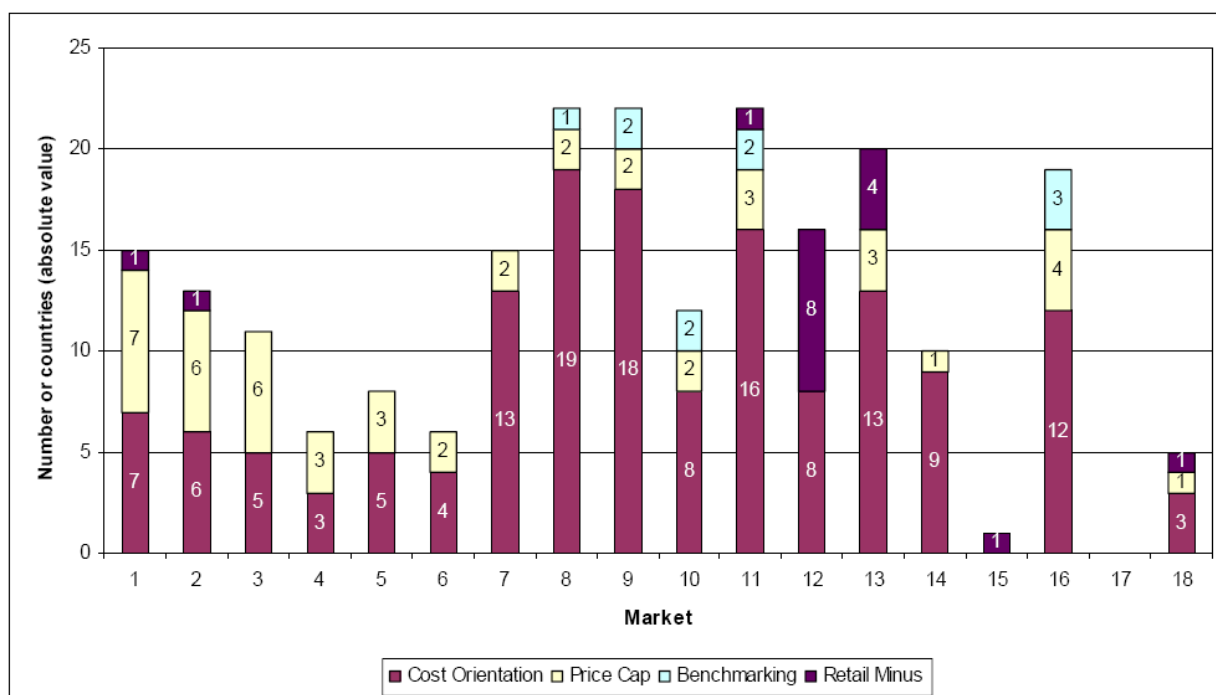


Figure 23: Price Control method used in each of the EU regulated markets<sup>24</sup>

Source: ERG RA-PT 07

Another application of cost accounting estimates the net cost of Universal Service Obligations (USO) and further assignment of contributions from designated operators.

In conclusion, a cost accounting model is a useful tool for operators, either SMP operators or other alternative operators, since it provides powerful information about the efficiency of the production process and helps to identify particular activities or network components that are causing a lack of competition.

## 9 Overall conclusions and recommendations

- Regulators must be supported by legislation to impose cost accounting and accounting separation obligations on designated SMP operators. Moreover, NRAs should have the authority to ask for as much information as necessary whenever a competition problem arises.
- Prior to imposing the obligation of cost accounting and accounting separation, NRAs must undertake a market analysis to identify:
  - the markets which constitute the telecommunication sector (services that need to be included in the accounting model),
  - the Significant Market Power (SMP) operators (who will be obliged to present cost accounting), and
  - potential anticompetitive behaviour.

<sup>24</sup> The list of markets is provided on page 30.

- A cost accounting model is a useful tool for regulatory purposes, in particular, to identify anticompetitive behaviour such as price squeeze, cross-subsidies or anticompetitive bundling.
- Current Cost Accounting (CCA) is the most accurate model to set wholesale charges because it captures the efficiency in the production process and, at the same time, reflects the real situation in the provision of services both from the point of view of operating costs and that of capital expenditure.
- When Modern Equivalent Asset (MEA) valuations are used, it will be important to correctly choose the replacement asset and, in particular, if specific adjustment on the OPEX associated with the replaced assets are required. For instance, when an old switch is replaced, a reduction in power supply cost is likely as well as location related costs for the replaced asset.
- When using a bottom-up model, NRAs must be aware that they are calculating the costs of an efficient operator with efficient and optimised network infrastructures, which might not correspond to the real situation; so specific analysis and adjustments must be carried out in order to allow the operator to recover costs.
- NRAs should exercise control on key variables like the Weighted Averaged Cost of Capital (WACC) and the lifespan of assets.
- The accounting system must be approved by the Board of the NRA and must be periodically audited to guarantee that the results presented follow the principles, criteria and conditions specified by the NRA.
- Cost Accounting models are useful tools to set wholesale charges, to identify anticompetitive behaviour, to estimate the net cost of universal service obligations and to establish controls on retail prices since it will also provide information on the margins achieved in each category of service.

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## Glossary

### Attribution system

The processes, systems, procedures used to apportion and allocate an operator's revenues, costs, assets and liabilities to its activities, businesses, components, services and products.

### Book value

The amount recorded in the accounting records of the operator in respect of fixed assets normally including acquisition and commissioning costs plus, if appropriate, internal costs incurred in bringing the asset into use. The net book value represents the gross value minus amortisation, depreciation or impairment values recorded during the estimated economic life of the asset.

### Core network

A set of assets, and associated operating activities, put in place to switch and transport the traffic over the network. Includes the transport network and the exchanges.

### Costs

A basic classification of costs includes variable cost, fixed cost and common costs.

#### 1. Variable Cost

Variable cost, or volume-sensitive cost, is the cost that varies with the level of the activity that generates it. For example, the total cost of switching within a telephone network depends on the volume of usage (switched traffic) on that network. As that traffic increases, more switch capacity is installed and the cost of switching increases accordingly. Variable costs are usually directly assignable. That is, since a variable cost varies with the level of a specific activity, it is possible to identify the “cause” of that cost (namely, that activity) and, hence, to attribute all of the cost to that activity.

#### 2. Fixed Cost

Fixed cost, or volume-insensitive cost, is generated by an activity but does not vary with the level of the same activity. Such a cost may not be increased or reduced; it is either incurred or avoided. The only way to avoid a volume-insensitive cost is to cease altogether the activity that generates it.

Fixed cost, may be either directly assignable (i.e., activity-specific) or shared or common (i.e., not specific to any single activity).

##### 2.1 Shared fixed costs

Shared fixed costs are the fixed costs that are shared by two or more, but less than all, of the activities of a firm. Ceasing one or the other of these activities will not avoid these shared costs; only the cessation of all of that subset of activities will avoid the shared costs. An example is the Advanced Intelligent Network (AIN) that, when installed, can be used to provide a variety of AIN services; however, not providing any one service in that group will not avoid any portion of the cost of that network.



## 2.2 Fixed common costs

Fixed common costs are the costs that are shared by all of the activities of a firm. Fixed common costs can only be avoided by ceasing all of the activities of the firm altogether. These are sometimes referred to as **overhead costs**. An example of a fixed common cost related to services is switch costs, since switch sites are shared by activities such as calls and lines.

## 3. Common Costs

Common costs are the costs of those inputs necessary to produce one or more services in two or more increments, where it is not possible to identify the extent to which a specific increment causes the cost. An example of common costs is corporate overheads. Common costs can be either fixed or joint costs.

### Cost category

Defined as a group of costs with an identical cost driver. For example, common costs, directly attributable costs, or joint costs.

### Cost driver

The factor that causes a cost to be incurred. For example, the number of subscribers is the cost driver for the cost of line cards.

### Cost-volume relationships

Illustrate how costs vary according to the change in volume of the related cost driver.

### Costing methodology

Describes the order and way in which procedures and methods are applied to derive and attribute costs.

### Current cost accounting (CCA)

An accounting basis that recognises and incorporates the effects of changing prices over time.

### Directly attributable cost

Costs that are incurred as a direct result of the provision of a particular service in a particular increment. These costs could be classified in:

- I. Direct variable costs, are the costs of some inputs that vary with the level of output, so that even if the output of more than one service requires this input, the extent to which a single service causes the costs can be calculated.
- II. Direct fixed costs, are the assets and operating costs which are fixed with respect to the level of output but which are service specific.

### Direct fixed costs

See “directly attributable cost”.

### Direct network cost

The cost of inputs necessary for the network to function in such a way that the volume of the input depends directly on the outputs required.

**Direct variable costs**

See “directly attributable cost”.

**Excess Capacity**

Capacity that provides no operational or direct economic benefit to the operator. For example, vacant accommodation, resilience build in excess of normal engineering parameters.

**Financial capital maintenance (FCM)**

A Current cost accounting (CCA) concept that considers the maintenance of a company's financial capital in real terms. Under this approach profit is only measured after provision to maintain the purchasing power of operating financial capital has been made.

**Forward-Looking Cost**

The economic cost of an activity is the actual forward-looking cost of accomplishing that activity in the most efficient possible way, given technological, geographical, and other real world constraints that exist. In contrast to embedded costs, forward-looking costs are those associated with present and future uses of the firm's resources. Only these costs are relevant for making present and future production and investment decisions, for placing resources in alternative uses, and for setting prices for the services to be provided at current time or in the future.

**Fully distributed costs (FDC)**

Allocates the different categories of costs to the different services. The principle of cost causality is often applied to support this methodology. Also referred to as "fully allocated costs" (FAC).

**Fully allocated costs (FAC)**

See “fully distributed costs”.

**Historical cost accounting (HCA)**

A cost accounting model that uses historical information provided by statutory accounting systems, in which transactions are recorded and reported at their initial transaction value. Traditionally used as the main basis of reporting for statutory and management purposes.

**Incremental Costs**

Incremental costs are the forward-looking economic costs incurred to produce an additional quantity or increment of output; incremental costs do not include embedded or historical costs. Incremental costs measure how much of the total firm's costs changes under a baseline scenario or an alternative scenario. To measure incremental costs, the alternative scenario is compared to the baseline scenario in order to determine: (1) an output increment, and (2) a corresponding cost increment. Because there is a time dimension to business decision-making, the costs that must be compared in the alternative and baseline scenarios must be discounted. Therefore, the exact definition of incremental costs is the difference between the present value of the flow of costs for a projected output level and the present value of the flow of costs for an alternative projected output level.

**Joint costs**

Joint costs are defined as costs in which an input produces two or more separable outputs in fixed proportions irrespective of volume. Reducing the output of a single activity will not reduce joint costs,

but reducing the output of all activities will reduce them. Fixed common costs and joint costs make up common costs.

### **Long-Run Incremental Cost (LRIC)**

The cost of producing a specific additional increment (normally an activity, service or product) in the long run (the period over which all costs are variable) assuming at least one other increment is produced. Includes all the directly assignable variable economic costs of a specific increment of service, which usually is less than the whole service.

### **Marginal cost**

The additional cost caused (saved) by increasing (decreasing) the production of a product or service by a single unit, holding constant the production levels of all other products and services offered by the firm.

### **Mark-up**

A mark-up is the difference between the cost of an item and what you charge your customers for it.

### **Network components**

This pool contains the costs related to the various components of transmission, switching and other network plant and systems.

### **Operating capital maintenance (OCM)**

A Current cost accounting (CCA) concept that considers the maintenance of a company's physical output capability (production capability) of the asset of the company, i.e. the operating capability at the end of the year must be the same as at the beginning of the year. Under this approach profit is only measured after provision for replacing the output capability of the company's physical assets has been made.

### **Other functions**

This pool contains the costs of functions that are not related to the provision of particular services but are an important part of the operations of the company. Examples of such costs include planning, personnel and general finance.

### **Related functions**

This pool contains the costs of retail and wholesale functions necessary for the provision of services to the customer or end users such as billing, maintenance, and customer services.

### **Replacement costs**

The value of an asset when replaced by a modern asset providing the same functionality.

### **Services**

The term "service" refers both to end user services (e.g. the provision of retail leased lines) and network services (e.g. interconnection services).

### **Spare Capacity**

Capacity necessarily to meet normal demands that can be objectively justified in operational or economic terms (e.g. unavoidable because of equipment modularity or necessary to satisfy reasonable levels of current and foreseeable peak demands).

**Total element long-run incremental costs (TELRIC)**

Introduced by the Federal Communication Commission in the US in 1996, TELRIC is viewed as a special case of TSLRIC, where costs are calculated for network elements, rather than retail services.

**Total service incremental costs**

The forward-looking cost avoided (added) by discontinuing (offering) an entire product or service, holding constant the production levels of all other products and services offered by the firm.

**Total service long-run incremental costs (TSLRIC)**

Includes all directly assignable variables and fixed economic costs of a service. Total service incremental cost is a special case of incremental cost, where the increment of the output in question is the total volume of a service.

**Holding gains and losses**

The adjustment necessary to reflect the increase or decrease in asset values resulting from real price changes.

The alternative to financial capital maintenance in which the productive capacity of the business is maintained.

## Abbreviations and acronyms

|        |   |
|--------|---|
| ABC    | Activity Based Costing                                    |
| ACDAS  | Activity Cost Centre Directly Attributable to Services    |
| ACNDAS | Activity Cost Centre No Directly Attributable to Services |
| ACNC   | Activity Cost Centre of Network Components                |
| CAIR   | Cost Accounting Internal Report                           |
| CAPEX  | Capital Expenditure                                       |
| CAPM   | Capital Asset Pricing Model                               |
| CCA    | Current Cost Accounting                                   |
| CC     | Current Cost  |
| COSITU | ITU model for the calculation of costs                    |
| CPP    | Calling Party Pays  |
| CVR    | Costs Volume Relationships                                |
| DSLAM  | Digital Subscriber Line Access Multiplexer                |
| EC     | European Commission                                       |
| EPMU   | Equal Proportionate Mark-Up                               |
| ERG    | European Regulatory Group                                 |
| EU     | European Union  |
| FCC    | Federal Communications Commission                         |
| FCM    | Financial Capital Maintenance                             |
| FDC    | Fully Distributed Costs                                   |
| GBV    | Gross Book Value  |
| GSM    | Global System for Mobile Communications                   |
| HCA    | Historical Cost Accounting                                |
| ICT    | Information and Communication Technologies                |
| IP     | Internet Protocol   |
| ISP    | Internet Service Provider                                 |
| ITU    | International Telecommunications Union                    |
| IXP    | Internet Exchange Point                                   |
| LRAIC  | Long-Run Average Incremental Cost                         |
| LRIC   | Long-Run Incremental Cost                                 |
| MEA    | Modern Equivalent Asset                                   |

|        |   |
|--------|---|
| NCA    | National Competition Authority          |
| NRA    | National Regulatory Agency              |
| NRC    | Net Replacement Cost                    |
| NBV    | Net Book Value                          |
| OCM    | Operating Capital Maintenance           |
| OPEX   | Operational Expenditure                 |
| PBX    | Private Branch Exchange                 |
| PSTN   | Public Switched Telephone Network       |
| PTS    | Post Och Telestyrelsen                  |
| RIO    | Reference Interconnection Offer         |
| RUO    | Reference Unbundling Offer              |
| SAC    | Stand Alone Costs                       |
| SMP    | Significant Market Power                |
| TELRIC | Total Element Long-Run Incremental Cost |
| TSLRIC | Total Service Long-Run Incremental Cost |
| ULL    | Unbundled Local Loop                    |
| USF    | Universal Service Fund                  |
| USO    | Universal Service Obligations           |
| VoIP   | Voice Over Internet Protocol            |
| WACC   | Weighted Average Costs of Capital       |
| WBA    | Wholesale Broadband Access              |
| WBG    | World Bank Group                        |
| WLR    | Wholesale Line Rental                   |
| WTO    | World Trade Organization                |

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