LRIC Model Guidelines for the Kingdom of Saudi Arabia

Final Guidelines- Main Document

March 1, 2008

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1 Introduction

The draft LRIC Model Guidelines (LMG) was released for public comment in April 2007. The draft LMG defined the features and key principles applied to the costing models to be developed to determine the Long Run Incremental Cost (LRIC[1]) of certain (wholesale) access and interconnection services in the Kingdom of Saudi Arabia (KSA).

This document presents CITC's final view on the LRIC Model Guidelines, having taken into account the views of interested parties during the public consultation phase. A separate report has been released that outlines the CITC response to the list of issues raised by interested parties during the public consultation.

These LRIC Model Guidelines shall form the basis of the LRIC model building process.

1.1 Background

The Communications and Information Technology Commission (CITC) wishes to develop an efficient competitive telecommunications market. The CITC issued the Interconnection Guidelines in November 2003 in accordance with Article 36 of the Telecommunications Bylaw. The Interconnection Guidelines (Section 8) identify the Long Run Incremental Cost (LRIC) approach for interconnection pricing as reflective of international best practice and state that the Commission's objective is to adopt the LRIC approach for interconnection pricing.

The Interconnection Guidelines provide the direction to ensure that competing service providers have access to telecommunications facilities under reasonable terms. This includes LRIC based service pricing.

Interconnection services are defined in the Saudi Telecommunications Company's (STC) Reference Interconnection Offer (RIO). However, STC has not used LRIC based methods to set the current tariffs for interconnection services.

This document defines the approach to be taken by the CITC and by the Dominant Service Provider in any telecommunications market in the Kingdom of Saudi Arabia (currently only STC has been declared by the CITC to be a Dominant Service Provider) to determine LRIC based estimates for fixed and mobile wholesale services. These LRIC Model Guidelines supplement the existing Interconnection Guidelines in this respect.

[1] Reference to LRIC in this context refers to an estimate of the incremental direct and variable costs of services including a mark-up to cover common costs (sometimes referred to as LRIC+). This is discussed in more detail later in the paper.

The need for LRIC

Competitive markets naturally evolve to provide a range of services and prices to meet the needs of customers. Competitive pressures reduce the prices and so provide the best outcomes for customers, as service providers strive to become efficient and to compete. Competition also results in negotiated agreements for the provision of wholesale services exchanged between service providers (interconnection services) and these tend towards being cost-based. The net result is prices that will be more closely aligned with the costs (including a fair profit or return on investment) of providing these services.

Economic theory shows that the prices of service should move towards the LRIC level in competitive markets. The telecommunications market, however, is not fully competitive and almost all countries require regulation to control prices and actions of Dominant Service Providers (DSPs). The CITC wishes to foster the development of the telecommunications market in Saudi Arabia. Competitive service providers are emerging and the CITC wishes to encourage this development. A key to market development is to ensure that alternative service providers have access to wholesale services on reasonable terms. Therefore the CITC must ensure DSPs allow access to telecommunications facilities at any technically feasible point, and under the same terms and conditions (including quality) as the DSPs provide for their own services (or those of their affiliates). These should be priced on the cost of an efficient service provider. LRIC based estimates for these prices are intended to replicate the outcomes that would occur in a competitive market.

A number of methodologies to determine the cost of service provisioning have been used by different regulatory authorities in other markets. These include, among others, the Full Distributed Cost (FDC, also termed Fully Allocated Costs - FAC) and Long Run Incremental Cost (LRIC) approaches. The CITC has determined that the LRIC methodology is to be adopted in telecommunications regulatory deliberations and in its move towards telecom market liberalization in the Kingdom.

Issues to address

A key problem to consider is: how to calculate the LRIC level? LRIC based estimates do not currently exist in KSA. Any information that currently exists must be adapted to meet LRIC requirements. This is done using an economic model.

All models require financial and other quantitative data to produce results. Various approaches for the design of the costing model are possible and there are different options for the selection and processing of inputs within any one approach. The CITC has defined a LRIC approach that takes into account these factors.

In this document, the CITC specifies the modelling techniques to be used. A reasonable and balanced approach to modelling techniques ensures a fair calculation of LRIC levels.

How the LRIC information shall be used

The relevant wholesale services are defined in the Reference Interconnect Offer (RIO) and the Reference Offer for Data Services (RODA). The LRIC levels for wholesale services can be used to define prices.

The completion of the LRIC process will enable the CITC to regulate the prices of relevant wholesale services towards LRIC levels. The LRIC service analysis defined in this document also defines the underlying costs of the services that are supplied by the DSPs to their own customers. This LRIC cost information can provide additional inputs to regulatory deliberations for retail price controls, accounting separation or tariff evaluations.

The LRIC results will be used in a price setting process that will follow after the development of the LRIC models. The price setting process does not form part of this LMG document.

1.2 Purpose of this document

This document outlines the proposed structure of the LRIC models to be built in KSA, giving information on how the CITC will build Bottom-Up LRIC (BU LRIC) models for the core fixed network and the mobile network, as well as providing guidelines to the DSP for building its Top-Down LRIC (TD LRIC) model of the fixed access and core network. It also outlines the CITC's requirements and expectations for information to be required from service providers.

This document forms the basis of the LRIC model building process.

1.3 Objectives and outcomes

Objectives

The specific objectives of the CITC's work with the implementation of LRIC based (wholesale) access and interconnection services pricing are to:

- Develop costing models which calculate estimates for the costs of access and interconnection services (wholesale services) according to the LRIC modelling guidelines
- Create a set of regulatory tools that enable the CITC to establish cost oriented prices for access, interconnection and other wholesale services in KSA
- Assist in the development of a competitive retail market for telecommunication services market, through the establishment of cost based wholesale services.

LRIC model outcomes

The outcomes from implementing LRIC according to the objectives mentioned above are to:

- Encourage the use of existing facilities of the DSP where this is economically desirable, avoiding unnecessary and inefficient duplication of infrastructure costs by new entrants. This is particularly important in the case of 'bottleneck' facilities, which are uneconomic to duplicate.
- Encourage investment in new facilities, where this is economically justified by:
  1. new entrants investing in competing infrastructure
  2. the DSP upgrading and expanding its national network
- Increase the transparency of the cost calculations underlying the determination of access and interconnection charges
- Increase predictability for both the DSP and the other service providers with regards to the future determination of access and interconnection charges
- Ensure a level playing field for all service providers in KSA and aid in the prevention of abuse of a dominant position in the market.

When access and interconnection charges are based on LRIC they do not distort the build/buy decision of new entrants. New entrants will be encouraged to use existing facilities if, and only if, it is economically desirable to do so. LRIC-based access and interconnection charges also mean retaining investment incentives for incumbents to upgrade or extend the existing network according to customer demand or when new technology becomes available.

When access and interconnection charges are set on the basis of LRIC, infrastructure competition is encouraged in those areas where it is efficient to have competing infrastructure, whereas service competition is encouraged in those areas where the investment in competing infrastructure is not efficient. Service competition only emerges if the competing service provider is able to provide better services or prices and hence buyers of wholesale services are only successful if they are efficient. LRIC therefore provides the basis for the correct incentives for the right type of market entry.

1.4 Methodology

In order to send the right investment signals and promote efficient competition in the market, prices should reflect the LRIC of an efficient service provider in the fixed and mobile markets.

Ultimately, the final pricing scheme derived from the LRIC principles should be based upon a fair comparison of the costs calculated using TD and BU LRIC costing models (defined in more detail below). However, either one of these models may be used on its own, if necessary. The CITC may also consider other factors when setting the final price. Hence the final regulated price may differ from the ones based on actual LRIC estimates from any one model.

The purpose of the TD model is to calculate the LRIC on the basis of the existing network and cost structure of the DSP, eliminating inefficiencies and replacing outdated equipment with new, more cost-effective technology. Therefore the cost basis is that of an efficient service provider building the same network scope today. It is termed 'Top-Down' as it is derived from a service provider's accounting data.

The purpose of the BU model is to calculate the LRIC of an efficient network capable of offering the same scale and scope of services being offered by the DSP, using the newest technology actually employed in other large-scale networks. In principle, the BU LRIC model starts with understanding the network element requirements for switching and transmission resources that an efficient service provider would install today to meet the forward-looking demand of the service provider. By implication, the costs (if any) of migrating to the efficient service provider standard from today's operations would not be expected to be included in a LRIC calculation. It is termed 'Bottom-Up' as it is derived from the basic network elements that build up a total business cost.

The DSP (currently STC) shall build a TD LRIC model of its network and operations (fixed core, fixed access and optionally of mobile). The CITC will build a BU LRIC model of the fixed core and mobile networks. The CITC will use the BU model to investigate the TD model and to compare outcomes and results. In the absence of any TD model for fixed network services, the BU model may be used exclusively. The CITC intends to use only a BU model for its mobile LRIC analysis (though service providers are welcome to build their own TD models; see Section 1.5). The CITC may also elect to build a BU model for fixed access services, at some time in the future.

1.5 LRIC Process and timelines

General LRIC model process

The CITC embarked on a process that will result in the development of LRIC models for fixed and mobile services in KSA. The process involves:

- Conducting a public consultation (completed)
- The development of a TD LRIC model of the STC (as the DSP) fixed network (fixed core and fixed access)
- The development by the CITC of a BU LRIC model of the fixed core network using market and technical network data and information provided by the DSP and other service providers. The fixed core network supplies switched voice and call termination services, plus leased line and other data services. Core network costs are traffic dependent
- The CITC *may* also develop a BU LRIC model of access network services at some point in the future. An access network connects subscribers to the core network. The costs are subscriber-dependent
- The development by the CITC of a BU LRIC model for the mobile network using market and technical network data and information provided by the service providers in KSA

- There is no obligation on service providers to produce a TD model of the mobile network, as the CITC will develop a BU model. However, service providers may wish to develop TD LRIC mobile models. The results of these models may be used by the CITC to supplement the results produced from the BU LRIC model
- The BU LRIC fixed model shall be used as part of a process to validate and reconcile results obtained from the TD LRIC fixed model to achieve fairly determined LRIC estimates for key wholesale services (unless no TD LRIC fixed model is available during the timelines established by the CITC, in which case the CITC will use its BU LRIC fixed model alone)
- The BU LRIC mobile model shall be used to determine LRIC estimates for key wholesale mobile services (specifically mobile voice termination rates).

The CITC will consider and review all models and other data, if and when submitted by service providers. The data in the model(s) and the techniques may be used to refine the CITC model(s) and to ensure the CITC analysis reflects local costs and KSA factors. Such additional BU models (or mobile TD models), other than the ones specified in the LMG which must be provided by DSP(s), are not a requirement. If delivered, they must be accompanied by suitable documentation and the service providers should be able to give training advice (if needed) on the model and data, plus they should reply to clarification questions as needed. Attention is drawn to the timelines and any models and data must be delivered so that they can be used during the CITC BU model development stages, and/or for any reconciliation process undertaken by the CITC.

Service providers are welcome to build their own TD (or BU) LRIC models of the mobile and fixed networks (though the CITC only requires the DSP to build a TD LRIC model of the fixed core and access network). The CITC may take the results of these models into account when assessing the outcomes of the LRIC model process. In the event that service providers wish to build alternative TD-LRIC models, the CITC recommends that they follow the same LRIC Model Guidelines that the DSP must follow for the TD-LRIC model for the fixed network.

The models shall continue to be developed and updated over time to provide new and updated LRIC estimates.

LRIC implementation stages and on going tasks

The LRIC Model Guidelines provide the basis for developing the LRIC models. The DSP(s) (currently, STC) must develop a TD model of the fixed access and core services and (optionally) of the mobile network based on these Guidelines. The process for doing this should include:

- Development of model specifications and structures
- A project plan to implement the system taking into account the efficient use of resources and re-use of any previous costing analysis that may exist
- Identification of model features to ensure the requirements of the LRIC Model Guidelines are met

- Regular communications with the CITC to ensure the plans, specifications and model designs are acceptable. For the avoidance of doubt, the CITC shall monitor and approve the TD LRIC model development at each stage in the building process (including TD LRIC model design and construction). Regular approval and frequent discussions of the LRIC work are *essential*
- The delivery of progress reports and LRIC design documents to the CITC. These shall be prepared in sufficient detail to ensure the LRIC model is compliant with requirements of the LRIC Model Guidelines and the central aims of the CITC
- Interim results and interim versions of the model shall be made available to the CITC
- Final documentation and all relevant information on the LRIC model shall be made available to the CITC. This must be sufficient to ensure the model complies with the LRIC Model Guidelines and to allow full understanding of the model features and all data. For the absence of doubt, the CITC expects any models that are provided to the CITC to come with comprehensive data and documentation as well as software and associated licensing to allow the CITC to investigate and analyse the model
- An audit of the model.

In addition, the LRIC models shall be subject to review, update and further development over time once the initial models have been completed. Periodic updates of the data and structures are expected. This shall allow development of costs for any new products and determination of improved or altered cost estimates. These shall be specified and must be agreed by the CITC.

A regular update of the TD LRIC model shall be carried out annually (or as specified by the CITC) to provide the CITC with the latest data and LRIC values.

Where considered necessary by the CITC, the BU models may be updated periodically and used to compare with updated versions of the TD models. Revised data inputs will be expected from the service providers to assist with updates to the models.

The DSP(s) shall contribute to the development of the BU models to be developed by the CITC through timely compliance with CITC data requests for information. The assistance required shall include:

- Provision of product data (volumes and customers/subscribers)
- Network design information
- Cost information
- Discussion meetings
- Information to assist with LRIC Model design features.

Other service providers are expected to also assist with the provision of information and with additional support to help with the development of the BU models.

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Timelines

It is understood that the development of effective LRIC models requires a significant investment of time and resources. It is important to balance the needs for detailed accurate analysis with the need to obtain initial estimates of the LRIC levels in the short term. The CITC has therefore agreed to extend the timeline to complete the TD LRIC model building to 9 months.

The DSP shall complete the TD LRIC model of the fixed network within 9 months from the effective date of the CITC Decision issued with the LRIC Model Guidelines.

The timelines for the BU LRIC models have remained unchanged from the original proposals in the Draft LMG.

The CITC expects to complete the BU LRIC models of the fixed network and the mobile network within 5 months from the effective date of the CITC Decision issued with the LRIC Model Guidelines (the "Decision").

A full formal CITC-approved audit of the TD model is not anticipated within the above period, but this may be required at a later stage. The audit, to be funded by the DSP, shall be carried out by CITC-approved experts who must be given full access to the TD model and all source information. During the audit process and in accordance with the Rules of Procedure, the DSP(s) may identify any confidential information that it does not wish to be disclosed. The model audit is discussed in more detail in section 10.5.

In any event (during development and prior to a formal audit), the CITC requires that parts or versions of the model must be made available for detailed review by the CITC's experts during the model development process. This is in addition to review meetings to discuss and review the model design and the creation progress. The TD model developments must be discussed and agreed with CITC at regular stages. Specifically:

- The DSP shall establish a technical working group within one month of the effective date of the Decision, to monitor progress and development of the TD model and facilitate data collection for the BU models. The chairman of the technical working group should have authority to enter into commitments with regard to the project on behalf of STC. This working group should also review data requests and liaise regularly with CITC on project and modelling matters
- The chairman of the DSP's technical working group shall meet with the CITC on a monthly basis (or as otherwise determined by the CITC) in order to report on progress regularly
- An initial project plan must be drawn up by the DSP and submitted to the CITC within two months of the effective date of the Decision and updates of the plan shall be discussed with the CITC. The project plan shall include, as a minimum, staged development of the TD model with key milestones identified, and the commitment of adequate resources to complete the development of the LRIC models within the timeframe established in these guidelines. The

plan should also show the team organisation and reporting structures, plus definitions of the processes to be followed and descriptions of how tasks shall be addressed

- In the event that DSP(s) have difficulties or issues that relate to matters such as (but not limited to) data supply or model creation, such issues must be raised with the CITC at the first opportunity so that they can be addressed efficiently and so as to avoid delay. For the absence of doubt, failure to deliver CITC requested data and/or the TD LRIC models within the specified timelines will be considered as non compliance with these Guidelines.
- Data requests shall be issued by the CITC and the most urgent data should be supplied within 8 weeks of their issue date, with other items within 2 further weeks. Meetings with service providers to discuss and clarify the data requests shall be held shortly after they are issued.
- If TD model developments do not meet the CITC‘s requirements, the CITC may use the BU model on its own to establish LRIC outcomes.

1.6 Role of Service Providers

In addition to building the TD LRIC models, as appropriate, the service providers are required to assist the CITC with its development of the BU models.

The BU LRIC models (to be built by the CITC) will benefit from information on a wide range of financial and qualitative data from the DSP, as well as other service providers.

Service providers shall provide to the CITC economic and engineering data about their network operations, service scope, customer base, service volumes and equipment volumes.

The service providers shall also fully co-operate with the CITC and it's appointed independent reviewers, with any other requirements, such as an audit of the TD LRIC model.

The detailed process to be followed during the LRIC modelling process is planned to be dealt during the data collection and modelling phase of the work.

The CITC will treat confidential information in accordance with the Rules of Procedure. Where confidential data is used in analysis that needs other parties to respond to, such values can be adjusted and/or the source disguised, in order to permit the CITC to issue public domain versions of the models that still provide information on the general results (and due comment), without revealing individual details.

The CITC looks forward to working together with the industry and will issue a formal data and information request to service providers.

1.7 Document structure

The outline of the remainder of this document structure is as follows:

- Part A provides general guidelines to the cost model development process which are common to the Top-Down and Bottom-Up LRIC model approaches
- Part B provides guidelines which are specific to the Top-Down approach
- Part C provides guidelines which are specific to the Bottom-Up approach.

Part A: General guidance on LRIC modelling

2 Long Run Incremental Cost

2.1 Definition of LRIC

Long Run

Costing needs to consider the time period in which the service provider can realise capital investments (or divestiture of capital) in order to increase (or decrease) its productive capacities. In the long run, all capital inputs, and therefore all costs vary, due to a change in the volume or in the structure of production, in response to changes in demand. All investments are therefore considered as variable costs in this long run view as all will require replacement at some time.

Incremental

The incremental cost is the increase in total costs following the introduction of an additional product or service increment. The service volume increment can take several forms. For instance, a volume change of a product or group of products could be defined as the increment. Alternatively, a single unit of output (either in the access or core network) could be the increment (this would also be equivalent to the marginal cost).

With telecommunications services, it is often convenient to think of an increment as the entire output of a given service (such as total call volumes or the total number of access lines). By adding or removing the entire service, the LRIC model can estimate the impact on total costs (which would be equal to the incremental cost for that specific service).

Similarly, in order to understand variable (incremental) costs, it is often convenient to consider the cost avoided by removing a service. This Directly Avoidable Incremental Cost (DAIC) is assumed to be the same as the incremental cost.

Forward-looking costs

The models should be based on forward-looking long run incremental costs.

Forward looking costs reflect the costs that a network service provider would incur were it to build a brand new network today, using modern equivalent assets (MEA). These costs would be based on looking forward to anticipated levels of demand for network capacities and planning horizons for equipment installation necessary to run an efficient network.

LRIC is estimated using forward looking economic costs because they mimic the cost base expected in a competitive market. The concept of forward looking costs requires that assets are valued using the cost of replacement with the modern equivalent asset (MEA), since a competitive-market operator would use the MEA.

Costs incurred in migrating from an existing network technology to a replacement network technology should not be included. It is assumed that the modelled network is already in place and any additional costs associated with moving towards the efficient service provider network are not included.

It is practical and convenient to model the costs of an efficient entrant assuming that the existing network topology forms the starting point for the cost calculation and allocation process. This approach is referred to as "scorched node" because the costing approach accepts the existing numbers (and location) of switching nodes as given. The alternative approach is less practical and open to wide interpretation as it attempts to take account of the costs of an idealistic network topology referred to as "scorched earth". This scorched earth approach allows complete redesign of the network, without considering any past investment and existing node locations/numbers.

The CITC plans to adopt the scorched node approach. This is consistent with the approach used by most other regulators in other markets. Scorched node is preferred to scorched earth for the following reasons:

- It corresponds to a more realistic real world efficiency standard
- Assuming a scorched earth approach introduces additional complexity into the model as well as some arbitrariness
- Scorched earth may assume a level of efficiency in the network design that might never be practically realisable and this would lead to an under-recovery of costs over time
- There are potential difficulties in measuring the correct level of indirect costs under a scorched earth approach.

Node locations and numbers are assumed to reflect the current network design but equipment in each node can reflect the MEA. This approach may not give the optimum efficient network design – which may have less (or more) node locations or altered site locations, but it acknowledges that the history of the service provider has some influence on the forward looking cost structures. The models should reflect appropriate volumes of equipment measured in current cost terms whereby the network is scaled to meet scorched node requirements and the current and expected levels of service demand.

2.2 Different cost types

Directly attributable costs

Directly attributable costs are those costs that are caused and can be directly and unambiguously related to a service or product.

For example: access copper cables are directly attributable to the increment of access and the supply of the various access services (local loop). An international gateway switch is directly attributable to the increment of international calls (if there were no such calls the cost could be avoided).

Directly attributable costs can be fixed or can vary with service volumes.

Indirectly attributable costs (also known as shared costs)

Indirectly attributable costs are costs that are shared by more than one service, but it is possible to allocate them across services on a non-arbitrary basis, based on their relationship to direct and directly attributable costs. An appropriate allocation method such as Activity Based Costing (ABC) can be used to spread indirectly attributable costs across products and services.

For example, the costs of a cable repair team can be attributed to the copper cables and fibre cables they repair. The cost can be allocated to the access copper and core fibre cables based on the time spent on each repair activity. The costs are then allocated to the access and core services that use the cables. Power costs can be attributed to the equipment within the building, based on consumption and then to the services that use the equipment.

Indirectly attributable costs can be fixed or can vary with service volumes.

Fixed costs

Fixed costs are costs that do not vary with the volume of a service. A billing system for some products may be considered a fixed cost – the computer and software is required for one or one million customers. This type of cost is a fixed cost but it may be directly attributable to the service that it was bought for.

When the volume of the increment is defined as the entire service (such as fixed interconnection) then the fixed costs associated with this service can be treated as a variable cost (if the service do not exist, then neither would the associated fixed costs). As a result, these fixed costs can be attributed to the service increment.

Common costs

Common costs (either network or non-network) are costs for which no direct or indirect method of apportionment can be identified. It is, therefore, impossible to allocate these costs to products and services in a direct way. Once direct and indirect costs have been allocated to particular services on the basis of causality, the remaining costs should be allocated to products and services on some rational basis. Such residual costs, after apportionment of all direct/indirect etc using ABC, are termed Common costs.

Non-network common costs include, for example, audit fees and the total costs of the office of the Chairman. These are common to all services and do not vary to any appreciable level with say core or access increments (an annual audit is required no matter the volume of traffic). Network common costs could include digging costs for duct or fibre cable that are common to several cables in the same duct.

Treatment of common costs

Economic theory states that prices should be set equal to marginal cost in order to promote economic efficiency. However, because of the existence of fixed and common costs in telecommunications, setting prices this way does not allow service providers to recover the full costs of investing in the network. Therefore in a regulatory environment it is accepted that all services should bear, in addition to their incremental cost, a reasonable proportion of the common costs. The CITC expects that:

- The models should allow the recovery of costs based on efficiently incurred common costs. These costs should be shown separately and can be recovered on the basis of adopting a mark up-in addition to LRIC costs.
- The models should identify the costs that are common to each service.

Allocation of common costs

Common costs can generally be allocated to service increments based on an acceptable methodology. Only common costs, for which it is not possible to identify the extent to which a specific increment or service causes the costs, should be allocated via mark-ups.

For example a fibre cable is a (network) common cost needed for many services that use the cable. Note that this may also be termed a "shared cost." However an indirect cost driver is the capacity of services (Mbit/s) since this demand ultimately drives the need for the cable. The use of Mbit/s is an appropriate proxy cost driver for such an element and will be used to determine how to allocate the costs of the fibre to the various services that use it. Digging costs used for a duct that carries a core and access cable are also network common costs, but in this case capacity is not an appropriate cost driver. The costs may be split 50:50, as there is no clear driver. A mark-up approach based on equal proportionate mark up (EPMU) may also be used. The cable size may be an ultimate measure of the cost driver as this consumes duct space, but the data for allocation is unlikely to be easy to obtain and it is weak – some cables are directly buried so size will then not matter.

There are a range of possible methods that could be used to allocate non-network common costs (e.g. the costs of the office of the chairman and annual audit fees). The CITC's preferred approach to the allocation of these costs is to apply an EPMU over directly attributable costs. This involves measuring the directly attributable costs of each service within the group and allocating the non-network common costs based on each service's proportion of the total directly attributable costs.

For many reasons the EPMU is considered preferable to other approaches for the allocation of common costs, in particular the complex information requirements of the alternatives (such as Ramsey Pricing). The EPMU approach has been widely accepted by regulators around the world.

2.3 LRIC and LRIC+

In a strict sense, LRIC is calculated based solely on the variable and direct costs of each of the increments, but as discussed above, adopting this as a regulatory price strategy would not allow service providers to recover a range of network and other common costs (which cannot be allocated to services). Hence, in most, if not all, regulatory LRIC models, an allocation of these costs is allowed (with the output of this sometimes referred to LRIC+). This allocation of costs is usually applied once the base calculation (LRIC) has been completed. For the avoidance of doubt, the CITC emphasises that the final LRIC estimates for the TD and BU models will include a mark-up for common costs (as discussed and defined in section 2.2). In this sense, LRIC and LRIC+ have the same essential meaning in this document when discussing the final outputs of the models.

3 Model outputs

Although the TD and BU models represent different costing systems, the results are expected to be broadly comparable for equivalent network services. The CITC will be able to compare the two modelling approaches and establish reasons for any differences. The analysis could cover, for example:

- The LRIC of wholesale services estimated by the two models and understanding the reasons for differences between the cost results (if any)
- The volume of network elements deployed and their relevant costs
- The range of technical factors assumed in both modelling techniques such as inflation rates for equipment, WACC[2], service volumes, equipment utilisation rates, volumes of equipment installed, direct network operating costs and mark-ups for common costs.

The development of cost models using different approaches enables the CITC to ensure that a wide range of assumptions and estimates for LRIC are considered in determining the appropriate level of cost based charges to apply in KSA.

All model outputs should include:

- The ability to identify the cost types (operational, cost of capital etc.)
- The ability to identify the cost sources (how much the cost from one input contributes to each result)
- Reconciliations of results and inputs to ensure output values can relate to earlier stages
- Clear definitions of the services and the calculation methods
- Identification of common cost contributions.

The output product lists of the TD and BU LRIC models must be comparable.

Outputs should include analysis and checks to ensure that there is no double counting of costs or incorrect exclusion of items. Methods to probe how costs are processed are needed in order to aid in the use of the models and to enable better audit and review.

Documentation and knowledge transfer to the CITC are required outputs to ensure the models are understood and their compliance with CITC requirements can be ascertained.

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[2] The weighted average cost of capital (WACC) is used to measure a firm's cost of capital. Firms raise money from two main sources: equity and debt. The WACC takes into account the relative weights of each component of the capital structure (equity and debt) and presents the expected cost of new capital for a firm. The WACC determines the profit margin on the investment. No other return is allowed, other than recovery of costs.

The LRIC models need to define the total element and total network costs in order to define the service costs. The CITC may verify the data provided independently through an audit process, as well as being closely involved in the TD LRIC model building process and employing review processes. This approach is considered to be sufficient to guarantee that the LRIC outcomes are robust.

Network element costs and other key retail service costs will be defined (local and national calls and PTSN line rental) in the LRIC approach. This follows the approach used in some other regulatory regimes. This approach allows element based charging to be understood and it gives transparency of the cost basis, of both the wholesale (interconnect) services and the equivalent retail services. The model outputs therefore include network element costs and the per unit (e.g. per minute) cost of each network element. The CITC may decide to release this information, as well as service costs.

The model outputs should include the cost of the regulated services and other retail services that share the same network. Non-relevant service costs (such as data) need not be specific outputs that need to be costed in detail. Therefore many diverse data communication services might be grouped together. The cost of these services cannot be ignored as they contribute to the overall network dimension (and cost) giving economies of scale and scope, plus they should be assigned an appropriate portion of the network (and common) costs.

4 General costing issues

4.1 Assets, working capital and operational costs

The LRIC models should be based on the capital investments required to build an efficient network. A functioning network incurs operational costs. Both capital and operational costs must be recovered. In addition to the fixed assets, some working capital is required – net assets less net liabilities. This requires an additional investment that should be allowed for.

Models should identify the efficient working capital that is required and include appropriate methods to ensure a fair return on this investment.

The efficiently incurred operational costs shall be recovered. No premium or additional recovery on this cost is allowed.

The asset investment costs must be recovered using appropriate methods as described for each model type, including a recovery of the fair return on this investment – this is determined by the WACC value. The WACC shall be an input to each model. The determination of the WACC value does not form part of the LMG.

4.2 Annualisation methodologies

Capital investments in telecommunication networks are significant and many items last long periods of use before they are replaced. The investment costs could vary significantly from year to year as a result of changes in the inventory of assets. The effective annual cost of the investment is required to define the revenue needed to provide for the replacement of the investment (asset) and to allow an adequate (fair) return on the investment (profit). This is termed annualisation of the capital investment

Annualisation charges are calculated on capital investment as the sum of the cost of capital, and depreciation.

Annual cost of capital is calculated as the mean capital employed in the equipment during the accounting year multiplied by the WACC. The mean capital employed in the equipment during the accounting year is calculated as the arithmetic average between the gross values of the fixed asset from the beginning and the end of the accounting year.

4.3 Economic Depreciation

Theoretically, economic depreciation is the optimal annualisation method, as this is the most accurate way of measuring the economic value of the asset over its lifetime.

Economic depreciation can be calculated as the estimated Net Present Value (NPV) of net cash flows generated by an asset for the remaining lifetime at the end of a given year less the estimated NPV of cash flows at the start of the year. This is the change in economic value where the economic value is the asset's earning power, i.e. the discounted present value of expected future revenues from the output produced by the asset, less the present value of associated future operating costs.

The values depend on a variety of factors, such as:

- current and future output demand
- the asset's output
- operating costs
- the asset's life
- the impact of technological improvements
- the cost of capital.

The depreciation profile will depend on how the factors determining an asset's value are expected to change over time.

The disadvantage of using economic depreciation is the complexity of its calculation, given the detailed set of information required. For practical reasons several alternative methods for deriving annualisation costs can be used (such as linear depreciation, accelerated depreciation, regressive depreciation, and annuity methods).

The DSP (in its TD model) and the CITC (in its BU model) shall use either economic depreciation or an alternative method which best approximates an estimate of economic depreciation. For the BU LRIC model, the CITC intends to use the tilted annuity approach. The CITC considers that this is a solution that provides adequate accuracy and simplicity appropriate to the accuracy of input data expected in the BU models.

The DSP shall keep a record of assets in use, including the amount of fully depreciated assets in use. This will contain all the information necessary for the identification and calculation of the extent of these assets by asset class and age.

4.4 Cost of capital (WACC)

The cost of capital shall be determined by the CITC. This is an input to TD and BU models. It provides a fair return on the asset investment.

Both models shall define the cost of capital as an input.

When the cost of capital is correctly defined, it allows sufficient return to account for the risks of the associated telecoms market. The costs of capital for fixed and mobile business are usually different and so a different WACC value may need to be considered for each of the LRIC models of fixed and mobile. The cost of capital is the pre-tax nominal value. This cost of capital is normally set using the Capital Asset Price Model, using the weighted average cost of capital of an efficient service provider in the relevant market (using the appropriate optimum debt/equity ratio). The CITC intends to use the same methodology.

Determining the cost of capital is not part of the scope of this document. It shall be an input to each model and will be defined separately by the CITC. WACC values shall be made public, by the CITC.

4.5 Other costing issues

Averaging of land and buildings

The current replacement costs of land and buildings used by the existing fixed network may vary according to specific locations or other characteristics. One approach would be to calculate land and building costs as a national average for each type of site, i.e. by adding together the costs of all sites and dividing it by the total square metre of these sites. Another option would be to calculate the land and building costs for each type of site. Between these two extremes, the land and building costs may be calculated for a group of sites with similar characteristics (for example, location).

The averaging approach taken in the TD and BU models respectively may depend on the data available on land and buildings. The DSP and other service providers shall co-ordinate with the CITC to ensure that the two models, as far as possible, use the same averaging of building costs.

Base year

As far as possible, all cost and volume data should be based on 2007. This is the base year for the model. In addition, the models should have provision to update the data to a new base year.

Routing factor tables

Routing factor tables will be required for TD and BU LRIC models. Routing factor tables specify, for each type of service, the average use made of each type of network element. Each service therefore has a routing (or "usage") profile indicating how the service uses the network elements (distinguishing between the different types of exchange and the different parts of the transport network).

In BU models, routing factor tables are used both to dimension the network and to cost the services whereas in a TD model, routing factor tables are normally only used to cost the services, as its network elements' costs are defined from accounting data.

Having calculated the annual cost of each network element, service costs are calculated using the routing factor tables. These factors are applied twice:

- First to calculate the total cost of using a network element for one minute or one call. This "per unit cost" refers to the element's total annual cost divided by total usage by all products that use the network element.
- Second to calculate the service cost by multiplying the network element's per unit cost by the routing factor (the number of times the network element is used by the product).

Network elements may be specific transmission links or different types of exchanges. For transmission links, element usage can be measured in minutes or kilobits/s; for exchanges, these are measured in minutes and busy hour call attempts. Network elements form the "building blocks" for services for which costing information is required.

Treatment of Next Generation/IP Networks

Next Generation Networks (NGN) *could* be considered the Modern Equivalent Asset (MEA). TD and BU LRIC models therefore *could* include the network costs of NGN networks as a proxy for the MEA.

However, the CITC considers that it is not appropriate at this stage of market development to consider NGN as the MEA.

Hence, the DSP is not required to revalue network assets according to the costs of an equivalent NGN. However, the CITC will take into account NGN costs and associated volumes in areas where it is being deployed. The DSP shall provide the CITC with detailed information on NGN deployment, where appropriate. In the light of this evidence, the CITC will consider whether it is relevant for the cost models to reflect the costs of a switched network or a "hybrid" switched and NGN network. This will depend on the view of the importance of NGN in the Kingdom and whether in this period it should be considered as the MEA technology.

Different approaches to the NGN cost modelling may be taken. For example, the NGN could be considered the MEA in areas where it has been deployed and the legacy network costs of servicing those areas could be excluded from the LRIC models. The CITC intends to take this approach, and not extend NGN costs as the MEA across the rest of the network. Therefore, in areas where there is duplication of NGN and legacy networks, it is appropriate to ignore the costs of the legacy network elements since they would not be regarded as MEA and therefore the least cost technology of choice is NGN.

The CITC considers that it is difficult to predict when NGN will become the MEA. This will become clearer over time. Given this uncertainty, at the time of the publication of this LMG, the CITC will not identify any formal timelines for the NGN to become the MEA.

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NGN networks that are used for trials or tests, or else for research and development, should not be included in the cost analysis.

Whilst NGN remains a small fraction of the total cost, the NGN costs and NGN network elements may be assigned to service using the same cost drivers as used for the equivalent legacy network elements. Therefore IP switches may be allocated to voice and data based on the peak Mbit/s usage and voice service costs recovered by per minute allocations using the routing factor table technique. This approach may be re-visited in the future once NGNs become widely deployed in KSA by the DSP, by which time NGN costing approaches are expected to be more generally accepted.

KSA specific factors

If the DSP considers that there are unique factors in its operating environment that need to be taken into account as part of the TD or BU LRIC modelling process, then these factors and their magnitude need to be separately identified and justified. These factors may include the extra network costs required to dimension to network for higher traffic levels during Hajj.

The CITC shall consider all KSA specific cost issues on their merits. The onus is on the service providers to specify what these factors are and to supply quantitative evidence of the possible impact. Such factors must be made transparent in any model. Their inclusion must be agreed to by the CITC.

Part B: Guidelines for the building of the Top-Down LRIC model

5 Overview of model structure

In this section we describe the approach to the TD model requirements. In many cases the process is generic to Access and Core services. Examples are mostly given only for core services for reasons of clarity.

The main steps to be followed are shown in the diagram 5.1 and are described in the following sections. The start points of a TD model are the financial systems of the business. These costs are processed in stages as shown in the diagram 5.1.

As discussed earlier, the CITC requires the DSP to build a TD LRIC of the fixed core and access network. There is no requirement on the DSP to build a TD LRIC model of the mobile network. However, the DSP as well as other service providers are welcome to build their own TD (or BU) LRIC models of the fixed and mobile networks. The CITC may take the results of these models into account when assessing the results of the LRIC model process.

In the event that service providers wish to build alternative TD LRIC models, the CITC recommends that they follow the same LRIC Model Guidelines that the DSP must follow for the TD LRIC model for the fixed network.

5.1 Determine homogenous cost categories and revalue assets

This step groups costs that have similar characteristics into individual cost categories, also called homogenous cost categories or cost pools. The level of homogeneity is determined by the need to identify individual cost drivers.

All costs that have a single cost driver can be grouped into the same category. Staff salaries and overtime payments have the same driver so can be combined in one category. However, the staff costs in two different divisions will have different cost drivers and therefore there would be two separate cost categories.

Since LRIC is a forward-looking concept, current cost accounting (CCA) principles have to be used to determine the appropriate net value of assets and associated depreciation charges. This involves re-valuing assets on the basis of the replacement cost of the modern equivalent asset (MEA). The MEA may be defined as one with the required capacity and functionality that has the lowest (discounted) cost over future years. Lifetimes for equipment should reflect actual lifetimes of the asset or its MEA replacement.

If there are differences in operating costs between the MEA and the existing asset, the MEA valuation of the existing asset plus operational costs must also be adjusted to reflect these differences. These may arise, for example, due to differences in maintenance costs, network management costs and associated indirect costs.

CCA shall be based on Financial Capital Maintenance (FCM). [3] 'Windfall' losses (or gains) as a result of migrating from Historical Cost Accounting (HCA) to CCA are not allowed. On a going forward basis, CCA using FCM ensures that the full value of the asset is recovered, therefore if the value of an asset falls rapidly in two years time, then this holding loss is recovered over the two years. There will be a number of corrections to asset values, both upward and downward, when converting from HCA to CCA. The impact of these one-off changes during the conversion is not relevant to the TD LRIC analysis.

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[3] FCM is an approach to accounting for changes in prices in order to protect the value of financial capital invested in the firm by shareholders and the providers of debt. The implication of FCM is that any change in the value of a firm's existing assets during the course of a year has to be matched by an allowance in the firm's revenue. This can be illustrated by showing how FCM works under a current cost accounting (CCA) approach. Under CCA (based on modern replacement costs) the value of existing assets is updated to reflect changes in the replacement cost of modern assets. Asset values can be increased or decreased. If modern assets are more expensive than the existing assets, then the Gross Replacement Cost (GRC) of the assets increases, i.e. their CCA value increases, but this is offset by the extra depreciation over the period. This results in a 'windfall' gain for the firm. If modern assets are cheaper than the existing assets, then the GRC of the assets decreases. This results in a 'windfall' loss for the firm.

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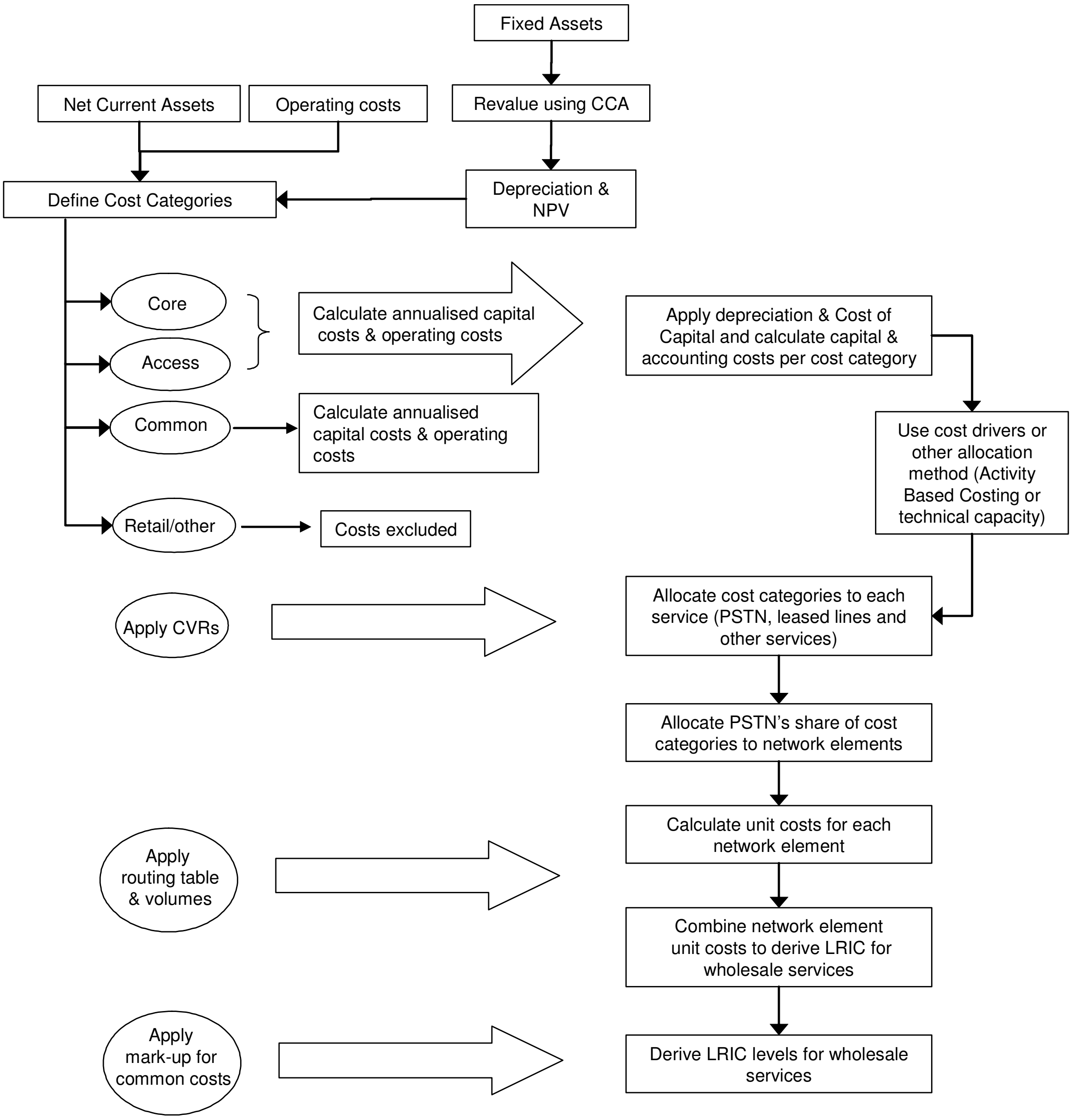
Figure 5.1 Overview of Top-Down model structure



Once the gross asset value has been calculated according to CCA, the net asset value can be found by subtracting accumulated depreciation. The net asset value represents the capital tied up in network assets, valued on a current cost basis. If gross asset values are estimated on the basis of replacement costs, this net asset value is referred to as the Net Replacement Cost (NRC) or Net Present Value (NPV). The accumulated depreciation should be calculated on a linear basis using the lifetime of the asset.

The measurement of asset values under forward looking MEA is a fairly standard feature of building TD or BU LRIC models. This is the intention in KSA. The CITC notes that net asset values are not based on historic costs but the asset values are measured in today's terms, using forward looking MEA.

The gross values may be calculated by direct assessment of the market value of the asset in the market today. This is typical for a few assets that need individual assessment by a valuator. This is acceptable if the re-valuation is documented and justified. Other simpler methods are expected – many categories of asset will have a known price trend. The purchase date and relative price compared to today can be used to form a re-valuation index table that allows all assets in this class to be re-valued in today's terms. Other methods may be discussed with the CITC.

5.2 Group cost category by activity and network elements

Once homogeneous cost categories have been identified and fixed assets have been re-valued, the next step is to determine the activities using the cost categories and to attribute the costs to different network elements, sub-element, products and other "cost pools," based on the activity driver. A cost pool is a collection of costs that are related to the same object. Costs of power, building space and operations staff may all relate to the same local switch cost pool.

This typically requires several stages of cost allocation. Costs may be allocated to a local switch element and then subsequently this can be allocated to per minute, per busy-hour and subscriber-access dependent sub-elements (or cost pools). The process shall include:

- Allocations of costs to cost pools
- Allocations driven by activities
- Identification of activity costs
- Allocations in subsequent stages to more detailed elements
- Allocation of all costs that do not relate to access and core increments to other cost pools (pools for mobile or retail costs for example)
- Allocation of non-relevant cost items (such as out payments to other operators, interest payments to investors etc.) to specific cost pools.

This step in the modelling process must ensure accurate allocations and dis-aggregation of costs to enable the individual products and services to be defined in the later steps.

Activity based costing (ABC) should be used as the basis for the allocation stages.

5.3 Apply CCA depreciation and the cost of capital (WACC)

Capital costs are defined at this stage. These are found by multiplying the average net asset valuation for the year with the cost of capital (WACC).

Depreciation, when calculated from the re-valued assets using CCA process, shall be included.

5.4 Develop cost-volume relationships

Cost-volume relationships (CVRs) show the way in which costs change in relation to a change in the volumes of the service provided. The incremental costs of services are derived by adding (or excluding) an increment of services and by identifying the effect of these changes upon the total costs using CVRs. CVRs can also help estimate the effects determined by the forecasted changes in the volume of demand on the level of costs.

Deriving CVRs will depend on the cost category to which they refer. Depending on the cost category, CVRs shall be estimated either using technical economic models, or simulations produced by engineering experts, or by the use of either regression analysis[4] or through the analysis of the processes which are at the basis of various activities or (where available) published benchmarks.

CVRs can be difficult to estimate in many cases – some are complex relationships which are non-linear. In the absence of evidence to the contrary – and in order to simplify the TD model calculation - the CITC will initially accept an assumption of straight line CVRs for all asset and operational classes in the model.

In addition, the CITC may accept CVRs as an additional model feature to be added later, to expedite rapid approximations of LRIC. In this case LRIC estimates would not vary with volumes and therefore the model would only estimate LRIC costs based on the current year's costs. In this case, the CITC may make additional estimations of the inputs when setting LRIC-based prices.

CVRs shall enable the detailed cost pools to be varied based on an input of volumes and the change in these volumes. The process must identify the cost driver for the cost pool and define the relationship. The cost driver must be related in some way to the volumes of the input and the overall demand for the service.

The CITC shall use the CVR data to examine how predicted volumes result in altered costs. The TD model will supply cost data for the base year. CVRs allow additional views of how service costs should change in the next year(s). These shall be factored together in the LRIC price determination process. This price setting process is not part of these LRIC Guidelines. The details of the pricing

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[4] Regression analysis is a mathematical tool for modelling relationships between different variables.

process will be defined later. The pricing process will need to factor in such items as: the TD and BU models' results, consider cost trends using CVR data, and consider the rate of change of cost (or volumes) over time, the impact of the price change on the market and the relative solidity of the data. For these reasons, the details of the price setting process cannot be defined in this document.

5.5 Calculate service costs

The model calculates the cost of services from the network element costs using the routing factor tables and product volumes (described in more detail in section 9.3). This determines the unit cost of using each element and then calculates the product cost resulting from using the network elements used by the product. Finally a mark-up is applied to include non-network common costs.

All costs within the LRIC model will be directly or indirectly related to the volume of output of the increments or else they shall be allocated to specific cost pools for non-relevant costs. Certain costs are directly related to those volumes whereas others will only have an indirect relationship through other intermediate cost drivers. However, the method for calculating the service cost is always the same, which is to:

- identify the cost driver volume associated with the service (or increment)
- derive the cost driver volume of the particular cost category
- calculate the associated cost of adding the cost category to the increment (cost allocation).

All relevant services must be calculated. The emphasis should be in the wholesale services (see sections 6 and 9 below). The services to be calculated must also include retail services, as these share the same infrastructure and systems. The core and access models are both needed to calculate retail and wholesale core and access services. Data from both will be needed for some services such as leased lines which have an access and a core portion.

The services to be costed may include services that are not yet launched and these may modelled with a nominal volume of one. The list of modelled services must be agreed with the CITC during the model design stages.

5.6 Outputs of the model

The outputs of the LRIC model include:

- the LRIC for each cost category
- the LRIC of all services defined in the model (such as fixed termination, leased lines, subscriber access lines etc.)
- the per-unit cost for using each network element
- the disaggregated costs by (1) the cost of capital, (2) depreciation (3) operating costs, (4) overheads, (5) mark-ups, etc.

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6 Services modelled

DSPs typically carry a wide range of services across their networks such as traditional voice services, leased lines and data services.

The TD LRIC model needs to account for all of these services. To exclude some would result in an under-used network and increased costs for the remaining services. For example, the costs of ducts would be allocated to fewer services. Therefore all services need to be modelled, even though only a subset of these services will be subject to regulation of rates based on LRIC.

Since the TD model is derived from a service provider's accounting data, all services are assumed to be included in the TD model. However, the degree of detail, in modelling services in the TD model, may vary by type of service.

The TD fixed model shall include and categorise core and access services under the following headings:

- PSTN services
- Access services
- Leased lines
- Other services.

'Other services' need not be modelled to the same level of detail as the other three services listed.

Common business costs should be allocated across all services: retail and wholesale using the approved mark-up method.

A range of retail and wholesale services exist under each category (PSTN, Access and Leased lines). Retail costs such as billing and marketing should be separately identified and these must not be allocated to wholesale versions of the products.

The CITC notes that the services modelled in the TD LRIC model by the DSP will be the same services that will be modelled by the CITC in the BU LRIC model.

Wherever feasible, network costs should be allocated based on agreeable methodology (based on appropriate cost drivers or other method). Costs (network and non-network) that cannot be allocated to services through an agreed methodology are called 'common costs'. These 'common costs' should be allocated to all services: retail and wholesale using an EPMU mark-up method (as discussed in section 2.2).

6.1 Core and Access services

PSTN services

The models should include all PSTN services making use of the core network that originate or terminate on exchange lines. Any wholesale or other transit services should also be included. These should include (but are not limited to):

- Local calls
- Long distance calls
- International calls
- Fixed to mobile calls
- Calls to other service providers
- Calls from other service providers and
- Calls transiting over the network.

A range of wholesale services shall also be included (including services that may not be currently included in the RIO). These wholesale services shall include:

- Local exchange interconnection
- Single tandem interconnection
- Double tandem interconnection
- Transit services.

All modelled services shall be defined using the routing factor table method defined previously.

A tandem exchange is one that is used to onward switch traffic. Tandem (main) switches are core switches that do not usually have customers connected directly to them. The double tandem call will usually include an additional local switch to connect to the customer. Tandems are also termed transit switches.

The costs of services that are not deployed at present can be calculated using a notional "one unit" volume (say one call minute per year) to enable the model to calculate correctly.

Access services

The model should define the costs of the following access services (as a minimum):

- PSTN access
- Wholesale transmission links (to be used for full leased line calculations)
- BSA – Bit stream access
- Data services
- Line Sharing

- Other (payphones, etc)
- Collocation services (discussed in more detail below)

A routing factor table type approach shall be used as described previously. This defines each access services' use of access network components (2 or 4 wire copper), use of line card or distribution frame, etc. Access network components may include items such as MDF (main distribution frame) and can also include fibre (some access services use fibre links for some services or for some parts of the access link).

Access services are relevant to some core services such as leased lines. A full wholesale leased line requires core network component and an access line component.

All services should have additional definitions of the service demarcations, including points of interconnect and the network elements that contribute to the service (these network elements should in most cases be identified in the routing factor table type allocation of element costs to services).

Wholesale transmission links

The volumes of leased lines are needed to help in dimensioning the network and for ensuring that a fair amount of the network costs, shared with PSTN services, are allocated to leased lines services.

The TD model shall calculate the cost of leased lines explicitly for the following leased lines types:

- 64kbit sub-rate lines (by distance and region)
- 2 Mbits (by distance and region)
- STM-1 (by distance and region)

Leased line services shall include retail and wholesale leased lines. Leased lines shall be categorised to define the cost of lines based on the speed, performance and distance.

The leased line costs shall include core and access components.

Leased lines shall be derived using a routing factor table type approach as described previously. This defines the usage of transmission, cross connect and access elements for each type of leased line.

Provision shall be included to enable wholesale half circuits to be evaluated. Components of the access service costs will need to be included in the wholesale half circuit determination.

Other services

Other services using the core and access networks should also be modelled to ensure that the core and access increments are dimensioned properly. Inclusion of these services will allow a fair distribution of shared and common costs. Virtual Private Networks (VPN), collocation services and packet-switching technologies such as frame relay and the internet are examples of these services.

As discussed above, it is not the purpose of the model to calculate the LRIC of these services, but only to ensure that a fair proportion of costs are attributed to these services. 'Other services' use of shared assets should be taken into account but shall not be modelled in detail.

Collocation services

To ensure that collocation costs are not included in any other services' costs they must be separately identified in the model. Collocation services are defined as wholesale services and ideally these should be cost-oriented. The CITC appreciates that it is typically difficult to estimate these costs in a TD model. To simplify the calculation and in the absence of better cost allocation data, the DSP may use revenues received for collocation services as a cost proxy. Alternative proxy measures (justified by the DSP) may also be used during the model building process. Collocation services are a specific product that is delivered as a wholesale product.

If possible, the costs of the buildings, staff and infrastructure should be allocated to the collocation service to enable the per-unit cost (per rack, per square meter, etc) to be defined. A TD LRIC model is unlikely to be accurate enough to define such small incremental volumes using standard cost allocation methods. BU cost methods are considered more appropriate.

The DSP should ensure through the use of suitable allocations or the revenue-proxy method (discussed above) that collocation service costs are excluded from the increments of other services (such as wholesale call services).

It is also vital that collocation (space and infrastructure) costs are allocated in a sensible way to different increments. For example, the costs of fixed network buildings that are used by mobile services should be allocated to the appropriate mobile service cost pools. All such costs (plus overheads) should be excluded from fixed network service cost calculations.

6.2 Demand and growth

Demand

Costs should be allocated to the total amount of traffic using the network. The network should be dimensioned to carry the traffic in the "busy hour," subject to the required quality of service level. The busy hour may vary between the different parts of the network or by service.

The model shall include flexibility for busy hour demand to be derived from the annual traffic for each product in different ways.

Costs for leased line and access products shall be allocated to the demand specified for the costing period base year.

Capacity based LRIC estimates is not part of the current model specification. Though the model could be requested to be updated over time to reflect capacity based costing (and hence capacity based wholesale price estimates). The model will reflect the costs of network capacity, since the costs of the existing network (in base year) are included, and these are assumed to be dimensioned to carry the base year capacity and demand, plus provision for planned growth. The onus is on the service provider to show that capacity (and costs) is efficient and include only prudent spare capacity for growth to meet future demand. Inefficient excess spare capacity costs should be identified and excluded.

The model will express the total network capacity costs into 24 hour average charges per minute, therefore the output of the model should not include time of day cost variations.

Accounting for growth in demand

The modelled network should meet the demand not only in the base year but also in the foreseeable future, taking into account normal and efficient planning horizons. Hence, demand forecasts will be needed.

The margins for growth will typically be incorporated in the TD model via the existing network's experience of prospective demand for fixed services in KSA. The TD model is expected to include capacity and costs, for normal efficient forward planning to meet forecast demand.

The cost of the current network is calculated using the MEA, and it should be designed to include capacity for growth. Additional costs are not expected to be added.

Spare capacity for future growth should be only the amount required to minimise long run costs. Excessive capacity (costs) for speculative growth, unrealised demand and from inefficient network design shall be identified and must not be treated as relevant to future demand. These costs shall be allocated to relevant cost pools. The obligation is placed on the service provider to show that the MEA definition provides adequate capacity and that no inefficient costs are included.

7 Fixed Assets Valuation

7.1 Current Cost Accounting

Assets shall be evaluated at current costs, using the Net Replacement Cost method. As discussed earlier, the Financial Capital Maintenance (FCM) method should be used when revaluing assets.

The DSP shall include in the model documentation a detailed description of methods used for restating assets' values on a CCA basis.

The re-valued assets shall assume that depreciation is calculated on a linear basis for the rest of the assets' lifetime. Total depreciation shall include holding gains and losses as a result to the change in value in the measurement period.

7.2 Replacement Cost

Replacement cost measures the cost of replacing the existing asset with another asset of similar performance characteristics. Gross asset values shall be evaluated using the replacement cost, calculated either at the current market value of the assets, or at the value of the modern assets, equivalent from the point of view of their capacity and functionality (the Modern Equivalent Asset – or MEA – method).

If the replacement cost is evaluated using assets existing on the market, and which make use of the same technology as the assets evaluated, then the replacement cost shall be the actual market value of these assets. Any adjustment (indexation) of this value shall be accompanied by supporting documents.

If the replacement cost is evaluated using modern equivalent assets (MEA), then it shall be adjusted in order to reflect the differences in quality, productivity and asset lives between existing assets and MEA assets.[5] Operating costs of the Operator shall be adjusted in order to reflect the operating costs associated with lease cost MEA. Differences in operating costs can appear due to differences in the costs of maintenance, of organising the network, as well as in the indirect costs associated with MEA.

In all cases, the asset existing on the market, and which is the basis for the valuation process, shall be capable to sustain the provision of the same services as the evaluated asset (including quality) at the lowest cost. The market is considered to be the international market of telecommunication equipment.

[5] The method used to adjust existing assets to MEA is discussed in more detail later in this section.

7.3 Valuation of major asset categories

Switching Equipment

Switching equipment comprises concentrators, local exchanges, tandem exchanges and ATM/IP switches for data traffic. The valuation shall identify separately the cost of each of these items, distinguishing, where appropriate, between the values of different makes of switches.

There are two cost drivers at the switching equipment level:

- call duration (e.g. exchange ports)
- call attempts (e.g. processing capacity).

Additionally, subscriber line cards may be included, but these should be allocated to access services (since the cost driver for these is subscriber numbers).

The costs relating to ports and processing capacity shall be separately identified by the DSP.

A significant part of switching equipment costs consists of software. Since software applications are regularly updated, this suggests that it may be appropriate to evaluate them at current costs and to derive separate asset lifetimes and separate cost-volume relationships for software and hardware. In case of several repetitive software upgrades, only the cost of the last upgrade shall be accounted for.

The CITC notes that there are two types of software. Basic software is defined as the software required to operate a switching centre. This type of software can be capitalised. Other types of software (for applications) may be capitalised or expensed.

The DSP shall provide information regarding the lifetimes used for the switching equipment and, where appropriate, justify applying the same (or different) asset lifetime to hardware and software.

The demarcation point between the fixed access and the fixed core is based on the following principle: access costs are those costs that are subscriber-dependent not traffic dependent. For PTSN access services therefore all costs after (and including) the line card in the local switch are access related.

Transmission Equipment

Transmission equipment comprises multiplexers, regenerators and cross-connects. The TD model shall disclose the values for each of these classes of equipment separately.

The TD model shall use SDH equipments as the MEA for PDH equipments.

The documentation of the TD model shall describe and explain the structure of the different levels of the transmission network used and the manner in which its elements are allocated to the telephony services provided through the fixed network. International and local transmission elements for example should be separately identified in the model.

Each asset component of the transmission network must be separately identified and re-valued, depending on the asset category's replacement cost.

Optical Fibre

The costs of the optical fibres include the cost of the optical fibre itself, cable-jointing costs, installation costs and various indirect costs.

In order to determine the replacement cost of the optical fibre network (as well as other items), two methods can typically be used: (1) the absolute evaluation method based on samples; or (2) by adjusting the historical gross value (as described in the section 7.2).

The use of the absolute evaluation method consists of the following steps:

- selecting a statistically representative sample of routes for the DSP's core network as a whole
- estimating each of the individual cost items on the selected sample of routes.

These estimates shall be applied to the entire core network in order to determine a gross value of the cost of existing optical fibre in the DSP's core network.

Since fibre is close to a commodity item, prices are well documented and so indexation over time may be an appropriate revaluation method.

In order to evaluate the efficiency of the optical fibre network, the DSP shall consider the existing level of demand, adjusted with a reasonable mark-up corresponding to a predicted change in the level of demand. If, following this analysis, there is an inefficient level of optical fibre currently deployed in the network, then the costs associated with this level of inefficiency should be removed from the costs to be included in the model.

Trenching Costs (digging)

Trenching costs shall reflect the costs that would be involved by the development of a modern network (taking into account efficient network dimensioning). Therefore, the historical costs incurred in network development shall be adjusted to reflect current 'actual' values (for example, adjustments to reflect modern trenching design).

In order to evaluate the replacement value of trenching, the DSP shall use a similar method to that applied to the evaluation of optical fibre (discussed above). The structure of the Top-Down model shall allow the identification of cost categories included in trenching value. The model documentation shall also justify and detail the chosen evaluation method.

Indirect asset costs

This category includes land, buildings, motor vehicles, computers and office equipment. For valuation, these assets shall be sub-divided into reasonable homogeneous classes, and identified in the model.

8 Working capital and operating costs

8.1 Working capital costs

Working capital costs include the costs of maintaining balances of physical or financial stocks (assets and liabilities). Working capital cost is calculated by multiplying the cost of capital factor with the calculated working capital.

The cost categories associated with working capital are likely to include:

- Stocks, e.g. spare parts
- capital work in progress, e.g. under construction
- cash
- debtors
- creditors
- provisions.

The following guidelines are provided for estimating the cost of working capital:

- Only the amount that would be required by an efficiently run telecommunications service provider may be included. Account data may not necessarily reflect the necessary working capital for an efficient service provider. Adjustment of operational costs may influence the level of working capital as will more efficient management of debtors, creditors, and current assets.
- Only working capital that is related to the operator's network (wholesale) shall be included. Working capital related to retail debtors and creditors is excluded.
- Cost should be apportioned according to an appropriate cost driver for each cost category. The cost driver may be different for each cost category, e.g. for debtors, the appropriate cost driver may be the proportion of interconnect charges incurred by different units (inclusive the company’s own retail unit), and for creditors, the appropriate cost driver may be network elements (or activities).
- The model should at least use two sets of accounts (e.g. beginning of year and end of year). If possible, more sets of accounts may be used in order to reduce seasonal fluctuations. This is needed due to the risk that estimates of working capital may not be representative. Hence, this problem may be partly solved by calculating working capital at different points in time.

8.2 Operating costs

Cost categories

The model should examine operating costs at a disaggregated level to ensure that they are assigned to the correct part of the network. Only network (or wholesale) costs should be included in the access and core increments. Any costs related to retail activities such as marketing, as well as the retail cost categories related to both wholesale and retail activities shall be excluded from these increments.

Billing and customer care are examples of retail activities. Wholesale billing and wholesale account management are relevant to wholesale services, but are different activities and should be identified as such. It is appropriate to include any costs, such as marketing or customer care, which result from a dedicated effort in offering wholesale services.

Operating costs for activities closely related to the network include provision, maintenance and network planning and installation. The difficulty here is in identifying whether the activity relates to the access network, the core network or both. For other operating cost activities, an additional problem is that they are only indirectly linked to the network; they represent indirect network costs or overhead costs. Such operating costs comprise among other things:

- *Transport*.[6] For example, company cars.
- *Accommodation*. The link to network activities may be straightforward in some cases, such as accommodation used to house exchange equipment, but it may be more difficult to allocate the costs of office buildings. In this case office accommodation should be allocated to the staff in the building and then by the activities of the staff
- *Finance*. Activities include payroll financing, maintaining asset registers (primarily network related), preparing company reports and accounts and management accounts
- *Network planning and network optimisation*
- *Computing*. Direct costs, such as costs of network management and indirect network operating costs such as PCs
- *Corporate overheads*. Human Resources, General management, the costs of legal and regulatory departments, insurance, royalty costs and the costs of senior management
- *Interconnection*. Specific operating costs, such as the costs of staff involved in interconnection billing.

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[6] Transport costs consist of both capital items (the vehicles themselves) and operating cost items such as gasoline and maintenance. The discussion here relates to the latter class of costs, for transport and for the other categories of costs discussed in this section.

Many of these costs affect both the wholesale (network) and retail business. Activity based cost (ABC) allocation methods should be used to determine their magnitude, and costs allocated to the wholesale network should be separately identified.

Where relevant, the TD model should distinguish between "pay" costs (cost related to salaries) and "non-pay" costs (costs that are not related to salaries).

Efficiency

The TD model should only include efficiently incurred costs. See also discussion of spare capacity in section 6.2.

The DSP may include operating costs incurred to satisfy legal and regulatory requirements, such as the provision of accounts and information, even when it would not be efficient to incur these costs if the legal obligation was not in place.

The DSP’s accounts are unlikely to distinguish between efficiently and inefficiently incurred operating costs. Reasons for inefficient operating costs are:

- using an asset which is not the MEA
- inefficient processes
- excess capacity
- excessive labour and other inputs, even given efficient technologies and processes.

With respect to the first class of costs, the current costs asset valuation (using replacement costs), as discussed earlier, will exclude inefficiently incurred operating costs.

There are a number of techniques for identifying efficient operating practices. Benchmark comparisons may compare the ratio of operating costs to capital costs, ideally at a disaggregated level, for the DSP and a range of other operators.[7] Alternatively, the DSP can make use of theoretical cost models which value the efficient level of operating expenses for each asset.

Inefficient costs should be identified in specific ‘cost pools’.[8] These cost pools allow reconciliation of inputs so that they can sum to all output costs.

Activity-based allocation of operating costs

Having identified the classes of operating costs and made adjustments to ensure that they only reflect efficiently incurred costs, the model shall then allocate these

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[7] When using benchmarking, appropriate corrections should be made for relevant differences between a service provider in KSA and service providers in other countries.

[8] Cost Pools are a collection of costs that relate to one item such as a product or network element. An ‘inefficient costs’ cost pool thus includes all the costs that have been identified as being inefficiently incurred throughout the network.

costs to the different services provided. This is more complex for operating costs that are common to more than one service. Here, an Activity Based Costing (ABC) approach should be used to achieve a more satisfactory allocation of operating costs.

ABC is conceptually a multi-stage costing system, with two stages of processing. The initial costs element is termed a resource. It assumes that activities cause costs and that cost objects (such as services or network elements) create the demand for activities. In the first stage, cost resources are allocated to activities. In the second stage, the costs of activities are allocated to the cost objects based on the activity driver (how the activities relate to cost objects such as network elements).

To assign the costs of each activity to products or services will require identification of a cost driver for each category. The cost driver should explain the costs of that activity and should be quantifiable – call conversation minutes and numbers of call attempts are examples of readily quantified cost drivers for network elements. In addition, the cost driver should be measurable in a way that enables it to be identified with individual products or services.

Operational activities (staff) drivers may be determined by tasks, time, staff numbers etc. These activities may relate to other operational departments. These supporting activities must be allocated first. IT support is one example. The operational activities of the supported department then define how the full costs of the operational department should be allocated.

Activity Based Costing should be documented and verifiable.

9 Costing services

9.1 Homogeneous cost categories

As discussed earlier, the first step in the TD modelling is to group costs with similar characteristics into homogenous cost categories. The cost driver should explain the costs of a particular activity and should be quantifiable. The model should be sufficiently disaggregated to accurately allocate costs to the various network elements and services.

9.2 Deriving cost drivers and measuring volumes

Within the allocation process, indirectly attributable costs shall be apportioned to network elements using cost drivers. Using cost drivers, the model shall determine the extent in which increments (services and network elements) generate a specific category of operating expenses. In this way, homogenous cost categories are allocated to incremental services or network elements depending on the volume of the associated cost driver.

The volumes of the cost drivers for the main categories of fixed assets within the modelled increments shall be determined as follows:

- **Trenching and ducts** - the volume of trenching and duct can be measured in kilometres with separate measurements carried out according to whether duct is in the Access or Core network or in the other increments to ensure separation of costs to the appropriate services. Shared ducts should be allocated to both the core and access network. The allocation shall be 50:50, but there shall be the flexibility in the model to apply different cost sharing ratios, if required by the CITC.
- **Copper and fibre cable** – where cable is in the access network, the model shall use subscriber lines as the relevant volume measure, noting that copper based services may use 2 wire or 4 wire etc. delivery. If fibres are used for service delivery, then the subscriber service numbers (taking consideration of numbers of fibres) is the cost driver. If fibre access cable is shared by services, the allocation of the costs should be based on the total capacity of each service (Mbit/s) that shares the fibre. Where cable is in the core network, traffic shall be used as the relevant volume measure (megabits per second). Copper pairs used for each service is the main access driver. Some services use single pairs, others such as leased lines may use more pairs. Fibre systems should be allocated based on the capacity of the services that use the cables (and drive the costs). The driver for transmission systems in Mbit/s. Voice traffic, leased lines and other services each generate their own total transmission capacity driver (in Mbit/s). This Mbit/s allocation is valid for core fibre transmission and for where fibre links are used in access networks.

- **Local exchanges** – the model shall use separate volume measures and therefore separate cost-volume relationships for different network components in local exchanges. These components include ports, processors and line cards. In some cases, a network component may have more than one exogenous cost driver. In these cases, the DSP shall determine different cost volume relationships for each component in correspondence with each cost driver. In addition, where software and hardware lifetimes differ significantly, separate cost-volume relationships are required for each of these
- **Tandem exchanges** - the method used for deriving the volumes for single and double tandem exchanges is the same as for local exchanges.[9]
- **Transmission Equipment** - while a single volume measure can be derived for all transmission equipment, problems arise in measuring the respective volume usage by different services and increments (PSTN, leased lines and other services). To solve this, all volumes can be converted into Mbit/second equivalents. Further adjustments may be required to take account of differentials in the quality of service (resilience). The driver for transmission is assumed to be Mbit/second used by each service.

9.3 Routing factor tables

The routing factor tables for the model identify the relationships between the costs of network elements and the costs of services. Routing factor tables identify the average usage of network elements by the services provided by the DSP through the core network. The tables identify the average frequency that services use different network elements within the network.

The model shall identify routing factor tables for each service. If routing factor tables cannot be identified, then a consistent alternative measure of how each service uses network elements should be used. Information on the routing factor tables used – or any alternative method – should be clearly identified in the model.

The costing models shall contain routing factor tables for the following network elements, as a minimum:

- remote concentrators
- processors within local exchanges
- transit exchanges
- national/international exchanges
- transmission links between remote concentrators and local exchanges
- transmission links between local exchanges

[9] Double tandem calls are calls that use two main switches. Tandem (main) switches are core switches that do not usually have customers connected directly to them. The double tandem call will usually include an additional local switch to connect to the customer. Tandems are also termed transit switches.

- transmission links between local exchanges and transit exchanges
- transmission links between transit exchanges
- transmission links between transit exchanges and national/international exchanges
- Signalling equipment.

Information should be provided separately for all the major call types. In addition, the documentation should include information (for all calls) showing the percentage of calls following a particular routing pattern.

Service values should include (as appropriate for the service and network element's cost driver) values such as:

- Call volumes (minutes, number of calls etc)
- Busy hour levels
- Factors for non-conversation holding time and unanswered calls
- Subscriber numbers.

Access services should identify elements such as:

- Copper pairs
- Line card
- Network termination unit
- Fibre in the loop.

Elements should enable all access-related products, including access links for non relevant services such as data communication products. A routing factor table approach shall be used. This shall define how each access service uses the access network resources (2 or 4 wire delivery, use of fibre in the loop, network termination unit etc).

9.4 Treatment of common costs

As discussed in section 2.2, a mark-up for common costs using the Equal Proportionate Mark-Up method, should be added to incremental costs. The model should allow alternative mark-up approaches.

It should be ensured that the total amount of annual costs allocated to services corresponds to the total amount of annual costs related to the individual cost categories.

The model documentation should present the mark-up calculation procedure as well as the way that it is applied to incremental costs.

9.5 Costs to be excluded from the model

Costs that don't relate to the forward-looking long run costs of an efficient service provider should be separately identified in specific cost pools and be excluded from the LRIC calculation of wholesale services. The CITC shall consider the merits of such items and may allow alternative treatments.

In addition the following costs shall also be excluded from the model:

- *Inefficient costs* – as discussed earlier, these costs should be separately identified and put in a specific cost pool
- *Bad debts* – This relates to failures to obtain revenues in the retail market and shall be excluded. Wholesale service bad debts are not expected but if they exist, they shall be identified and the CITC may consider options for their treatment. Bad debts that relate to retail services should be recovered through retail prices (not interconnection and other wholesale service charges)
- *Redundancy payment*s, such as early retirement compensation payments
- *Sunk costs* – which are unrecoverable past expenditures, such as losses on the disposal of fixed assets
- *Stranded assets*- which are assets that are worth less on the market than on the balance sheet due to the fact that they have become obsolete in advance of complete depreciation. The LRIC model is forward looking – stranded assets do not impact on future pricing decisions
- *Fully depreciated assets* – assets that are fully depreciated in the business are considered to have had their costs recovered and should be excluded to avoid double dipping – recovering the cost more than once
- *Research and development* – costs relate to future possible developments shall not be included in the incremental cost of existing services. However, the CITC may consider a proportion to be included after due consideration of evidence of the approach taken by other regulators as well as information from service providers.
- *Costs used by other services such as Mobile, Data or Retail* –includes costs of systems, staff, space and overheads that relate to other businesses and services. These shall be identified in specific cost pools to allow for reconciliation. The model must identify all such cost elements and ensure cost allocations are based on transparent and verifiable data. If fixed and mobile network elements (such as switches) share building space, costs should be allocated to both mobile and fixed increments. In addition, common costs such as power, air conditioning and technician's space should be allocated similarly.
- *Retail costs* – sales, marketing and distribution costs are not relevant to wholesale services
- *Accounting items such as goodwill, provisions and extraordinary items.*
- *Taxes on revenues* – these are not relevant to the definition of network costs
- *Overseas Activities* – these are likely to be business costs and activities that relate to functions that have no relation to the operations of a network in KSA.

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The CITC considers that these costs are not relevant to the cost of interconnection. The DSP needs to provide detailed justification of their relevance.

- *Investments* – financial investments and currencies that generate revenues (or losses) are not relevant. Only efficient working capital levels should be considered
- *Interconnection and similar inter-operator payments* – such payments are not relevant to the operation of the network. If payments are required to build up a wholesale service that includes network costs and other out payments (such as a transit interconnection call), only the network costs should be included. The addition of the additional out payment is a pricing process, not a costing issue and it will be considered separately and should not be added to the network costs of transit wholesale services
- *Windfall loss or gains* – the conversion of assets to current cost accounting values may result in one-of changes in asset values resulting from the change from historical accounting practices. These shall not be included. Future years, using CCA, shall include any holding gains and losses under FCM principles and full cost recovery is therefore assumed.

All excluded costs shall be identified in specific cost pools to allow reconciliation. If some of these are considered to be special KSA-specific cost and need to be included in part or wholly, then their inclusion should be discussed with the CITC and suitable justifications made. See the guidelines on KSA specific factors.

Some specific items shall be considered for inclusion:

- *Licence fees* – such costs are required to operate the network and are relevant to both wholesale and retail services
- *Annual operating fees* – payments may be required by legal (governmental) authorities to operate the business. These may be relevant to retail and wholesale services
- *Costs of interconnect* – efficiently and fairly incurred costs that are specific to interconnection and wholesale services are relevant and may be allocated to the wholesale and interconnection services (both inbound and outbound).

10 Model functionality and documentation

10.1 Model requirements

The model should show the LRIC and associated mark-up for common costs for each network element. Further, the model should show how the costs of services are derived by multiplying the routing factors for each service to the costs of network elements. The total LRIC of a service should show a breakdown between the LRIC and the mark-up for common costs.

10.2 Sensitivity analysis

The model should allow for sensitivity analysis to be carried out. Where possible, the model should have the flexibility to examine the impact of a change in:

- Equipment prices
- Utilisation rates
- Cost of capital (an exogenous input to the model).
- Volumes (such as traffic volumes, busy hour call attempts)
- Annualisation methodologies
- The inclusion/exclusion of fully depreciated assets
- Asset lives
- Price trends
- Alternative mark-up regime or altered mark-up values.

10.3 Model documentation

The model documentation should include but not be limited to:

- Cost of access and interconnection services
- Cost of individual network element stages
- Routing factor tables
- Volumes (such as traffic volumes, busy hour call attempts)
- Number of sites and exchanges by type and the treatment of site sharing by switch types
- Description of methodology, assumptions, samples, etc
- List of cost categories and network elements
- Re-valuation methodologies and sources of Gross Replacement Cost (GRC) etc for all cost categories

- Quantity and unit price information underlying the GRC for cost categories
- Annualisation assumptions (depreciation methodology, assets lives, price trends for all assets)
- Operating costs and allocation keys
- Working capital
- Description of the network structure, indicating changes compared to the existing network
- Average cable lengths in the access network by geo-type distinguishing between the primary and secondary network and the final drop
- Trench length in core and access
- Utilisation rates (existing as well as modelled)
- Documentation of efficiency and efficiency adjustments
- Identification of spare capacity and technical-economic justifications for inclusion of any such costs to show they meet the criteria defined in this LMG
- An operational reference document (user manual)
- A list defining how the general and specific TD criteria of the LMG have been met.

10.4 Audit of model

The model may be subject to an independent audit once the model has been competed by the DSP, and, if carried out, the CITC will pre-approve both the audit process as well as the choice of the auditor. Based on an assessment of significance and risk, the audit should include, but not necessarily be limited to:

- Checks on the relationship between the dimensioned network and underlying registers, statistics, etc. not included in the annual report
- Checks of the GRCs/current cost valuation of assets (comparison with price lists/contracts, asset register, etc.)
- Reconciliation of book values applied in the model against book values recorded in the fixed asset register
- Balancing working capital and operating costs against annual reports
- Checks on ABC methodology used to allocate operating costs
- Checks on the cost allocation methodology and allocation keys
- Checks of volumes, traffic statistics, etc. not covered by the annual report.
- Check for consistency and accuracy of the application of the user manual details with the reported results and their checks/balances with the overall annual reports filed for public record.

The purpose of the audit is to ensure that the information provided in the model and in the model documentation is correct, transparent and compliant with the overall aims of the CITC and with the specific requirements of the LMG. The auditor will be expected to issue an unqualified opinion to the CITC on the reasonableness of the financial information produced by the model.

The DSP shall provide for the audit:

- Full access to the model, data and source assumptions or calculations
- An auditor's guide to enable the features and process to be understood and how the model complies with accounting standards and with the LMG
- Access to the model and all documentation
- Assistance as required to rectify or reconcile information.

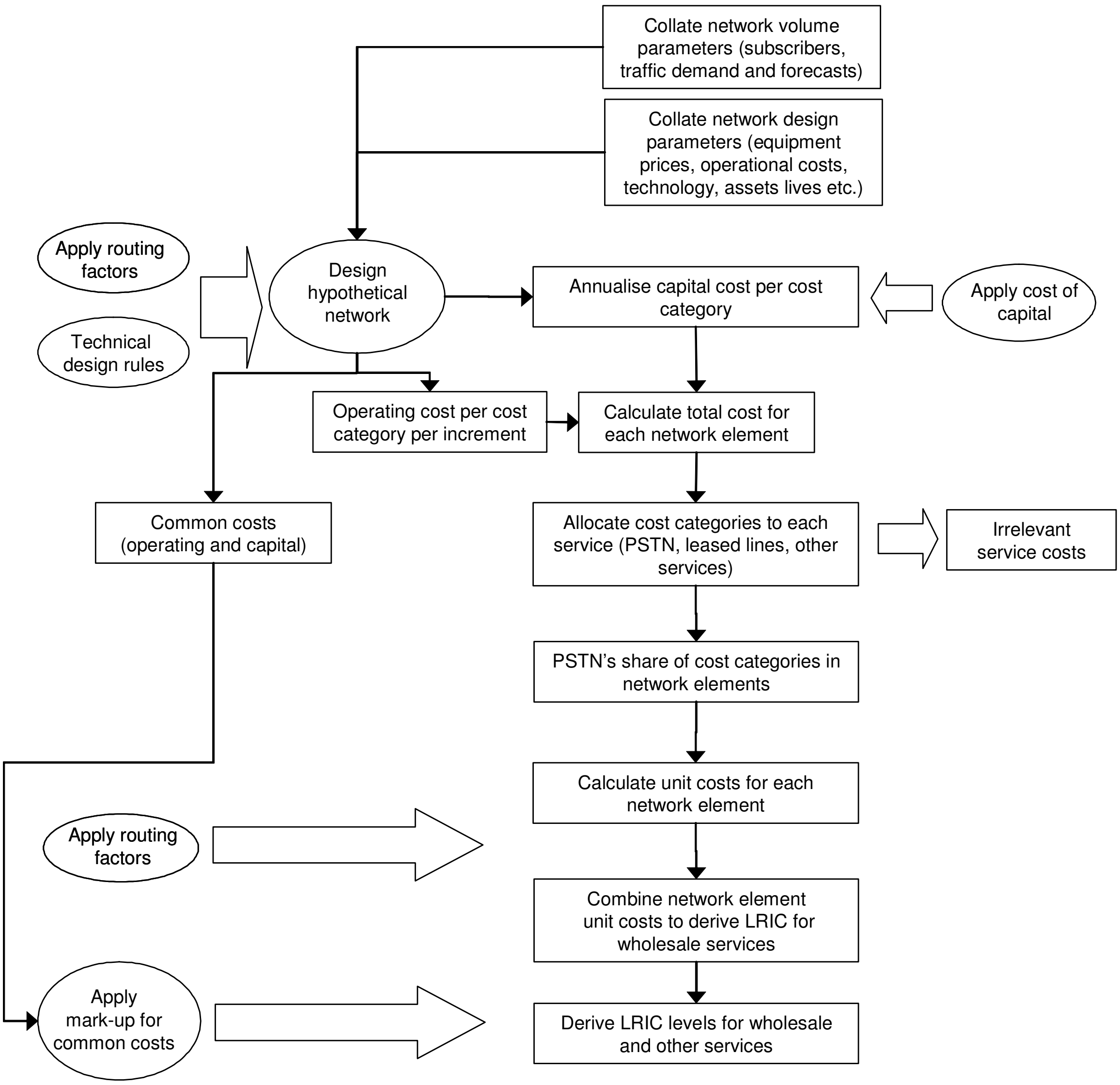
The audit shall be carried out by suitable qualified personnel proposed by the service provider and approved by the CITC. The cost shall be borne by the DSP. The service provider shall supply copies of the model and data to the CITC for its own investigations. The CITC may also appoint its own reviewer/auditor to audit the DSP's LRIC related inputs/outputs.

Part C: Specific guidelines for the building of the Bottom-Up LRIC model

11 Overview of model structure

A Bottom-Up (BU) LRIC modelling approach can be described as modelling a theoretically efficient network to meet a determined demand profile based on engineering design rules. It starts with the demand for the service/product included in the increment and builds an efficient network that can address this demand. It then assesses the use of each network element and processes the costs to the different services of the increment.

Figure 11.1: Overview of Bottom-Up model structure



The diagram shows the main stages used in the BU models of fixed or mobile services. The essential structure and principles remain the same but the actual products and network elements will vary. In the following sections we describe the BU LRIC model process is described in more detail. There are references to fixed network related products and network elements. These are for illustration only as the actual models will require detailed lists to be defined during the model specification and construction phases. Similarly, there are equivalent products and network element lists for the mobile model.

11.1 Measuring demand and establishing input unit costs

Demand data must be collected from the DSP (other service providers may also have insights to contribute). This should include information about how demand for services will change over the future. This will enable the transformation of demand into dimensioning the network to allow for growth. If volumes are expected to fall, this demand change may also be factored in to the LRIC calculation.

Information on equipment prices and other cost data is also collected at this stage, again including information about how prices may be expected to change over time. This provides inputs of the unit costs of elements needed to build the network.

Other service providers are also requested to supply demand information.

All mobile service providers are requested to supply mobile data for all stages of the modelling – to cover both their own demand and any knowledge or predictions of the other service provider's demand.

11.2 Building a hypothetical network

One mobile model will be built by the CITC. It will reflect a theoretically efficient mobile operator in KSA based on forward-looking assumptions. The mobile model shall be built to reflect the volumes and node numbers (and locations) of the mobile network of the DSP. The CITC notes that there is only one DSP mobile operator in KSA at present.

In building this model, a decision firstly must be made on the choice of network topology and technology. The next step is to build up a network design that has sufficient resources to perform the desired activities required by the estimated future demand.

The dimensioning of the network will be based on using standard engineering design rules. Equipment prices and cost data form the basis of determining the capital costs of the dimensioned network. Direct network operating costs will also be reflected in estimates of LRIC and other indirect (overhead) costs will also be considered and included on the basis that they are cost based and efficiently incurred.

Service providers will be requested to supply information to help define a range of technical and network topology issues that will be an input into the modelling process. This information will include such factors as the appropriate scope of the network, including geographical issues as well as KSA specific factors that need to be taken in to account during the modelling exercise.

The BU model must specify the design features and techniques needed to model the required network parameters.

11.3 Determining the cost of network elements

The capital cost of each network element needs to be estimated. Investment costs will be annualised to generate annual figures for the capital expenditure involved in using each asset. This requires data on the purchase price of the asset, asset lives, price trend of each asset, scrap value of asset at end of its economic life, and the cost of capital.

Additionally operational costs of each network element are included to gain an estimate of total costs.

The BU model shall apply appropriate annualisation methods. The proposed method shall be the tilted annuity method. Other methods shall be allowed in the model.

11.4 Costing services

Costing of services to be provided is the final step in the model. The sum of capital costs and operating costs needs to be transformed into a per-unit cost for each network element. Per unit costs of network elements then need to be aggregated. Finally, a mark-up is added to take into account an allocation of common costs.

This costing process uses of the same routing factor table method as used for the TD LRIC model (described earlier).

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12 Services modelled

12.1 Fixed services

Telecommunications service providers typically carry a wide range of services across their networks. In addition to the traditional voice services, service providers provide leased lines, data services and a range of other services.

The services to be modelled in the BU LRIC model will be similar to the services modelled in the TD LRIC model (to be produced by the DSP). It is not expected that leased lines are modelled in the BU LRIC model (only the core network will be modelled and to model leased lines requires access costs).

The Bottom-Up model needs to account for all of these services making use of the national fixed network. To exclude some would result in an under-dimensioned network and increased costs for the remaining services as costs, such as ducts, would be allocated to fewer services. Therefore more services need to be modelled than the actual number of services that should be priced on the basis of LRIC. The addition of leased lines capacity (and data communications service) should be included but the BU model need not cost the individual leased line services.

The BU fixed model will estimate the cost of both wholesale and national services, for example:

- Local exchange termination
- Single tandem termination
- Double tandem termination
- Transit interconnection
- Local calls
- Long distance calls
- International calls
- Fixed to mobile calls
- Calls from other service providers
- Calls to other service providers

Access services include:

- PSTN access
- Bitstream access
- Local loop unbundling

Additional services include:

- Leased lines.[10]

The services to be defined shall include all types of traffic that uses the network (such as on-net and off-net calls) plus the additional wholesale products such as single/double tandem termination (and origination) etc. They shall be modelled even though they may not be commercially offered by the DSP. A notional "one unit" volume (say one minute per year) may be used to evaluate the cost of such services without impacting the costs of other services

Demand for other services such as data services should be specified to ensure the total capacity of the transmission network is adequate. This ensures economies of scale. Because the BU model will only model the core network the costs of these other services' capacity will be excluded from the model to leave only the cost of the network needed to provide the services that need to be costed. Therefore detailed costing of non-relevant services (IP, ATM) is not required. Demand for these services shall be provided in the form of Megabit/second required in the transmission network.

12.2 Mobile services

The BU mobile model should, as a minimum, include the following services:

- On-net calls
- Off-net calls (to both fixed and mobile as these can differ)
- Inbound calls
- Voice mail
- SMS
- MMS
- GPRS and other data.

Customer related costs such as handsets and connection costs are not required.

Call origination services – as used by Mobile Virtual Network Operators (MVNOs) are not required.

12.3 Services not modelled: Access services

The CITC *may* develop its own BU LRIC model for Access services at sometime in the future. In the interim, the CITC will depend on DSP provided LRIC results and input/output data for Access services, as well as on other benchmark data. If an access model is built in the future it should cover the same services (PSTN, ISDN etc) as specified for the TD fixed model.

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[10] Leased lines are not calculated explicitly in the BU model, except as part of the total increment. Individual leased lines including wholesale versions should be costed in the TD model

13 Technology

Forward looking modern technology is required for BU modelling. The network cost structure is based on the most cost effective technology available which is being readily deployed in large scale networks.

The technology must be technically feasible and take into account the spectrum used by the service provider (given that technology is in some cases spectrum dependent).

13.1 Switching technology

The switching network provides the connectivity for customers to make calls to others. Circuit switching could include remote switches or concentrators, local switches, and main or tandem switches.

NGN and IP technology shall be considered where they are currently deployed. The fixed network shall be based on circuit switched platforms unless there is evidence of NGN/IP in the existing network or as the appropriate MEA.

It may be considered that IP-technology is lower cost than circuit-switching equipment. If "soft-switches" provide functionally equivalent services to "legacy" PSTN switches, and are (or will be) readily used in large scale fixed networks, then it may be appropriate for the cost model to assume IP switch costs.

Ideally, the mobile model should be based on the least cost MEA technology that is currently available and widely deployed. Where both 2G and 3G technologies exist, regulators in other countries have generally ignored 3G costs, and only estimated LRIC for 2G.

The CITC intends to consider using 2G costs for the model.

Additional 3G network costs may be considered by the CITC during the model development. These additional costs are only relevant to mobile voice termination cost calculations if the 3G costs provide efficient voice services (i.e. comparable or lower than 2G costs). 3G costs (if included) that relate to data services would be excluded from the voice termination service.

The final position to be taken by the CITC regarding the treatment of 3G costs in the BU LRIC model will depend heavily on the information received during the data gathering process.

The CITC shall define the BU modelling technology solution for mobile networks during the modelling process and will seek inputs from the service providers to ensure the model solution can be practically implemented and that it adheres to the principle of least cost forward looking MEA.

13.2 Transmission technology

The transmission network provides the connections between the different types of exchange sites in the network. The transmission technology assumed in the core network will be fibre and either SDH or IP-technology transmission end equipment. The choice of technology will be determined by what is likely to be adopted in a new large scale network. The volume of transmission equipment will be determined by the amount of traffic flowing across different route types.

The following lists the transmission route types which would be expected in the DSP's fixed network:

- Remote switch/concentrator to local
- Local switch to local switch
- Local switch to main/tandem switch
- Tandem switch to tandem switch link
- Etc.

Equivalent transmission route types would exist in the mobile network (e.g. inter MSC links and links to BTS).

The key cost drivers in the transmission network are:

- The duct lengths
- The length of optic fibre
- The traffic across routes, which determine the amount and type of multiplexing equipment needed
- The route distances, which determine the number of repeaters required
- The amount of associated equipment such as cross connects.

Transmission shall be dimensioned to carry all services carried by the network service provider to ensure economies of scale and scope. Costs of non-relevant services shall be excluded. Transmission costs shall be apportioned to the services based on the km*Mbits/second used by each service (or Mbit/s if total length data is not available).

Call and message services shall recover the transmission costs on a per-minute or per-message basis, as appropriate.

13.3 Requirements of the efficient service provider network

The Bottom-Up model will meet certain minimum requirements. These include:

- a network based on a scorched node assumption
- services to be provided with a quality of service equal to that provided by the DSP to end-users and interconnecting service providers

- the network to be dimensioned correctly.

Quality of service

The BU model will be dimensioned to provide services at a level of quality and functionality corresponding to the level that the DSP is required to offer to interconnecting service providers and end-users. This ensures that the network reflects a quality of service, including expected call failure rates (i.e. call blocking assumptions) which would be delivered by an efficient network service provider.

Sufficient resilience and duplications of resources shall be included to reflect modern practice and ensure obligations to customers for maintenance of services are met.

Correct dimensioning of the network – network scale

A key requirement for the BU model is that the network is dimensioned to meet the demand required. This will be determined by its end users and other interconnecting service providers (that is, the access seekers). The model will show that:

- that exchanges are dimensioned sufficiently to carry all subscriber lines
- that exchanges are dimensioned sufficiently to carry all of the relevant traffic taking account of the busy hour (both in terms of number of calls and call duration) and blocking margin
- that the traffic, processed by exchanges using the transport network, can actually be carried over the transport network, and that the network has been dimensioned with sufficient resilience
- future traffic demand can be met. Efficient design minimises investment but must consider demand and the need to pre-provide for future growth. This provisioning must consider the efficient time horizon use for each investment category (line cards required minimal planning horizons but civil works and cables need longer term plans)
- the degree of spare capacity allowed should reflect the minimum required to meet the quality, scale and scope required by an efficient service provider. This should take into account the practical technical issues that network items increase in size in a modular way (that is, network elements are available only in finite size increments).

Correct dimensioning of the network – network scope

The network must be dimensioned to accommodate all services that share the same network, including those that are not specifically required to be costed.

Operational costs

These are the required costs to operate, plan and maintain the network and provide the services specified. Retail business costs should be excluded.

14 Demand

14.1 Estimation of end-user demand

Information required by the CITC to model demand in the fixed core network will be provided by the DSP. Demand must be specified for all relevant services including:

- PSTN traffic
- leased lines
- other services provided to end customers via the DSP's network.

For the BU mobile model, equivalent information on mobile calls and data should be provided by the DSP and other mobile service providers.

Adjustments for growth must be added to the current traffic volumes.

Other service providers may assist the CITC with an estimation of end-user demand for the fixed and mobile network.

14.2 Estimation of dimensioned demand

Once the end-user demand has been estimated, the model will show how this has been adjusted to estimate the *dimensioned demand* for both the fixed and mobile networks. The adjustments include:

- the application of routing factor tables
- allowance for resilience and spare capacity
- application of the "busy hour" estimate
- KSA specific factors
- reasonable growth.

Routing factor tables

The CITC would expect the same (or similar) routing factor tables to be used in TD as BU models for equivalent network elements.

Allowance for resilience

If there is a switching or transmission failure then alternative routes must be available to avoid loss of traffic. Different services will require different levels of resilience. An allowance for resilience should take into account how the network has been configured.

Application of the “busy hour” estimate

The calculation of the “busy hour” traffic needs to take into account traffic variations over different days of the week and different hours of the day. It also needs to take into account seasonable variations as well as any additional network traffic factors that may impact on the dimensioning of the network. The network busy hour may be seasonal – data on this should be supplied by service providers to ensure that the BU model is correctly dimensioned.

KSA specific factors

Demand factors that are specific to KSA (such as the Hajj) that may impact on the design and dimensioning of the network should be considered, defined and modelled.

Accounting for reasonable growth

The dimensioned network should meet the demand in the base year but also in the future, taking into account normal and efficient planning horizons. Civil works will be dimensioned to meet demand with a longer time horizon than say electronic line cards that can be deployed at short notice. The time horizon to be used for each category should be based on best current practice.

15 Modelling issues

15.1 Scorched node assumption

The CITC expects that the model will start with the presumption that all existing node locations and numbers (for main, local and remote switches) will be taken as given. In other words, the BU model will use a scorched node assumption, taking account of the existing network topology of the service provider to be modelled.[11]

Transmission network decisions may be optimal in the Bottom-Up model to reflect the Modern Equivalent Asset (MEA) design.

The mobile models shall use the scorched node assumption for Mobile Switching Centres (MSCs) but for the radio network and transmission an optimised method, based on an efficient operator will be used.

15.2 Equipment prices and cost data

Equipment prices and other cost data should reflect those of an efficient service provider with the bargaining power of a DSP in KSA. The model will rely on service providers to give information on the prices they have paid to acquire their equipment. The prices used should represent a number of recent contracts and exclude any extraordinary discounts.

Prices for bundled network elements may be used on the condition that all products are related to the modelled network.

15.3 Modelling fixed exchanges

This section provides the guidance and criteria on issues relating to the nature and size of each exchange (node).

The hierarchy of the exchanges

The BU model should be based on a hierarchical exchange structure. This is because a large number of nodes (and several types in the hierarchy) will be required to provide connectivity to all subscribers in KSA.

Choosing between different nodes

The total number of exchanges (nodes) in the DSP’s network will be the starting point for the modelling of exchanges in the BU model. Based on this structure, the size and nature of each node must be decided upon given the modelled hierarchy.

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[11] Except for mobile radio networks.

The numbers of each exchange type in the hierarchy can be optimised to minimise costs, whilst maintaining the scorched node criteria and the required technical performance.

The first step will be to model the top layer of exchanges in the core network. The switches at this layer will be the main or transit switches, which do not have any subscribers connected to them. Many of these same sites may require a local switch that is collocated to connect to subscribers.

The number of nodes in this layer of the exchange will be determined by how many units are employed in the DSP's network. The capacity of each typical transit switch can be determined by the total traffic volumes carried in the network and how the traffic is routed through the network, to yield an overall traffic resource requirement for ports and processors.

The same approach to dimensioning the traffic resource requirements for remote and local switches can be applied except that remote or concentrator units do not employ processors and therefore manage call attempts in the way a local or transit switch does (by virtue of the presence of a processor).

15.4 Modelling mobile base stations

Mobile base stations require technical factors and dimensioning requirements. The numbers and types are determined by:

- Coverage needed to meet customer and legal (license) requirements
- Geography – urban or rural coverage
- Spectrum – coverage depends on the spectrum (900 versus 1800)
- Customer traffic – call and data volumes generated
- Teledensity – subscriber numbers in each cell
- Mast and building constructions – depending on local planning rules and geography.

Specific factors must be included to ensure cost drivers are correctly modelled.

The scorched node assumption will not apply for modelling mobile base stations as the model will be based on the optimal number of base stations in the optimal locations (which may differ from the existing network deployed).

15.5 Modelling transmission

This section defines the minimum requirements with respect to the network architecture and configuration for the modelling of transmission where the transmission network provides connection between the exchanges.

The CITC notes that the TD LRIC model will be based on actual transmission elements while the BU LRIC model will be based on an estimate of efficient transmission costs. These may or may not equal the same cost. If the DSP has rolled out an inefficient transmission network then access seekers should not be forced to pay for it. If so, there will be differences between the BU and TD models.

Consistent with the scorched node approach, for costing purposes, the BU model will take existing numbers and locations of switching nodes into account. However, transmission technology will be optimised because it is not a fixed node and can be altered more easily over time. The use of equipment optimisation is consistent with MEA, which is to replace, at existing switching sites and transmission routes/links, the existing legacy equipment with MEA equipment. This approach is also consistent with the approach used in other countries. A node's equipment may alter, but numbers and locations of nodes are fixed

Transmission design

Transmission will be based on fibre optic systems (SDH) for all fixed network links, unless there are exceptional reasons that should be specified by service providers. Ring structures will be used in most cases to provide required resilience.

Mobile transmission is assumed to be fibre for inter-MSC and Fibre and microwave for BTS and BSC links. The optimum proportions of each depend on technical and economic factors. Alternatively, microwave transmission links may use leased lines. The choice will depend on the optimum economic choice or any relevant license obligations.

Transmission design should:

- Define the optimum physical connectivity to all nodes and provide fibre rings and resilience, plus point to point links where needed
- Define the logical link (traffic demand) requirements derived from the routing factor table. The logical links defined the traffic between local-trunk or local-local switch links.
- Apply the logical links traffic to dimension the capacity needed on each of the physical links
- Derive the optical systems' speed and numbers required.

A simpler process is sufficient for the mobile network as there is a simpler structure but some rings are likely in the core (inter MSC and MSC-BSC).

Network configuration

The BU model may investigate the consequences of different configurations in each layer of the transport network. The following factors may need to be taken into account:

- Double parenting provides more resilience than single parenting (a switch may connect to two switches where one may be sufficient purely to meet the traffic demand)

- A ring structure usually provides better reliability than a point-to-point structure or dual point-to-point links
- Cross connects can provide flexibility to the network.

Different technologies may also be more appropriate for different parts of the transport network depending on the distribution of the traffic or on the geographical characteristics of the network.

Dimensioning the network

Once the structure, technologies and configurations have been established for each part of the network, the BU model should be able to dimension the transport network on the basis of total traffic demand in the network and how the traffic is distributed across the link types and between thick and thin routes.

Total traffic includes PSTN (or mobile) plus leased lines, data, access and transmission. However, only the core costs for PSTN services (and the equivalent for mobile) are required.

Modelling infrastructure

Infrastructure is defined as all the equipment between nodes or distribution points used to carry traffic over the network. The model should show infrastructure costs of cable, duct and trenches separately. Modelling this will involve allocating a significant amount of shared and common costs – the main source of which will be the trenches and ducts.

Trench in the core network

The amount of trench length in the core network will depend on the configuration of the network and the actual distances between nodes. These volumes will be declared by the service providers but the modelled total amount may be different. Transmission links are not considered nodes and hence not invariant under the scorched node view: transmission may be optimised in the model.

Cable

The results of transmission modelling (as outlined above) along with declared data on cable length by the DSP will be the starting point for estimating cable requirements in the core network. The trench length for each part of the network will be used to calculate the total length of cable and the different sizes required.

16 Other costing issues

16.1 Costing year

The BU model should be based on the current prices for equipment and operating costs. The cost of services will change depending on the volumes used. The volumes and hence the resulting unit costs should consider:

- The costs based on current volumes
- The cost based on predicted volumes
- The impact of the reduction in unit costs over time.

The need to consider the impact of future cost variations is clear in a new network with (say) one customer currently. The LRIC levels of such a network are clearly high, but later years will result in more volume and lower costs. The long run average is lower.

The results of time-varying costs shall be considered where appropriate (for example, when future volume-induced unit costs become significant).

Where volumes are more static, the results shall be determined using one year's traffic volumes.

16.2 Indirect network costs

Indirect network costs are those that are required for the network to function and can include costs such as power, accommodation and maintenance. Because these are often difficult to model, they may be estimated based on a mark-up on direct network costs. However, where possible, costs will be modelled directly.

16.3 Non-network common costs (corporate overheads)

An efficient allocation of corporate overheads that are incurred to operate the company but are not directly incurred to provide a core and access network will be included. Examples are costs of human resources, legal, and planning departments.

All retail costs will be excluded.

16.4 Annualisation

The BU model will include annualisation of capital costs. Annualisation techniques will approximate the outcome from economic depreciation calculations, if this is not actually carried out. Tilted annuities will be the default assumption for asset annualisation method.

The BU model may use various methods, as appropriate. The use of the tilted annuities method should be the default method, without supporting evidence of better methods.

Annualisation should include factors for the capital purchase value (current price), lifetime and price tends. Additionally scrap values (costs) may be considered.

Alternative annualisation methods should be possible in the model.

16.5 Operating costs

Operating costs are those concerned with maintaining the network and providing service to customers. Ideally the BU model should use cost estimates based on the best practice data from efficient service providers, as the basis for these costs. The operational cost would be defined and then allocated in the model to network elements and products based on cost drivers. The operational costs could be estimated from the tasks and processes required to operate the network. This uses an event-based approach whereby the costs are driven by the number of times an event occurs – such as a repair of a cable and the time (and hence cost) to repair it.

Computationally this method is complicated and efficient operational costs are not easy to define.

A functional area method may also be considered. This defines the staff levels needed for a functional area (say cable repairs) to repair the scope of cables needed in the network. The costs of these staff (plus overheads) may be estimated and the results allocated. This is a possible, but potentially complicated, method.

Given the difficulties involved, it may be more appropriate for operating costs to be estimated at a more aggregated level. It is common to model the operational costs as a percentage of equipment capital costs. Whichever approach is used, allowances will be made for the limitations that occur.

Service providers are expected to assist with the estimation for operational costs as a percentage for the capital costs. Operational cost shall be modelled as a percentage.

The model need not be limited to modelling operational costs in this way and if better data is obtained and can be used, alternative methods may be considered by the CITC. This will be considered during the implementation process, dependent on the degree of support and participation from service providers in their responses to data requests and to requests to discuss modelling issues

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16.6 Working capital

Allowances will be made for working capital which preferably will be cross checked against international benchmark data to ensure that only working capital related to network activities is included. The levels should reflect efficient service provider practices and should not include retail and other business capital requirements.

The BU model shall provide a calculation of appropriate working capital levels and associated costs (cost of capital). These costs shall be allocated to the network services.

16.7 Requirements of service providers

Service providers are expected to co-operate with the CITC during the course of the BU model building process. The major input will be a comprehensive response to the data requests that the CITC will prepare and circulate to service providers.

In addition, the CITC may request additional information from service providers and may require face to face meetings during the course of the model building work. Inputs on (for example) technical design parameters and engineering design rules are typical areas where meetings with the CITC modelling experts are anticipated.

The CITC will respect any confidential or sensitive information disclosed as part of these discussions.

Inputs need not be limited to the areas highlighted specifically in the LMG. Service providers should view the wider requirements of the BU model process and provide any materials that will assist the CITC with the development of robust models.

17 Use of Bottom-Up model results

17.1 Fixed BU LRIC model

The BU model for the fixed network will be reconciled with the results of the TD LRIC model to be built by the DSP. A reconciliation of the results is required as it is likely that the LRIC results from the two modelling approaches will differ. The reconciliation process will involve a detailed review of the LRIC results, data and assumptions from the TD and BU LRIC models. The CITC intends to investigate the key sensitivities in each of model so that underlying drivers of the TD and BU results can be understood. Once this analysis has been completed the CITC will decide on the most appropriate LRIC for KSA. This information will subsequently be used (combined, potentially, with a range of other factors) to determine the appropriate regulated prices of interconnection and other relevant wholesale services.

The reconciliation process depends on the data supplied (e.g. quality and amount) to CITC and the TD models delivered to CITC (e.g. quality and compliance with the guidelines). If there is no TD model, or if it does not comply with these guidelines, then the BU model will be used as the main source of LRIC results.

For example, the BU fixed network model may be used as follows:

- To identify the costs of wholesale and network services used by the DSP's retail business and other service providers
- Identify cost areas of significance and evaluate results from the TD model
- To model the impact of varying demands over time and the resulting average costs may be used to set a representative LRIC level.
- Sensitivity analysis to identify the impact of change in parameters
- Analyse differences of core network costs when modelled in isolation from access and other business areas
- Calibrate and check the results of the TD model
- Identify inefficient costs.

It is reasonable to expect that as the LRIC process matures in 3-4 years, the results of the periodic BU and the TD models will likely tend towards similar results with small deviations, resulting in minimal requirements for reconciled LRIC levels.

17.2 Mobile BU LRIC model

The BU mobile model is intended to form the basis for determining the LRIC of mobile services. Any TD data may be used to help ensure the model is robust and realistic. The TD data may be used or the BU model may be adjusted to match these values, as appropriate.

The results of the BU mobile model will be the main input used by the CITC to set the key mobile wholesale prices. The CITC may draw on other factors in setting the final regulated rates. The mobile BU model may also:

- Be used to model the impact of varying demands over time and the resulting average costs may be used to set a representative LRIC level.
- Identify sensitive areas and their impact
- Identify KSA-specific cost issues and their impact
- Identify cost differences between service provider networks and their impact on wholesale costs
- Assist in evaluation of retail prices, if such an investigation requires inputs on the underlying cost.

Glossary of terms

ABC: Activity Based Costing.

BU: Bottom-up (LRIC model).

Common costs: Costs that are shared by all of the activities of a firm. Ceasing one or the other of these activities will not avoid these common activity costs (e.g. head office building and head office staff costs).

Current Cost Accounting (CCA): An accounting technique that considers assets based on current values. These costs are unrelated to the historic purchase price. This technique gives depreciation and NPV calculations based on the FCM (Financial Capital Maintenance) principles or Operational Capital Maintenance (OCM) principle. FCM methods are usually preferred.

Directly avoidable incremental costs (DAIC): The costs that are avoided when an activity ceases to exist. In LRIC modelling it is normally assumed that all types of cost are potentially avoidable. That is to say even those assets with the longest lives, such as trench and duct, would be assumed to be avoidable if the activities that make use of them were to cease. In that sense, the concept of long-run in LRIC cost modelling is the very long run.

DSP: Dominant Service Provider

Economic depreciation: Depreciation expenses are the returns that firms must recover over the useful life of the asset to allow replacement of the asset. Economic depreciation is the change, from period to period, in the market value (earning power) of an asset. .

Financial capital maintenance (FCM): Depreciation calculations that takes account of the loss (or increase) of value in the asset's purchase value.

Fixed costs: Costs that do not vary with the volume of output.

Forward looking: LRICs are forward looking costs rather than taking a 'backward looking' view of costs as historic costs do. As a forward looking cost concept, this idea assumes the use technology using modern equivalent assets (MEA).

Fully Allocated Costs/Fully Distributed Costs: An accounting method to distribute all costs among a firm's various products and services. The FAC/FDC may include costs not directly associated with a particular product or service.

Gross Replacement Cost (GRC): The cost of replacing an asset with an equivalent new item (the MEA purchase price).

Incremental cost: The additional cost of providing an increment of output (e.g. calls or lines) at full volume of expected output. The cost increment includes volume and non volume related resources required to provide the service increment. 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 a total firm's costs of doing business change as a result of some business decision such as a change in the price of an existing product, offering or discontinuing an entire product line.

LRIC: Long Run Incremental Cost.

Marginal Cost: Marginal cost is 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.

MEA: Modern Equivalent Asset.

Net Present Value (NPV) or Net Book Value (NBV): Net present value (same as net book value) – value of the asset today after depreciation and re-valuation.

PDH: Plesiochronous Digital Hierarchy

SDH: Synchronous Digital Hierarchy

Shared fixed costs and common fixed costs: 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 a network management system which can be used to provide a variety of services in the core and access network, so not providing any one service in that group will not avoid any portion of the cost of that network management system.

Stand-alone cost: Economically efficient prices fall within a price floor and price ceiling. LRIC represents the price floors for individual units of any service and stand alone cost (SAC) is the price ceiling. The SAC is defined as the total forward-looking cost (inclusive of fixed, common and variable costs) of producing a service on a stand-alone basis (i.e., separately from any other production activity).

Sunk cost: A cost incurred in the past that will not be affected by any present or future decision. Sunk costs should be ignored in determining whether a new investment is worthwhile.

TD: Top-down (LRIC model)

Weighted Average Cost of Capital (WACC): The method used to calculate a firms cost of capital. The WACC takes into account the relative weights of equity and debt in the capital structure of a firm and calculates the expected cost of new capital for a firm.