Final Document

# Top Down Long Run Average Incremental Cost (LRAIC) Model Specification Paper

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# 1 Introduction

This document describes the methodology that the Authority will use to implement the top down LRAIC model to be developed by Frontier Economics for the Authority. Following consultation on the specification, it will be used as the basis for developing the LRAIC model. The document will also form the basis of the final documentation of the top down LRAIC model.

The reference paper accompanies draft data templates which have been prepared in Microsoft Excel.

The rest of this section is structured as follows:

- summary of the objectives of the LRAIC model;
- decisions taken to date on the form of the LRAIC model;
- discussion of role of operators in the modelling process;
- description of the data collection process; and
- overview of the rest of this specification.

## 1.1 Modelling objectives

The Authority's overall requirements are set out in "*The Costing Methodology for the Telecommunications Sector*" published on the 29th May 2008. The primary objective of the model is to provide the Authority with a standardised tool that allows making informed regulatory decisions to enhance effectiveness and competitiveness of communication services in Trinidad and Tobago. The model will be used to assist in a range of regulatory purposes:

- "the determination of interconnection rates for all concessionaires when required;
- the determination of rates for accessing the facilities (e.g. unbundled local loops) of any concessionaire when required;
- the determination of rates, where necessary, for any telecommunications service in which there is a monopoly or exclusive provider (un-contested market);

- the determination of rates, where necessary, for any public telecommunications service provided by a dominant provider in a contested market ; or

- any exercise by the Authority to detect unfair cross subsidies or any act of anti-competitive pricing."[1]

The Authority has decided to follow a long run incremental cost approach in order to set and monitor prices where competition is not sufficient or may be distorted, to establish prices at a welfare maximising level.

Incremental costing models attempt to understand the cost of delivering an increment of demand, that is, the change in cost resulting from adding or subtracting an increment thereof. 'Long-run' signifies that the incremental cost calculation should include both costs that may vary in the short-run (for example, operational expenditure) and costs which vary in the long run (such as capital costs). Costs that are fixed or common across increments will not form part of the incremental cost[2] as such, but may be added through a mark-up, to ensure investors receive a reasonable return overall.

'Long run average incremental cost' refers to a modelling approach that calculates prices with respect to increments such as total demand, and hence which set service prices based on "average" prices across this increment of total demand.

## 1.2 The Authority's requirements

In the costing methodology, the Authority defined some key characteristics of the top down LRAIC model. These are set out below.

- The top down approach requires the use of cost information that initially consist of historic, most likely statutory accounts data. The data that is used for the model however, is required to reflect current cost on the basis of modern equivalent assets (MEA).

- Depreciation of assets should follow the tilted straight line approach.

- The cost of capital is to be determined on an annual basis using the weighted average cost of capital (WACC) approach.

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[1] Source: Section 1.1.4 of the Costing Methodology

[2] Fixed and common costs are typically recovered through mark-ups to ensure that an operator is able to recover its total costs

- Cost volume relationships (CVRs) should be based on engineering models and activity based costing (ABC).

- Network element costs will be attributed to services on the basis of service volumes and routing factors. Routing factors for all network elements should be established and justified by concessionaires for the use in the model. Alternatively, the Authority may estimate efficient routing factors for individual network types on the basis of the data concessionaires have provided.

- Common costs which would otherwise not be included in the service cost in a pure LRAIC approach should be included by applying an equi-proportionate mark up (EPMU).

However these characteristics alone are not sufficient to determine fully the approach to be taken. This specification builds on and develops these key principles in order to provide a more complete view of the implementation of the model. This development is based on international best practice drawn from top down LRAIC models implemented in other jurisdictions, such as the United Kingdom. The specification also takes account of the relatively small size of Trinidad and Tobago and hence the resources available to both the Authority and the Concessionaires in implementing the model. The approach has been simplified as far as possible whilst remaining consistent with the Costing Methodology and meeting the requirements of the Authority.

## 1.3 Need for operator input

The costing methodology set out the requirements for concessionaires to implement a costing system. All of those concessionaires who are dominant in a relevant market will need to implement a costing model. This will include all concessionaires who offer call termination services.

There will be a separate model for each concessionaire, reflecting their network structure, costs and demand for services based on a common model template. The results for each concessionaire will thus represent the costs for that concessionaire. This approach differs from that use in some other jurisdictions where a single hybrid industry model representative of a number of networks (typically mobile networks) has been developed with the results being a representative "average" cost for the industry.

Given the range of technologies used by the concessionaires, the template model will be sufficiently flexible to reflect the different technologies used while harmonising the principles and methodology as far as possible.

Given that the LRAIC model will be constructed on a top down basis using the costs of the concessionaires, concessionaires will be required to submit data relating to both operating costs and capital costs. In addition, the concessionaires will need to supply information necessary to model the relationships between costs and demand, for example cost volume relationships. A high level view of the data required is described below and set out in further detail in Section 6.

The model will be populated on an annual basis covering each concessionaire's financial reporting year. The model will initially be populated with data for the latest financial reporting year at that point. There will be no requirement to populate the model for earlier time periods.

### 1.3.1 Capital costs

Concessionaires will need to provide cost estimates for all their assets used for the provision of fixed and mobile services in Trinidad and Tobago. The role of concessionaires will be fundamental to ensure that the model inputs, and therefore the model results and any regulatory decisions based on the results, reflect the operating environment faced by concessionaires in Trinidad and Tobago.

The model requires asset valuation (including installation costs and import duties) and the associated depreciation and amortisation charges to be calculated on a current cost accounting (CCA) basis. Therefore, operators will need to conduct a CCA study to revalue relevant assets. The process required is described in the separate CCA reference paper which complements this specification document.

Concessionaires will also be required to provide information on the level of working capital (current assets and liabilities). However this will be a categorisation exercise with no change in the reported level of costs.

### 1.3.2 Operating costs

Concessionaires will also need to take operating costs from their financial systems (general ledger) and categorise them into the appropriate cost categories. However this will be a categorisation exercise with no change in the reported level of costs.

### 1.3.3 Volume data

In order to model the impact of changes in demand on costs, the model will need information on the current level of demand in terms of services delivered to end users or other concessionaires.

In addition, information will be required on the volumes relating to the internal operations of the business such as head count.

### 1.3.4 Cost volume relationships

Key network cost volume relationships (CVRs) will be based on information supplied by concessionaires to ensure these CVRs reflect the networks deployed in Trinidad and Tobago.

In addition, other CVRs may be based on information sources from the concessionaires, for example those derived using ABC systems implemented by the concessionaires.

## 1.4 Overview of the LRAIC modelling process and the CCA revaluation study

The LRAIC modelling process started with an initial review of data availability to determine the level of information available to concessionaires with respect to network coverage, network dimensioning, costs, and product and service volumes on both an historic and forward-looking basis. This model specification has been developed for consultation which reflects the requirements of the Authority, the initial view of data availability and the recommendations received from concessionaires in the first and second rounds of consultation.

The next stage of the modelling process will be to issue detailed data request to concessionaires based on the specification. A data request which takes account of the model specification and recommendations received from concessionaires in the first and second rounds of consultation, will be issued shortly.

The table below provides an overview of the LRAIC model development showing the roles of the Authority, Frontier and the concessionaires at each stage and the anticipated timeline for each stage.

**Table 1. Overview of the data collection process**

| Stage | Role of the Authority/Frontier | Role of concessionaire | Timeline |
|---|---|---|---|
| **Initial review of data availability** | Ascertain level and nature of data already collected by concessionaires for day to day commercial and regulatory purposes | Respond to requests for high level information | Completed June 2009 |
| **Issue of detailed data request** | Issue of data request which seeks to capture the information required to build the LRAIC model based on the specification | Seek clarification on any aspects of the data request not fully understood | **March 2010** |
| **Submission of initial LRAIC data** | Review LRAIC data as it is submitted<br>Request clarification of data submitted where necessary<br>Provide clarification of data requested as required by operators<br>Assist operators in methodological issues and identifying potential data sources | Submit data as it becomes available and before the deadline for data submission<br>Provide clarification/validation of data requested as required within a reasonable time period | **March- April 2010** |

| | | | |
|---|---|---|---|
| **Submission of final version of LRAIC data** | | Submit final version of data and full documentation of methodology, sources and results | **30th April 2010** |
| **Input data submitted into LRAIC model** | Input data into LRAIC model and sense check the outputs | Provide clarification where necessary | **Upon completion of data submission** |

As set out in the table above, the data collection process will start with a detailed data request being issued in February 2010. This will consist of an Excel data template and detailed written guidelines on how to prepare data for the study. Concessionaires are encouraged to submit data as it becomes available and to seek clarification from TATT as and when queries arise. TATT staff will be available to concessionaires throughout the data collection process to assist with queries relating to the data collection that concessionaires may have. In addition, concessionaires will have the opportunity to meet with TATT and its consultants in March in order to discuss progress on the data collection and practical guidance on preparing the relevant information.

## 1.5 Outline of this document

The cost model requires additional specifications in the areas set out below.

- The overall methodological principles to be used to implement the approach set out in the cost methodology is covered in Section 2 of this document;
- The required outputs of the cost model as set out in Section 3;
- The technologies that the model should assume are described in Section 4
- The increment structure to be modelled is defined in Section 5
- The input data required is set out in Section 6;
- Section 7 gives an overview of the calculation methodology used in the model (reflecting the specifications set out in Sections 2 - 5).

A series of annexes setting out our proposals in terms of the structure of the LRAIC cost model are attached. These annexes relate to:

- Annexe 1 sets out a glossary;
- Annexe 2 defines the network elements to be modelled;
- Annexe 4 describes the LRAIC cost categories; and
- Annexe 5 defines the CVRs.

# 2 LRAIC principles

This section introduces the LRAIC concepts and discusses the key assumptions that will be applied in the LRAIC calculation.

## 2.1 Definition of LRAIC

Incremental cost refers to the change in cost resulting from adding or subtracting increments of demand for a product/service, where a company produces a multitude of products/services.

As a result, only those costs that would be incurred (avoided) if an increment of demand for a product or service was added (subtracted) are included in the incremental cost estimate for that increment. Costs that are fixed or common across increments will not form part of the cost of that increment.

In the LRAIC calculation, incremental cost is measured over the long run. This signifies that estimates of incremental cost should include both costs that may vary in the short run, such as operating expenditure, and also costs which vary in the long run such as capital costs.

Under a LRAIC approach, as set out in the costing methodology, incremental cost are estimated for increments of demand which relate to individual network elements rather than end to end services. The costs of end to end services are estimated through a combination of the LRAIC cost of the elements, service volumes and routing factors.

## 2.2 Summary of principles

The Costing Methodology sets out three principles that should be followed when calculating incremental cost estimates. These principles are:

1. A top down approach must be adopted.
2. Current cost and efficiency adjustments must be made to actual costs.
3. An EPMU approach should be used to attribute common costs to increments.

A summary of the additional principles, that will also be applied when building and populating the LRAIC model, are set out below and then described in further details in the rest of this section.

- LRAIC must be calculated based on the principle of scorched node rather than scorched earth.

- Thinning – existing transmission routes are required to provide connectivity between network nodes, independent of the scale of activity.

- Service levels – it may be assumed that existing levels of quality of service are maintained.

- Mix – the mix of demand characteristics that impact on the volume axis of a cost function should be assumed to be constant with respect to scale.

- Recovery of fixed common and joint costs – the EPMU approach is to be applied for the recovery of fixed common and joint costs on a cost category by cost category basis.

These principles are widely used in other TD-LRAIC models. The choice of the approach takes into account the need, as far as possible, to ensure that output LRAIC prices reflect cost causality and hence results in efficient prices. The principles have also been derived from experience in implementing LRAIC models, to ensure the implementation is based on readily available information and the implementation is proportionate. The principles are explained in more detail below.

### *Top down*

A top-down model is based on (and reconciles to) the actual costs of the business under consideration. Therefore the top-down modelling approach analyses the efficient level of costs for the modelled concessionaire's business and determines the extent to which they are incremental or otherwise with respect to the defined set of increments.

### *Current cost*

Before LRAIC can be calculated, the actual cost of each concessionaire's assets will be adjusted to reflect the current value of the equipment. The detailed procedures of this adjustment are developed in parallel to this specification and will provide rules and guidance to the concessionaires. There will be a need for internal consistency between the CCA approach adopted and the LRAIC model. For example the estimation of CVRs in the LRAIC model will need to be based on consistent assumptions about the technology and network dimension as the CCA valuation of assets.

### *Scorched node*

The current network structure of the concessionaires reflects the current level of demand and may not reflect the optimal network architecture if the network were

designed from a "green field" scenario given a lower level of demand. As LRAIC involves calculating the avoidable costs of removing incremental volumes from the stand-alone network, it is necessary to consider how the design of the network might be affected if the network had to support lower volumes.

The LRAIC model will use a scorched node, as opposed to scorched earth, assumption when reducing the network to the minimum point. The scorched node assumption states that the minimum network point equates to a notional network in which every existing network node is maintained, but at a minimum level of capacity. For example, at the minimum point in a fixed network it is assumed that all present nodes are maintained but at the smallest capacity that is technically viable. This smallest capacity network is defined to be the minimum network and the cost reflects the minimum cost of operating an equivalent network.

### *Thinning*

In order to compute the smallest technically viable capacity, the thinning principle will be adopted. Under this principle, each route or operational function is "thinned down" to the theoretical minimum required to support the delivery of one unit of any existing product over the routes or activities that are currently serviced.

### *Mix*

The model will be built with the assumption that the mix of demand characteristics that impact on the volume axis of a cost function is assumed to be constant with respect to scale. That is, as volume is reduced to the minimum point, the existing demand profile (in terms of type of customers, relative demand for services, call duration, etc) should not be altered.

### *Service levels*

When reducing the capacity of the network to the minimum point, it will be assumed that network performance and quality of service should be maintained at current levels. If the number of alternative routes is reduced, then network performance may not be maintained in some cases. For example, the percentage of dropped calls is partly a function of the number of alternative routes in the network. Therefore, it may be necessary to include some duplicate equipment at the minimum point to ensure that current service levels can be adequately maintained.

### *Recovery of fixed common and joint costs*

One of the outputs of the LRAIC model will be the cost of network components including a mark up to cover fixed common and joint costs. This mark up will be calculated on the basis of EPMU on a LRAIC cost category by cost category basis.

Fixed common costs are those, which span more than one of the increments identified and are invariant to changes in a concessionaire's volumes.

Joint costs are also costs that span more than one increment and are predominantly variable with respect to volume, in contrast to fixed common costs. Some element of these joint costs may also be fixed. For example, the cost of transmission equipment varies according the volume of traffic carried over the network. However, there is a fixed cost associated with the minimum "thinned" network that covers all routes.

The model will be designed so that the fixed common and joint costs between increments are recovered by use of an EPMU, whereby fixed common costs are recovered pro rata to incremental costs. The model will calculate common costs for subsets of increments, (such as the network) on a cost category by cost category basis as set out below.

- For each LRAIC cost category the sum of component incremental costs (where each component is removed in turn) is compared to the incremental cost for the subset of components as a whole (where all components are removed at once).

- The difference between these two sets of costs is the fixed common and joint costs across these increments for this cost category. These common costs to the subset of components are then allocated to the components using an EPMU approach.

# 3 LRAIC model outputs

This section provides further discussion of the outputs of the overall costing process. The requirements for the model outputs are driven by the nature of regulation which may vary for different services. This will then feed into the definition of the increments (see Section 5 and Annexe 3) which will be determined as an output of the LRAIC modelling process.

Wholesale and retail services that are subject to *ex ante* price controls may require a full determination of the costs associated with the services. For wholesale services subject to retail minus price regulation, only the cost of the retail and customer service operation would be required. Assessing the potential anti-competitive practices may require the estimation of the incremental costs of different services or of the cost differential between retail and wholesale services. The Authority may also use the model as an input to calculate the size of any access deficit. The Authority should therefore be able to use the model outputs to cost different components and activities to cater for these requirements including:

- network components including a division between subscriber sensitive (access) and traffic sensitive (core) components;
- costs associated with non network activities related to serving end users (retail activities);
- activities related to serving wholesale customers; and
- corporate activities.

## 3.1 Ex ante regulatory requirements

The Authority's requirements set out that any dominant concessionaire is required to provide cost estimates for its services. With the completion of this model, these estimates must be based on the LRAIC approach.

As the relevant markets for call termination is defined as call termination on an individual operator's network, then all operators offering voice services including call termination are likely to be dominant in at least one market and thus must produce LRAIC service costs. For these reasons the Authority has the power to act in interconnection disputes between concessionaires without the need to first establish dominance.

Up until now, a full market review has not taken place and dominance of individual operators has been established on an *ad hoc* basis. The Authority has therefore decided to assess potential *ex ante* price regulation on the basis of the 2003 EC commission recommendations of product and service markets as set out in the table below.

**Table 2.** Product and service markets

| | Retail | Wholesale |
|---|---|---|
| **Domestic fixed** | Narrowband (voice) access | Unbundled access |
| | Broadband access | Broadband access |
| | Voice services | Internet services |
| | Narrowband internet | Interconnection services – origination |
| | Broadband internet | Interconnection services – transit |
| | | Interconnection services – termination |
| | | Domestic leased circuits |
| **International** | International voice calls | International leased circuits |
| | | International fixed termination |
| | | International mobile termination |
| | | International fixed origination |
| | | International mobile origination |
| **Domestic mobile** | Voice calls | Interconnection services – origination |
| | Messaging services | Interconnection services – termination |
| | Narrowband internet | |
| | Broadband internet | |
| | Roaming | |

Source: "Price Regulation Framework for Telecommunications Services in Trinidad and Tobago", Telecommunications Authority of Trinidad and Tobago

The model should therefore provide inputs to costing products and services in the relevant markets defined. The model further needs to take into account any services that:

- are provided over the same infrastructure as the above, as this may change the scale of the infrastructure and hence the cost that are incremental to the above services; and

- share common cost with the above services; as this may impact the portion of common cost that is allocated to the above services.

The ex ante determination of these relevant markets, means that the output of the model process in terms of service costs is defined. However as the market develops the structure of the relevant markets may evolve. Thus the model should reflect a forward looking view of networks, as far as this is possible and proportionate.

It should be noted that the market definitions are technology neutral. The model will need to take account of services in the same market carried using differing technology, for example voice calls carried over legacy TDM networks or as voice over IP packet switched networks or mobile calls carried over 2G, 2.5G or 3G networks. However for the purposes of service costing, the model will not explicitly produce separate costs for services using differing technology.

While the focus of the cost modelling will be on network costs, retail specific costs will also be identified separately within the modelling. Given that retail costs are typically subscriber driven rather than product driven, retail costs may be considered joint and common costs across services. Estimates of the costs of retail services may be estimated by applying appropriate mark ups to the costs of network services.

## 3.2 Ex post competition cases

In some cases adverse competitive behaviour is not pre-empted and regulated accordingly. In such cases regulators or competition authorities often face the need to assess whether prices have been consistently set at adverse levels. Whether a pricing behaviour reflects normal competitive behaviour or only intends to harm competitors requires analysing the price relative to the cost of service provision.

Given that the nature and scope of *ex post* competition investigations cannot be defined in advance, the LRAIC model developed will need to be flexible enough to provide input to the process for any services or markets required.

## 3.3 Access deficit

One of the decisions that the results of the costing methodology will need to feed into is an assessment of whether the costs of the provision of fixed wire line access are greater than the revenues generated.

The Authority has proposed the following as an appropriate definition for access deficit[3]:

*"The difference between the efficient economic cost of providing and maintaining the access network and the appropriate revenues generated from services utilizing the access network."*

In the event that such an access deficit does exist, further decisions will need to be taken by the Authority as to the appropriate action, if any.

Calculation of the costs of the access network requires taking a decision about the appropriate demarcation between the access network and other parts of the network (generally defined as the core network). This demarcation should be reflected in the increment structure of the model.

The access increment of a fixed wire line network operator may be defined as all connections from the "access node" (remote concentrators or equivalents) to individual premises. The costs of this access network are largely independent of the quantity of traffic generated by the subscribers on that network, but may vary depending on the number of customers served. As there is no routing of traffic through the access network, it can be treated as a single network element.

For fixed wireless access networks the dimensioning and cost of the access network are dependent on a combination of coverage and traffic, and only indirectly on the number of subscribers. While it is appropriate to define the wireless access network as a separate network elements, the attribution of the costs of the wireless access network to services will need to reflect the differing cost causality from wire line networks.

[3] Initial Assessment of TSTT's Access Deficit Claim

# 4 Network technologies to be modelled

A range of network technologies are used by the various concessionaires to provide the wholesale and retail services and the costs of these will therefore need to be estimated. For fixed markets quite different technologies are used by concessionaires to deliver products in the same markets. For example, twisted pair copper cable, fibre, co-axial cable and wireless technologies are all used to deliver fixed services in Trinidad and Tobago.

The model needs to be sufficiently adaptable to allow all concessionaires using the model to cost services based on the mix of technologies they use while being sufficiently generic to ensure that cost estimates resulting from the different concessionaires are comparable.

Where an indexation approach has been used to revalue assets (the default approach), the LRAIC model should reflect the current network structure and cost volume relationships. Where the CCA revaluation has been carried out on a Modern Equivalent Asset basis the LRAIC model should also reflect the MEA technology both in terms of the increments defined in terms of network components and the cost volume relationships modelled.

## 4.1 Access technologies

Different concessionaires will be using differing technologies to deliver services. Traditional fixed wireline, CATV, fixed wireless and mobile (cellular) access networks differ clearly in terms of structure, costs and capabilities to such an extent that the model will need separate cost categories for each type of network.

### 4.1.1 Fixed access technologies

Even where networks offer similar services to the end user (for example fixed voice calls can be provided over traditional fixed wire line access networks, cable television networks and fixed wireless networks), the networks differ to such an extent that differing cost categories will be needed for each type of network.

Therefore, the Authority proposes to include cost categories and network elements for three principle types of fixed access networks:

- traditional fixed wire line networks, using twisted pair copper in conjunction with fibre to deliver services;
- traditional co-axial and hybrid fiber co-axial (HFC) cable television networks; and

- fixed wireless networks including broadband wireless access (BWA) networks.

### 4.1.2 Mobile access technologies

The two principal mobile networks for voice traffic use the GSM family (GSM/GPRS/EDGE) standards. In addition the incumbent mobile provider operates a CDMA network, principally for data services. If 3G (UMTS) services are introduced it is likely that these networks will be introduced as an overlay to the existing GSM networks, with customers with dual mode handsets using either network depending on both the availability and capability of the network.

The existence of multi-mode handsets and the sharing of towers and, in some cases, the core network between different technologies means that it is effectively impossible to separately cost networks or the services that use these networks. For voice services there is little or no differentiation between services offered by the different networks.

In addition cellular access networks tend to have similar structure across differing technologies even if the implementation of standards by different vendors may differ somewhat.

For these reasons, the Authority proposes not to distinguish between the differing technologies used currently, and technologies that may be introduced in the future, for the purposes of service costing.

## 4.2 Core network components

In the long term there is the expectation that mobile and fixed access networks will be served by a single converged packet switch network based on IP/MPLS technology. However currently voice traffic is largely switched using traditional TDM switches, while data services are carried over a range of overlay networks. In addition where operators have both mobile and fixed networks (in particular, TSTT) the switches for these are generally separate although there is typically some sharing of underlying infrastructure such as buildings or transmission.

While the convergence to a single integrated IP/MPLS network carrying both narrowband voice and broadband data traffic is the long term target, this is unlikely to be achieved in the short to medium term. Indeed those operators who had hoped to be at the forefront of such a migration, for example BT with its 21CN, are now expecting to continue to run traditional TDM switches for a number of years.

Therefore, the Authority proposes to maintain separate cost categories for fixed and mobile network components and for narrowband voice components and data components. These cost categories are set out below:

- fixed dedicated voice components such as traditional TDM switches and soft switches;
- fixed (or converged fixed and mobile) broadband data components including DSLAMs, aggregation nodes and routers;
- mobile specific voice components such as mobile switching centres (MSCs);
- mobile specific data components, such as SMS messaging centres (SMSCs).

As networks converge over time the model will need to be populated in a way that reflects this convergence. For example, where narrowband voice traffic is carried over the packet switched network also used for broadband traffic (voice over IP), this usage of a converged network will be included through the routing factors for the relevant services. When this transition is complete the legacy components defined in the model will no longer be needed.

# 5 Increments

This section begins with a high level overview of the cost categories, increments and network elements and then continues to describe them in further detail. This section also sets out the proposed increment hierarchy.

## 5.1 Cost categories, increments and network elements

The LRAIC model will attempt to attribute costs of each of the concessionaire to individual network services. Network services are the access and conveyance services underlying both wholesale and retail services provided to other operators and end users respectively. The costs of these services exclude any retail or wholesale specific costs such as product management and customer care. In order to carry out the attribution a number of intermediate stages are defined:

- cost categories into which the costs of the operators are mapped;
- increments for which incremental costs are calculated; and
- network elements consisting of sets of network components, to which costs are attributed as an intermediate step in the service costing process on a LRAIC basis.

These concepts and the relationship between them are described in further detail below.

## 5.2 Definition of network elements

Network elements are one of the building blocks of regulatory cost accounting and are used to represent logical network components. Service costs are calculated by attributing the cost of network elements across the services that utilise the element based on routing and usage factors.

In order to identify the appropriate network elements, services should be separated into five broad groups of services delivered by logically separate network. These service groups consist of:

1. fixed access services;
2. fixed narrowband conveyance services;
3. fixed broadband services;

4. leased line services; and
5. mobile voice and data services;

When defining network elements, the Authority needs to consider whether a single cost driver can be used to allocate the cost of the element between services. This means that network elements do not typically include any routing within the element itself.

### 5.2.1 Fixed access

The fixed access network is generally considered a single network element in LRAIC models, with the cost driver being the number of lines. This reflects the dedicated access nature of traditional twisted pair infrastructure, where each subscriber has dedicated capacity from their premises to the MDF

Other technologies, such as point to multi-point wireless and HFC CATV networks include an element of shared access in the access network since a number of customers shared a fixed amount of bandwidth. As such, the driver for these elements should be based on capacity or traffic rather than the number of lines.

Therefore, the Authority proposes to define three network elements for access networks:

- fixed dedicated access, which will include traditional wireline networks, and other networks with dedicated capacity to a single customer such as point to point wireless and direct fibre connections;
- fixed wireline shared access, which will include those elements of access networks whose capacity is shared between subscribers such as cable TV networks; and
- fixed wireless shared access, which will include point-to-multi-point technologies such as WiMAX.

### 5.2.2 Fixed narrowband conveyance

The services in this group include voice call services: end to end calls; call origination and call termination.

A typical traditional TDM network has a four level switching hierarchy:

- remote switches/concentrators;
- local exchanges;

- transit switches; and
- international gateway switches.

Remote switches/concentrators and local exchanges to which subscriber are directly connected should be further divided into the line card element which is dedicated to a single subscriber and those elements that are sensitive to traffic. There has been a trend towards flatter network hierarchies with in some cases local exchanges also acting as transit switches and switches acting as both national transit switches and international gateways. Within the LRAIC methodology such 'collapsing' of layers in the network hierarchy can by allocating the costs of the relevant switch with dual functionality (for example allocating to one or other cost category and ensure the routing factors reflect the dual use.

Given that call services are routed through different levels in the network hierarchy, the corresponding transmission links between nodes will need to be separately identified.

Incumbent operators are gradually transitioning narrowband voice traffic to packet based soft switches, but the current topology is likely to endure for a number of years. During the migration from TDM networks to packet switched networks calls both technologies will be in use, with a single call potentially using both technologies. Given the technology neutral approach set out in this paper, the model will not attempt to distinguish between calls carried over the various combinations of technology. Instead the routing factors will need to reflect the mix of technologies in use for each time period with the resulting costs being a weighted average.

New entrant fixed operators who have rolled out voice networks more recently are likely to use flatter network based on soft switches, rather than traditional TDM switches. In this case the network elements used should reflect the lower number of levels in the hierarchy, for example not including separate transit and international gateway switches.

### 5.2.3 Fixed broadband services

Services in this group consist of always on broadband services typically used for internet access. Incumbent fixed operators, using ADSL to deliver the access part of the service typically have a four level hierarchy (mimicking the hierarchy in the narrowband network) consisting of:

- DSLAMs (Access Nodes);
- aggregation nodes;

- core routers; and
- broadband remote access servers (BRAS).

Each of these will be defined as a network element, along with the transmission links between them.

Other fixed networks, such as fixed wireless access (FWA) operators are likely to have less complex network hierarchies and should map their respective network components onto the relevant network elements.

### 5.2.4 Leased line services

Leased line services provide end to end connectivity between two customer premises. Typically they consist of two "tails" providing connectivity from the customer premises to the network and matched capacity within the core network.

The appropriate driver for the access part is the capacity of the links. Generally the leased line will be provided over the existing fixed access network. Thus the Authority does not propose to define a separate network element for leased line access.

For the core element, leased line transmission will be shared with other transmission. Thus for leased line services the Authority proposes to define a single network element: leased line transmission capacity[4].

### 5.2.5 Mobile networks

#### *GSM networks*

The main mobile networks are GSM and as such are highly standardised.

The base station subsystem consisting of the base stations (BTS) and base station controllers (BSCs) and the backhaul networks between them can be considered a single network element. Unlike the traditional fixed network, this is a shared access network and so the appropriate driver is traffic based rather than the number of subscribers.

The relatively small mobile networks in Trinidad and Tobago appear to have a flat switching hierarchy. As such there is no need to distinguish between types of MSC.

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[4] At the network level there is no distinction between leased lines bought by end users ('retail') and those bought by other concessionaires ('wholesale') although there may be differences in the types of lines bought and the level of customer care offers which may be reflected in prices.

Other network components will also need to be included as separate network components. In particular:

- location registers– the home location registers (HLRs) and the visitor location registers (VLRs) where they can be separately identified;
- the SMS message centre (SMSMC); and
- packet switched data network (SGSN, GGSN and so on).

#### *CDMA network*

The structure of CDMA networks is broadly similar to that of GSM networks and the same set of network elements can be used although the costs of those elements may differ. if there are difficulties in mapping the CDMA network components into the GSM based cost categories, the Authority will work with the corresponding concessionaire(s) in order to ensure the model accurately captures and attributes costs.

## 5.3 Definitions of increments

In a LRAIC approach the output of the model is the LRAIC cost of the network elements. In general, the network elements will be defined as the sub-increments in the costing. Larger increments, consisting of sub-sets of network elements, are also defined at higher levels in the increment hierarchy. This allows the recovery of common costs across network elements in a manner that reflects cost causality where possible.

In general, the network elements identified above are physically separate components and thus can be defined as increments at the lowest level in the increment hierarchy. However there are two principal exceptions.

The first is remote concentrators/switches and local switches which sit on the boundary between the core and access networks. These elements will be decomposed into logical network elements by applying appropriate Cost Volume Relationships.

The second is the core transmission network where the same set of components, for example making up a SONET ring, is often used to deliver a range of the transmission network elements set out above.

### 5.3.1 Transmission

While in theory it is possible to estimate the incremental costs of the individual network elements for the transmission network, in practice the resources

required may not be proportionate given the limited accuracy of the results. For the transmission network the Authority proposes to include an increment as the combined set of relevant network elements and then to allocate costs to the network elements as a separate stage.

## 5.4 Cost categories

Concessionaires will need to categorise costs according to a defined set of cost categories for the purpose of inputting costs for the LRAIC model. For the purposes of the CCA study, assets may need to be further disaggregated than is required for the LRAIC modelling. For example if assets in a single LRAIC cost category have different asset lives then the assets need to be separated for the purposes of calculating the CCA capital charges.

### *Relationship between increments, cost categories and network elements*

In many cases there will be a one to one mapping between a physical asset and an increment and hence a logical network element (for example a Mobile Switching Center). Where such a relationship exists, the cost categorisation should be designed to allow the separate identification of the relevant assets and related cost categories.

However in other cases a physical asset, for example a duct, will be mapped to a number of increments reflecting a more complex causal relationship. Similarly, most network operating expenditure will not have a one to one mapping to increments and network elements. In this case, the cost categories need to be defined in such as way as to allow cost causality between the increments (and underlying network elements) and costs to be accurately captured.

## 5.5 Defining the increment hierarchy

The network elements or sets of network elements defined in Section 5.3 will form the lowest level of the increment hierarchy. However, a number of intermediate levels (known as an increment hierarchy) are typically defined for two reasons:

- first, to provide aggregate estimates of the costs of groups of activities broadly consistent with "businesses" defined for accounting separation purposes; and

- second, to identify fixed and common costs between groups of network components in order to calculate EPMU to recover these costs.

The increment hierarchy will consist of 5 levels as set out below.

- **Level 0** – at the highest level the whole enterprise can be considered as a single increment, with the incremental cost equal to the total cost of the business;

- **Level 1** – the total business can be divided into the network increment consisting of the cost of operating and maintaining the network, the "Retail and other" increment which consists of non-network activities;

- **Level 2** – the network can be divided into mobile networks and fixed networks. As in integrated fixed/mobile business the fixed network makes greater use of the transmission network, in this case the transmission network can be included in the fixed network. The "Retail and Other" increment can be divided into "Retail", "Wholesale" and "Other";

- **Level 3** – the mobile and fixed networks are divided into "core" and "access" networks;

- **Level 4** – the lowest level of increments (in most cases corresponding to network elements).

# 6 LRAIC model inputs

This section discusses the inputs to the LRAIC model and how they integrate to calculate the LRAIC of the defined increments.

The basis for construction of a top down model is that for each activity which gives rise to costs, a cost driver must be identified. The cost driver must be a measure for each activity and the cost of the activity should be wholly dependent on the level or volume of the cost drivers. Thus the identification of appropriate cost drivers for each cost and applying the defined relationship between the costs and their respective drivers is the primary task of the top down model.

This means that the LRAIC model requires the following key inputs:

- base cost information used in the model;
- the cost of capital applied to the mean capital employed;
- LRAIC cost categories;
- cost drivers;
- CVRs;
- hierarchy of dependencies; and
- increment specific fixed and common costs (ISFC).

## 6.1 Base cost

Concessionaires will be required to provide the base costs for the LRAIC model. These costs will consist of operating expenditure, CCA information for fixed assets and balance sheet items.

### *Operational expenditure, direct costs and cost of sales*

Concessionaires will be required to provide operating expenditures, direct costs and cost of sales based on a specified template.

### *Depreciation*

The depreciation charges included in the LRAIC model are based on CCA and will be based on the CCA information produced by the concessionaires. The

methodology for this is set out separately to this document in the CCA reference paper.

### Capital employed

The value of capital employed included in the LRAIC model for fixed assets is the NRC taken from the outputs for the concessionaire's CCA exercise. For current assets and current liabilities the values are taken from the balance sheet and will be classified into the appropriate cost categories. The methodology for this is set out separately to this document in the CCA reference paper.

***Statement on Base Cost:***

*The Authority requires that concessionaires provide the base costs for the LRAIC model. These costs will consist of operating expenditure, CCA information for fixed assets and balance sheet items.*

## 6.2 Cost of capital

The cost of capital estimates the return that a concessionaire must be expected to earn on the capital it employs in its business in order to attract investment funds. As such, it plays a key role in estimating the overall cost of the business and hence of services. The cost of capital is typically measured using a weighted average cost of capital (WACC) and includes both the cost of equity and debt finance, weighted by the assumed debt to equity ratio for a company.

The Authority will provide a WACC calculation using the capital asset pricing method (CAPM) to set the cost of equity.

Given the limited amount of direct data available for the concessionaires, the estimated cost of capital will rely to a great extent on benchmarks derived from operators in other jurisdictions.

The cost of capital is associated with the corresponding assets operated by the concessionaire, rather than the concessionaire itself. Given the likely use of benchmarking information the degree to which the cost of capital for different types of assets can be determined is likely to be limited. However in some other jurisdictions different costs of capital have been determined for fixed assets and for mobile assets.

### 6.2.1 The cost of equity

The CAPM is a widely-used explanatory model based on a number of simplifying assumptions on the behaviour of investments and markets and is calculated as follows:

$$r_e = r_f + \beta \times (r_m - r_f)$$

Where:

- $r_e$ is the cost of equity;
- $r_f$ is the risk-free rate;
- $\beta$ (beta) is the measure of relative risk of the relevant assets; and
- $r_m$ is the expected return on the equity market. The difference between the market return and the risk-free rate is known as the equity risk premium (ERP).

The principal advantages of CAPM are its strong theoretical foundations, its simplicity and transparency.

The risk free rate will be estimated based on the return on benchmark risk free government securities such as US government bonds.

Given that the concessionaires are not publicly listed, it will not be possible to directly estimate the beta for any of the concessionaires. Instead the estimate of beta will be based on information on the calculated beta for a sample of comparable operators in other jurisdictions.

There are a range of methods for estimating the ERP, with a wide range of estimates resulting. Regulatory practice in other jurisdictions will be considered when determining the appropriate ERP.

In order to reflect any greater perceived risk of investing in Trinidad and Tobago, for example due to currency exchange risks, it may be appropriate to add a country specific risk premium to the estimated cost of equity.

### 6.2.2 The cost of debt

To calculate the WACC the Authority will also need the cost of debt. To calculate this, the Authority will consider the debt premium. This is best obtained by observing the actual cost of debt of comparator telecoms companies. In making this comparison, the following factors will be taken into account:

- the size, credit rating and gearing levels of the comparator firms;

- the maturity of debt held by comparators;
- the time period over which the debt premium is calculated;
- any country specific risk premium; and
- decisions on the debt premium made by other telecoms regulators.

Lastly the Authority will also consider available information on the optimal debt to equity ratio.

***Statement on Cost of Capital:***

*The Authority shall determine the cost of capital to be used in the LRAIC model using a WACC calculation with the capital asset pricing method (CAPM) used to estimate the cost of equity.*

## 6.3 LRAIC cost categories

In the model the cost data will be supplied on the basis of LRAIC cost categories. To group cost information together into a LRAIC cost category it is necessary that:

- costs included share the same driver; and
- costs included have the same dependencies with regard to other cost drivers further down the driver hierarchy.

The LRAIC cost categories are grouped into nine categories:

- network components;
- network infrastructure and support equipment (such as network power equipment and network buildings);
- non-network assets (such as office furniture and billing systems);
- network activities (including network maintenance);
- product management (for example, interconnect product management);
- support activities (such as human resource and finance department costs);
- direct costs, cost of sales, and so on (such as interconnection out payments);
- other operational expenditure; and
- balance sheet items.

Annexe 4 contains a full list of the cost categories.

## 6.4 Drivers

For each of the LRAIC cost categories a cost driver, or in a small number of cases two cost drivers, will be identified. The cost driver of a LRAIC cost category is considered to be the variable(s) which influences the level of costs in the cost category through the volume or dimension of the network component or activity purchased. The respective unit cost of the cost category is not a direct input to the LRAIC model (although may from an input to the CCA valuation).

Drivers can be classified into two broad groups.

First, exogenous drivers are directly dependent on levels of demand for services as specified by the increments. For example, the cost of a mobile network BSS is driven by the volume of BSS traffic.

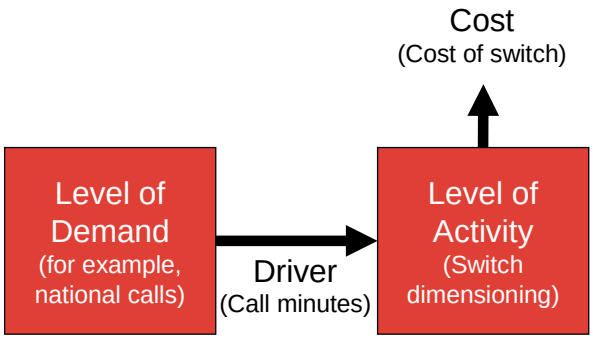
Second, endogenous drivers are dependent on internal demand from other activities within the concessionaire's business and their related cost categories. For example, the cost of HR (human resources) department is driven by the number of employees in the business, which in turn will depend indirectly on the demand for services as defined by the increment.

These two broad groups are described in further detail below.

### 6.4.1 Exogenous cost drivers

Some activities and hence costs are driven directly by the level of demand as shown below. Activities or cost categories that are driven directly by demand are only dependent on the level of the increments. Such drivers are "exogenous" drivers, i.e. the level of the drivers is dependent on demand which is external to the concessionaire.

**Figure 1.** Exogenous cost drivers



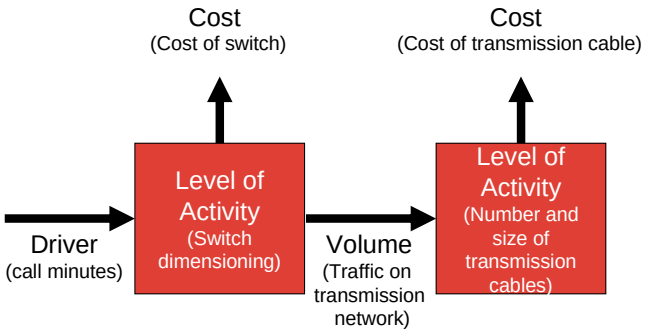
The increments have been specified so that exogenous drivers are dependent on a single increment. For instance, BSS equipment cost is driven by the volume of BSS traffic. As a result these drivers are set either at 100% or 0% of current demand during the calculation of incremental costs.

### 6.4.2 Endogenous cost drivers

Endogenous costs drivers are those that are dependent on internal demand for activities and only indirectly on external demand.

For many activities and hence costs, the causal link between demand and the level of costs is indirect. For these activities (e.g. Activity B below), the level of their corresponding drivers is dependent of the level of other activities (Activity A below), which in turn is dependent on the input drivers for these other activities as illustrated below. Such drivers are endogenous, i.e. dependent on demand which is internal to the operator.

**Figure 2.** Endogenous cost drivers




The model will use five different types of endogenous drivers:

- endogenous network drivers;
- non-network endogenous drivers;
- employee drivers;
- gross replacement cost drivers; and
- other cost drivers.

### Endogenous network drivers

Endogenous network drivers drive the costs of network support cost categories. As the dimension of network components (such as MSCs) vary in response to changes in demand, the demand for network support functions will also vary. Volume-volume relationships (VVRs) are used to drive the relationship between the dimensioning of network components and the demand for network support equipment. For example, network floor space is driven by an endogenous network driver, namely the floor space requirements of network components.

### Non-network endogenous drivers

Non-network endogenous drivers drive the cost of some non network activities. For example demand for vehicles is driven by a combination of network operations and other commercial and administrative activities. These drivers are defined by the base level of the driver associated with each activity (for example the number of vehicles in each department) and the relationship between demand for the activity and the level of the driver.

### GRC drivers

GRC is used as a driver where it is believed that the driver for a cost category (typically a network support cost category), can be a reasonably proxy of the total acquisition cost of the equipment it supports. Intuitively it seems reasonable that there will be a strong degree of correlation between the support costs of equipment (which will increase with the number and complexity of network components), and the replacement cost of the equipment (which will also increase with the number and complexity of network components). Using GRC as a driver also has the following advantages:

- it is a common cost driver that can be applied to all assets; and
- a common CVR can be used because GRC can be assumed to vary in the same manner as annualised costs,.

### Employee drivers

Employee drivers will be used for LRAIC cost categories for which the values are expected to vary in relation to the number of staff, either in total or for a department or group of departments. Examples of LRAIC cost categories driven by employee numbers include HR costs or the cost of office machinery (PCs, office furniture etc).

### Other cost drivers

Some activities, for example finance, can be considered to be driven directly by the total costs of a given subset of activities (or in the case of finance, all

activities). The drivers here are thus the costs of the relevant activities calculated in the model.

## 6.5 CVRs and VVRs

In order to calculate LRAIC, it is necessary to understand how costs vary according to the volume of services produced. CVRs are used to define how costs change as the volume of the driver also varies. VVRs (volume-volume relationships) are used to define endogenous CVRs (see Section 6.6). The quantification of the relationship between the volume of services offered and the cost of providing those services is fundamental to the calculation of LRAIC.

In developing the cost model, the Authority will pay regard to the need to minimise resources required to develop CVRs where appropriate allowing the concessionaires to make simplifying assumptions:

- CVRs will not be required for those cost categories driven by a single exogenous cost driver, this driver is either set to the current level of demand or to zero, at which point the modelled cost of the cost category is zero. This will result in a significant reduction in the amount of resources required to develop CVRs compared to the practice in other countries, such as the UK, where CVRs are required for all cost categories.

- CVRs will be required for all cost categories driven by endogenous cost drivers or a by multiple cost drivers. However initially the Authority will assume that the CVRs for cost categories driven by endogenous cost drivers are linear with no fixed costs (i.e. costs are directly proportional to the driver), unless specified otherwise by the concessionaire. Thus concessionaires will not be required to provide information for these CVRs initially.

As a result concessionaires will only be required to supply information required to derive CVRs for those cost categories driven by more than one exogenous driver or where there may be Increment Specific Fixed Costs. These are set out in Annex 5.

CVRs are typically expressed as two-dimensional charts, plotting the relationship between the value of the volume driver and the value of the affected cost category. The relationship can be mapped with cost driver volumes on the X-axis and the costs, caused by the cost driver, on the Y-axis, and with both costs and volumes expressed as percentages of current values.

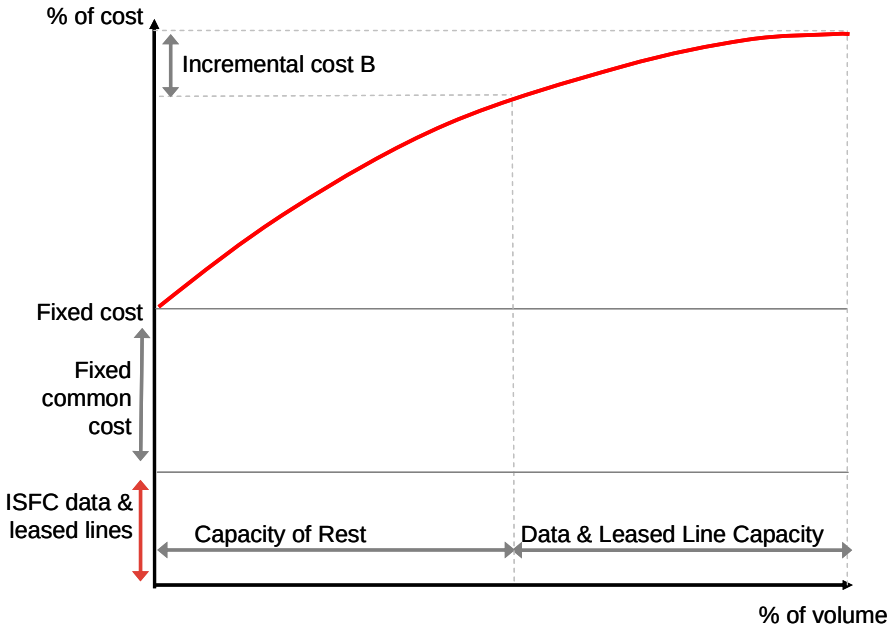
The two key characteristics of CVRs are:

- the shape of the curve, reflecting the relationship between variable costs and volumes; and

- the extent of fixed (and/or common) costs exhibited in the relationship (the X-axis intercept).

In Figure 6, two increments, A and B, drive the total volume of the cost driver. The incremental cost of B is shown given that increment A is already produced.

**Figure 3.** A typical CVR




For some LRAIC cost categories there are fixed costs. That is, costs do not fall to zero as the volume of the cost driver falls to zero. The intercept with the y-axis of the CVR represents the fixed cost associated with the cost category. A fixed cost may either be uniquely associated with the production of one increment or shared between increments.

### *Increment specific costs*

That portion of the fixed cost that is not shared with any other increment is known as increment specific fixed costs. These costs are included as part of the incremental costs of the increment they are associated with.

### *Shared fixed costs*

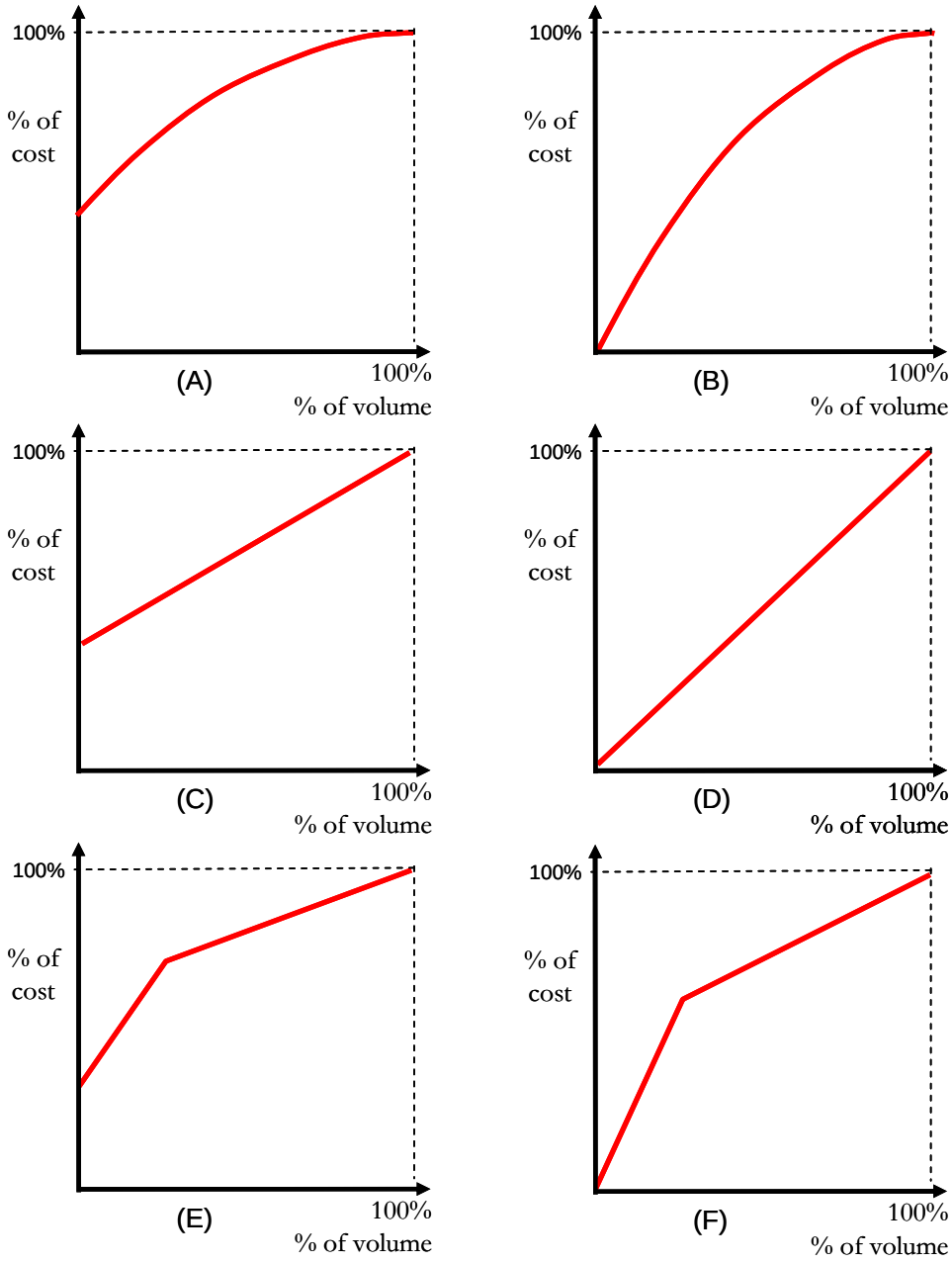
Fixed costs which are not increment specific are called fixed and common costs. The existence of such costs indicates the presence of economies of scope[5].

The mapping of CVRs to cost categories can be one to one or one to many, as different cost categories may share the same cost driver and the same CVR. However, a CVR can only be shared by cost categories where the cost causality for each cost category is identical.

CVRs can take many forms, a selection of which are represented graphically as shown in **Figure 4**.

[5] Economies of scope are present when it is more cost effective to produce two or more outputs together rather than separately.

**Figure 4.** Typical CVR functions




In analysing CVRs, it should be noted that:

- A positive intercept represents the presence of fixed costs and therefore economies of scope and/or economies of scale in the provision of the increment [(A), (C) & (E)];

- A concave function demonstrates that economies of scale/scope increase as the volume of the driver also increases [(A) & (B)]; and

- A kinked function indicates a change in the unit cost of the volume input beyond a certain volume level (e.g. due to the introduction of volume discounts above a certain level of output) [(C) & (D)].

### *Format of CVRs*

Where concessionaires supply information on CVRs they will need to be documented using a common format consisting of:

- name and number of the CVR;
- cost driver;
- list of cost categories which use the CVR;
- description of the general form of the CVR (including graph);
- explanation of the rationale and assumptions underpinning the CVR;
- methodology for the derivation of the CVR; and
- sources of data.

***Statement on CVRs:***

*The Authority requires concessionaires to document CVRs using a common format consisting of:*

- *name and number of the CVR;*
- *cost driver;*
- *list of cost categories which use the CVR;*
- *description of the general form of the CVR (including graph);*
- *explanation of the rationale and assumptions underpinning the CVR;*
- *methodology for the derivation of the CVR; and*
- *sources of data.*

### 6.5.2 Development of CVRs

The number of CVRs within the model depends on:

- the number of cost categories;
- the particular cost types; and
- the detail of the network components defined.

It will be necessary to assign a specific CVR to each LRAIC cost category. In some cases one CVR will be applied to several cost categories on the basis that the cost categories have the same cost driver and the behaviour of costs with respect to volume is deemed to be very similar.

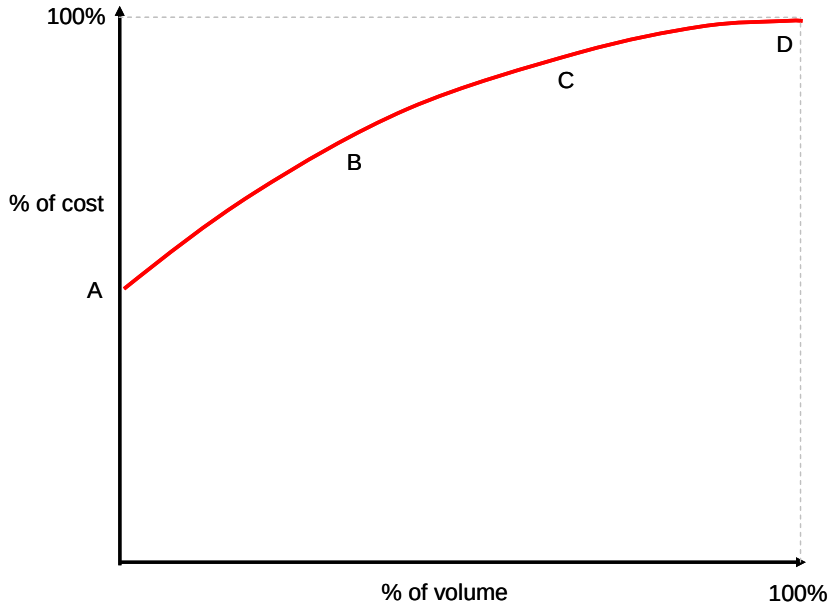
As noted above for the majority of cost categories a default CVR will be used initially.

### 6.5.3 Construction of CVRs

For each CVR developed it is necessary to identify:

- the minimum point [Point A in Figure 8], as defined within the scorched node assumption;
- the maximum point [point D] which is the actual input value for the cost category; and
- intermediate points or the method for joining the maximum and minimum points [for example, points B & C in Figure 8].

**Figure 5.** CVR construction




The following process will be undertaken for estimating each CVR:

- the cost category and corresponding cost driver will be identified;
- the current cost and equipment quantity relating to the CVR category will be established. The current cost values and quantities will be based on operator input;
- the amount/volume of equipment relating to the minimum point is determined, which is then expressed in cost terms;

- a method for linking the minimum and maximum points is determined (i.e. the shape of the curve); and
- the CVR is applied to the relevant cost categories (as input to the model).

### Sources of information

Whilst the maximum point of a CVR is obtained from inputs to the model, it is necessary to define the minimum point and the shape of the curve. There are two main methods to do this:

- engineering simulation models; and
- interviews and field research.

***Engineering simulation models:*** For the required CVRs for network components, concessionaires will be required to estimate the reduction in cost from moving drivers toward zero. This will require implementing engineering models.

The steps in the modelling process are as follows:

- break down the cost category into its components (for example, breaking the remote concentrators into individual components such as line cards, power supplies, etc.);
- determine the unit cost for each of the components;
- populate a model with data reflecting demand driving the component volumes;
- establish dimensioning rules linking demand to component volumes;
- apply the relevant unit costs to each asset component, in order to capture any difference in the mix of component parts; and
- modify the volume of the identified cost driver to derive a cost volume relationship.

***Information from concessionaires (interviews and field research):*** By interviewing experts within each area that contributes towards the cost of a cost category, the concessionaries should be able to estimate the fixed and variable cost and hence the shape of the CVR. This relationship also takes into account reasons why costs may change as volume alters, such as vendor discounts and the impact of outsourcing services.

## 6.6 Hierarchy of dependencies

All costs within the LRAIC model are directly or indirectly related to the volume of output of the increments. However, while certain costs are directly related to those volumes, others only have an indirect relationship to the volume of increments, mediated through other intermediate cost drivers and volume-volume relationships.

### *Exogenous CVRs*

Exogenous CVRs are those, whose volume driver has a direct relationship to the external demand for an activity, i.e. they are not dependent on any other CVRs. The cost driver volume for an exogenous cost category is exogenous to the model and known without calculation.

### *Endogenous CVRs and VVRs*

Endogenous CVRs drive intermediate cost categories. These do not have a direct relationship with any exogenous cost driver, but may themselves be dependent on other exogenous cost drivers. Consequently, before the incremental cost can be calculated, the relevant cost driver volumes must be calculated using a VVR between exogenous driver volumes and the relevant cost driver volume for the dependent CVR. Endogenous cost drivers are typically used for indirect and support costs.

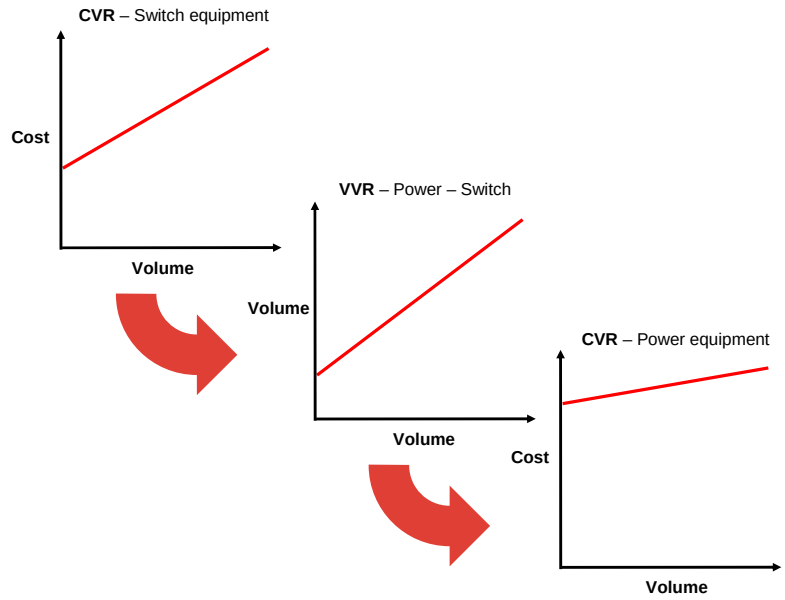
In order to capture the full set of costs, it will be necessary to define hierarchies of relationships within the model. This will allow for those costs that are driven directly by exogenous drivers to be allocated first, with successive interdependencies being rippled through the model. The dependency hierarchy will be defined in such a way as to ensure there is no circularity in the dependencies.

The guiding principle will be to define those costs that are specific to network assets at the top of the hierarchy (since these are generally the costs which are driven by exogenous variables such as call and line volumes). Following this it will be possible to define those costs that are driven by endogenous drivers.

An example of a dependency hierarchy is shown in the figure below. In this example, based on legacy TDM technology, it can be seen that:

- the volume of switch minutes (an exogenous variable) drives switch costs;
- the volume of switch minutes also drives the requirement for network power; and
- the demand for network power (an endogenous variable) drives the cost of network power equipment.

**Figure 6.** A typical dependency hierarchy




## 6.7 Increment specific fixed and common costs

ISFC are costs which are independent of the relevant cost driver volume and uniquely associated with a single increment. An ISFC is defined as the fixed cost associated with the production of an 'increment' which is not shared between any other increments. It is the element of fixed costs that can be uniquely associated with an increment independent of other increments and, as such, would be avoided if the increment is no longer produced. As a result, the ISFC associated with a given increment forms part of the LRAIC for that increment.

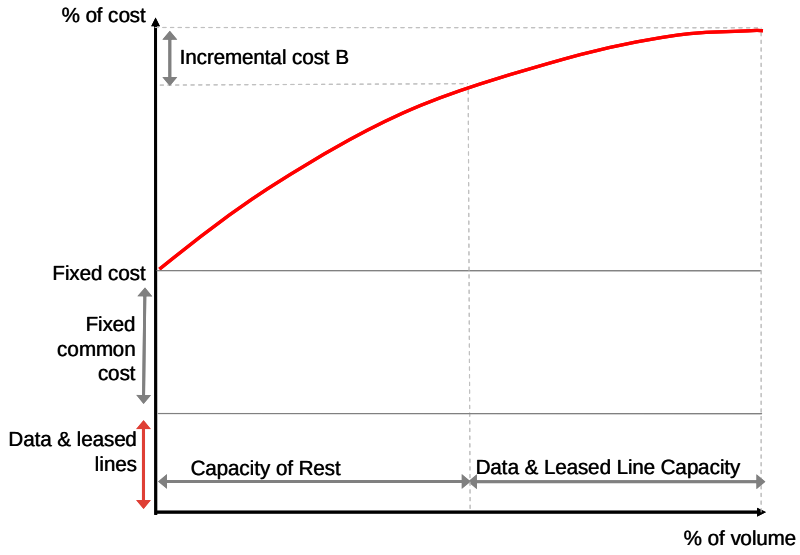
In cases where a cost category has two drivers or where a CVR drives the costs of multiple increments (and all or part of the fixed cost is specific to one increment), it will be necessary to define which proportion(s) of the fixed cost is specific to one or more increments.

An example illustrating the presence of increment specific fixed costs is an SDH transmission ring that is exclusively used for data and leased lines, while all other rings contributing to the transmission equipment cost category are shared between data, leased lines and other increments. The transmission ring used only for data and leased line services is required in the case that there is demand for data and leased lines. The CVR for transmission equipment contains enough information to determine how the cost varies as capacity requirements vary as a consequence of the exclusion of increments. If the data and leased line increment

is excluded, the driver volume is reduced and thus the variable costs would be saved according to the CVR. Hence, the fixed cost of the rings dedicated to data and leased line transmission have to be identified also and removed.

A CVR with increment specific costs is shown in the figure below.

**Figure 7.** A CVR with increment specific fixed costs




In this example if the demand for data and leased lines is zero, the costs saved would consist not only of the savings due to lower capacity equipment being used ("Incremental cost B") but also the fixed costs relating to those SDH rings that are used solely for Data and Leased Lines ("ISFC data and leased lines"). Thus the ISFC would need to be subtracted from the output of the standard CVR.

## 6.8 Transmission allocation

As noted in section 5.3.1, transmission equipment and infrastructure is used to support links that in turn support a range of services. Given the high proportion of joint and common costs it is difficult to precisely attribute costs to individual links and hence services through an incremental costing approach and such an approach would require a disproportionate amount of resources.

The approach adopted in the modelling will be to define two increments for the domestic transmission network:

- Domestic transmission (capacity dependent). This will consist of those network components whose cost is dependent on the number and capacity

of links but largely independent of the length of links. Examples include transmission terminal equipment, cross connects, etc.

- Domestic transmission (length dependent). This will consist of network components whose cost is dependent on the length of links they serve (which may also be dependent on the number and capacity of links). Examples include fiber cables and the duct housing the cables and may include wireless links where multiple hops are required or where longer distance links require more expensive equipment and/or frequency.

The costs of these two increments are then allocated to the defined transmission network elements on the basis of the relevant volumes of each network element:

- The total capacity of links for each network element expressed as the number of T1/E1 equivalents; and

- The sum of the capacity multiplied by length of the links for each network element expressed as T1 km equivalents. For example a T1 link of 10 km length being recorded as 10 T1 km equivalents.

## 6.9 Service volumes, conversion and routing factors

The costs of network elements will be allocated to network services on the basis of the total volume of each service combined the average usage that each unit of the service makes of a given network element.

The defined network services are set out in Annex 6.

A discussion of each of these elements follows.

### 6.9.1 Volume of services

The units used for the total volume of service are typically:

- conversation minutes in the case of circuit switched services;
- messages in the case of SMS services;
- bytes in the case of packet switched services.

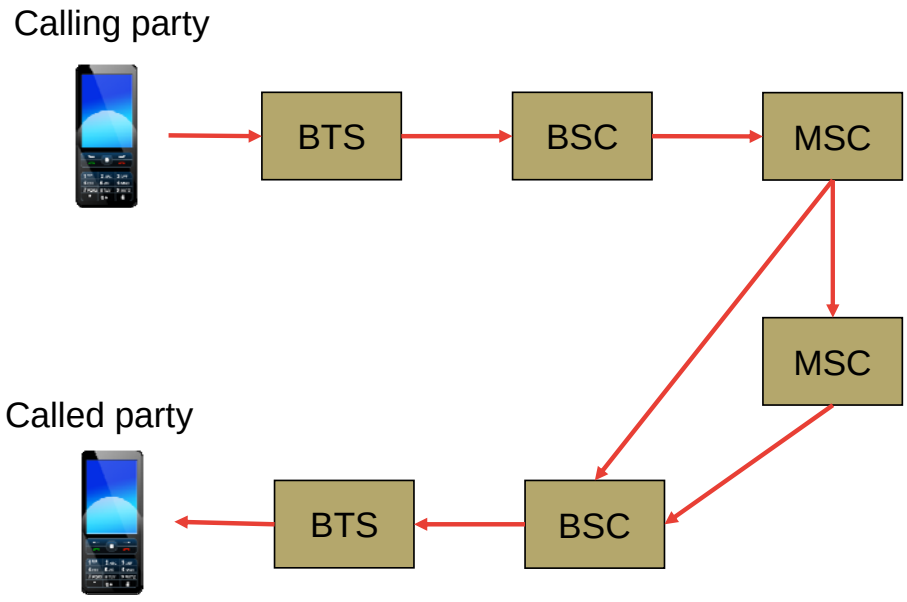
Care must be taken when measuring volumes of similar services, that a consistent approach is used or that the estimates are adjusted to take account of differences in measurement. For example data from retail billing systems often present data in terms of "billed minutes" where conversation time is rounded up to the nearest billing increment, while interconnection minutes are usually billed on a per second basis and so output from interconnection billing systems is generally on a per second basis. In the case where retail billing increments of similar

duration to average call length case there can be a significant difference between "billed" minutes from the retail billing system and minutes on a per second basis from the interconnection system, with "billed" minutes being materially higher than minutes on a per second basis. In this case a conversion factor should be used to convert to a per second basis.

### 6.9.2 Routing factors

For services delivered over networks with a complex hierarchy such as voice calls, different services may use greater or fewer network elements. Routing factors are used to describe the way in which a call makes use of different network elements. The figure below shows a simplified diagram of how mobile calls are routed in different ways over the mobile network and therefore make different use of network elements in order to explain how concessionaires should calculate routing factors.

**Figure 8.** Simplified network diagram




Source: Frontier Economics

In this simplified example, an on-net call could be routed in two different ways, either:

- It would be routed via a BTS, a BSC, an MSC and then directly to the BSC and BTS of the called party (A); or

- It would be routed via a BTS, a BSC, an MSC and to another MSC before being routed to the BSC and BTS of the called party (B).

If 70% of on-net calls are routed in the first way (A) and 30% in the second way, (B) the routing factors would be calculated as set out in the table below.

**Table 3.** Simplified calculation of routing factors for an on-net call

| | BTS | BSC | MSC | % of on-net calls routed in this way |
|---|---|---|---|---|
| **On-net call (A)** | 2 | 2 | 1 | 70% |
| **On-net call (B)** | 2 | 2 | 2 | 30% |
| **Average on-net call** | 2 | 2 | 1.3<br>=(1*0.7)+(2*0.6) | n/a |

Source: Frontier Economics

Routing factors should be an estimate of the **average** number of each type of network component used for a given type of service. Where a number of potential routings exist for a service the routing should be a weighted average of the number of components used for each route, with the weights based on the proportion of traffic (by volume) taking each route.

### 6.9.3 Conversion factors

While the routing factor shows how many times a given service on average uses a component, this does not form a useful basis for allocating costs in a mobile network as different services are measured using different metrics (minutes/messages or bytes). In addition there may be differences in the relative load placed on network components by different services even where they are measured on a consistent basis. In order to convert network usage to a consistent basis conversion factors will be applied.

Where volumes of services using the same network components are measured using different units, for example voice, SMS and GPRS traffic using the GSM air interface, conversion factors will be necessary to convert the usage to a consistent basis. These conversion factors may vary depending on the component, for example while an SMS may use minimal capacity in the air interface, the load it may place on an MSC processor may be comparable to a call set up.

# 7 LRAIC model calculation

This section of the specification provides an overview of the LRAIC model calculation process.

## 7.1 Model overview

The incremental costing model will be split into four sections:

- a section where the overall structure of the model is established, consisting of the relationships between costs, CVRs and drivers (see as described in Section 7.2);
- a section where the input data in terms of base costs, base driver volumes and CVRs is entered (see Section 7.3 and Section 6 for more detail);
- a section which calculates the level of costs for a given level of demand, defined by the increments (see Section 7.4 and Section 5 for more detail); and
- a section which calculates the incremental costs for each increment and the incremental costs including mark ups (see Section 7.5).

The results of the incremental costing model will then be allocated to services through a two stage process:

- transmission costs will be allocated across network elements based upon the usage of the transmission network by each of the network elements;
- the costs of the network elements will be allocated across services based on a element based costing approach (see Section 7.5).

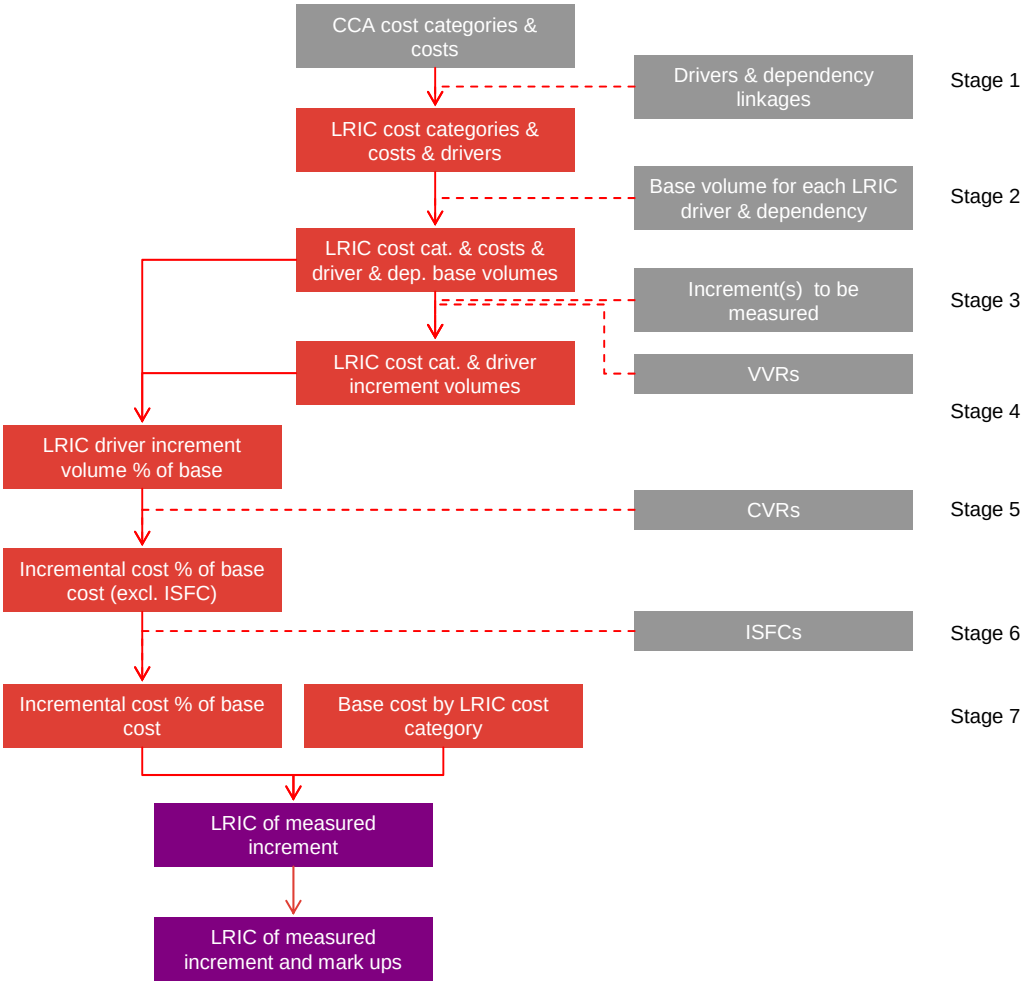
## 7.2 Overall structure of the incremental costing model

This section sets out the overall structure of the model. However, it does not include any numerical data, either on the base level of costs or drivers, or on the form of the CVRs and VVRs.

The data entered in this section largely defines the dependencies within the model.

The structure of the model is shown in Figure 8.

**Figure 9.** Outline of the LRAIC calculation process




## 7.3 Inputs

This section of the model includes all of the numerical data used to populate the model including the base cost information, information on base volumes for calculation of drivers and CVR and VVR inputs.

### *CCA cost input*

The net replacement cost and depreciation data relating to fixed assets is input on a CCA basis (which, where appropriate, takes into account the costs of MEA technology). Operating cost will also be required as an input (see Sections 6.1 and 6.2). This data is then aggregated into the LRAIC cost categories as described in Section 6.3.

### *Base driver inputs*

In addition to the cost data, a number of measures which form the base value of drivers will be entered into the model (see Section 6.4).

In the case of exogenous drivers, the base driver inputs can either be associated with a number of increments, or just with a single increment. For example the driver 'E1 Links' is associated with each of the core transmission increments whilst the driver 'Transit switch minutes' is only associated with the transit switch increment.

### *CVR and VVR inputs*

For each CVR the following data will be input:

- For the first input driver, the value of the cost volume relationship at each volume decile between 0% and 100% as this input driver is varied;
- Where there is a second input driver, the value of the cost volume relationship at each volume decile between 0% and 100% as this input driver is varied; and
- Any ISFCs associated with any of the increments.

## 7.4 Calculation of incremental costs

The model calculates the cost of each increment in turn. As noted previously the costing will be carried out in a decremental fashion with demand for the increment that is being measured being set to zero, whilst the demand for all other increments is maintained at current levels.

The calculation of the cost of the business excluding the increment will be carried out in the following order:

- calculation of the exogenous drivers;
- a number of stages, corresponding to each of the levels in the dependency hierarchy with the output from each stage being endogenous drivers used for the following stage; and
- the final calculation of costs, once all drivers have been calculated.

Each of these stages is described further below.

### *Calculation of exogenous drivers*

As set out in Section 6.4.1, for the direct increment related drivers, the value of the driver is set to zero for the driver related to the increment being measured,

and any drivers associated with components that make up the increment. For example drivers of all the core network components are set to zero if the "core" increment cost is being calculated. Demand for all other increments is set to 100%, i.e. the current level of (external) demand.

For the weighted exogenous drivers, the value of the driver is effectively a weighted average of the direct increment related drivers, with the weights being the driver base volume assigned to each increment.

### *Calculation of endogenous drivers*

As set out in Section 6.4.2, most indirect costs categories can be assumed to be dependent on the level of costs for other cost categories at lower levels in the dependency hierarchy.

However, it is not expected that the volumes required of "Floor space" and "Network Power" will move in line with costs for the network components that they are used for. This means that network floor space for components is unlikely to be directly proportionate to the cost of those components. Hence the model employs VVRs, to understand these relationships.

As a result, a number of cost drivers are dependent on other drivers. The values of these endogenous drivers are therefore calculated by the model in a number of stages.

### *Calculation of costs*

Once all of the drivers are available, the cost of the business for the given level of demand can be calculated by applying the CVRs.

## 7.5 LRAIC of measured increment including mark-ups

The model calculates incremental costs by setting demand for the corresponding increments to zero, which in turn yields the cost of total business excluding the increments to be measured.

LRAIC is then calculated as:

$$LRAIC_{\text{Increment(s) to be measured}} = Cost_{\text{Corporate Entity}} - Cost_{\text{Corporate Entity excluding Increment(s) to be measured}}$$

### *LRAIC of measured increment including mark-ups*

Common costs, and hence mark ups, are calculated by comparing the incremental cost of an increment, (e.g. mobile core) with the sum of the incremental costs of each sub increment included within an increment (e.g. MSC,

VLR, SMSC, etc) for each LRAIC cost category. The difference forms the fixed common costs (FCCs) across all the relevant sub-increments.

The model calculates and sequentially marks-up four different sets of common costs for each LRAIC cost category reflecting the four levels in the increment hierarchy.

## 7.6 Allocation of element costs to services - element based costing

The principle of element based costing is that component costs are allocated across services in proportion to the use made of the component by a service. In order to carry out this allocation we need to calculate the use made of each component by each service. The use that each service makes of a component can be decomposed into three elements:

- first, the total volume of service delivered by the network measured on an appropriate basis (for example call minutes);
- second, the number of times *on average* that the service uses the component; and
- third, a conversion factor that converts the units used for each service to a comparable basis in terms of the load resulting on the component.

# Annex 1: Glossary

**Table 4.** Glossary of terms and abbreviations

| Term | Description |
|---|---|
| **ABC** | Activity based costing |
| **BRAS** | Broadband remote access servers |
| **BSS** | Base station |
| **CAPM** | Capital asset pricing model |
| **CATV** | Cable television |
| **CCA** | Current cost accounting |
| **CDMA** | Code division multiple access |
| **CVR** | Cost volume relationship |
| **DSLAM** | Digital subscriber line access multiplexer |
| **DSLAM** | Digital subscriber line access multiplexer |
| **EC** | European Commission |
| **EDGE** | Enhanced data rates for GSM evolution |
| **EPMU** | Equal proportionate mark-ups |
| **ERP** | Equity risk premium |
| **FAR** | Fixed asset register |
| **FCM** | Financial capital maintenance |
| **FWA** | Fixed wireless access |
| **GBV** | Gross book value |
| **GGSN** | Gateway GPRS support node |
| **GPRS** | General packet radio service |
| **GRC** | Gross replacement cost |
| **GSM** | Global system for mobile |

**Table 4.** Glossary of terms and abbreviations

| Term | Description |
|---|---|
| **HCA** | Historic cost accounting |
| **HFC** | Hybrid fibre co-axial |
| **HLR** | Home location register |
| **IP** | Internet protocol |
| **ISFC** | Increment specific fixed costs |
| **LRAIC** | Long run average incremental cost |
| **MDF** | Main distribution frame |
| **MEA** | Modern equivalent asset |
| **MPLS** | Multiprotocol label switching |
| **MSC** | Mobile switching centre |
| **NBV** | Net book value |
| **NPV** | Net present value |
| **NRC** | Net replacement cost |
| **PDH** | Plesiochronous digital hierarchy |
| **PPI** | Producer price index |
| **SDH** | Synchronous digital hierarchy |
| **SGSN** | Serving GPRS support node |
| **SMSC** | Short message service centre |
| **SONET** | Synchronous optical networking |
| **TATT** | Telecommunications Authority of Trinidad and Tobago |
| **TD** | Top down |
| **TDM** | Time division multiplexing |
| **UMTS** | Universal mobile telecommunications system |

**Table 4.** Glossary of terms and abbreviations

| Term | Description |
|---|---|
| **VAT** | Value added tax |
| **VLR** | Visitor location register |
| **VVR** | Volume volume relationship |
| **WACC** | Weighted average cost of capital |

# Annex 2: Defined network elements

**Table 5.** Proposed network elements

| Abbreviation | Label | Description | Maps to Level 4 increment |
|---|---|---|---|
| FAD | Fixed access network (dedicated access) | Network providing conveyance from customer premises to operator's network premises offering dedicated capacity to customers (e.g. twisted pair networks or fibre networks) | FAD |
| FAS | Fixed access network (shared access) | Wireline network providing conveyance from customer premises to operator's network premises sharing capacity between customers (e.g. Cable TV networks) | FAS |
| FAW | Fixed access network (wireless) | Wireless network providing conveyance from customer premises to operator's network premises sharing capacity between customers (e.g. Cable TV networks) | FAW |
| N1S | Remote narrowband access node (subscriber sensitive) | Subscriber specific part of network component providing an interface between the access network and the switched network without full switching capabilities (e.g. remote concentrator line cards) | N1S |
| N1T | Remote narrowband access node (traffic sensitive) | Traffic sensitive part of network component providing an interface between the access network and the switched network without full switching capabilities (e.g. switch facing ports on remote concentrator) | N1T |

**Table 5.** Proposed network elements

| Abbreviation | Label | Description | Maps to Level 4 increment |
|---|---|---|---|
| N2S | Local exchange (subscriber sensitive) | Subscriber specific part of a local switch (e.g. local switch line cards) | N2S |
| N2S | Local exchange (traffic sensitive) | Traffic sensitive part of a local switch (e.g. local switch processor) | N2S |
| N3 | Transit exchange | Switch only connects to other switches (i.e. which does not connected to the access network/remotes) | N3 |
| N4 | International gateway | Switch the connects to networks overseas | N4 |
| TR-N1-N2 | Transmission N1-N2 | Transmission between levels 1 and 2 in the narrowband network hierarchy | |
| TR-N2-N2 | Transmission N2-N2 | Transmission within level 2 in the narrowband network hierarchy | |
| TR-N2-N3 | Transmission N2-N3 | Transmission between levels 2 and 3 in the narrowband network hierarchy | |
| TR-N3-N3 | Transmission N3-N3 | Transmission within level 3 in the narrowband network hierarchy | |
| TR-N3-N4 | Transmission N3-N4 | Transmission between levels 3 and 4 in the narrowband network hierarchy | |

**Table 5.** Proposed network elements

| Abbreviation | Label | Description | Maps to Level 4 increment |
|---|---|---|---|
| B1 | Broadband level 1 - access node | Network component providing an interface between the access network and the core broadband network (e.g. DSLAM) | B1 |
| B2 | Broadband level 2 - aggregation node | Network component aggregating traffic from a number of access nodes but not providing routing capabilities | B2 |
| B3 | Broadband level 3 - BRAS | Network component providing access control to the network | B3 |
| B4 | Broadband level 4 - router | Network component routing broadband traffic within the core network | B4 |
| TR-B1-B2 | Transmission B1-B2 | Transmission between levels 1 and 2 in the broadband network hierarchy | |
| TR-B2-B3 | Transmission B2-B3 | Transmission between levels 2 and 3 in the broadband network hierarchy | |
| TR-B3-B4 | Transmission B3-B4 | Transmission between levels 3 and 4 in the broadband network hierarchy | |
| TR-B4-B4 | Transmission B4-B4 | Transmission within level 4 in the broadband network hierarchy | |
| TR-IX | Transmission interconnection links | Transmission between the operator's network and other domestic networks | |
| TR-INT | Transmission international | Transmission between the operator's network and overseas networks | |

**Table 5.** Proposed network elements

| Abbreviation | Label | Description | Maps to Level 4 increment |
|---|---|---|---|
| M-BSS | Base station subsystem | The GSM base station subsystem and equivalents (e.g. BTS and BSC) | M-BSS |
| M-MSC | Mobile switching centre | Voice switches for mobile traffic | M-MSC |
| M-MPD | Mobile packet data network | Core packet data network for mobile | M-MPD |
| M-LR | Mobile location registers | Location registers in the mobile network (e.g. HLR and VLR) | M-LR |
| M-SMS | SMS messaging centre | SMS meesage centre | M-SMS |
| TR-BSS | BSS transmission | Transmission within the BSS (e.g. BTS-BSC) | |
| TR-BSS-MSC | BSS-MSC transmission | Transmission between the BSS and MSC (e.g. BSC-MSC) | |
| TR-MSC-MSC | MSC-MSC transmission | Transmission between MSCs | |
| TR-MPD | MPD transmission | Transmission within the mobile packet data network (e.g. GGSN to SGSN) | |

Source: Frontier Economics

# Annex 3: Defined increments

**Table 6.** Proposed level 4 increments

| Abbreviation | Label | Description | Maps to Level 3 Increment |
|---|---|---|---|
| FAD | Fixed access network (dedicated access) | Network providing conveyance from customer premises to operator's network premises offering dedicated capacity to customers (e.g. twisted pair networks or fibre networks) | FA |
| FAS | Fixed access network (shared access) | Network providing conveyance from customer premises to operator's network premises sharing capacity between customers (e.g. wireless or HFC networks) | FA |
| N1 | Remote narrowband access node | Network component providing an interface between the access network and the switched network without full switching capabilities (e.g. remote concentrator) | FC |
| N2 | Local exchange | Local switch | FC |
| N3 | Transit exchange | Switch only connects to other switches (i.e. which does not connected to the access network/remotes) | FC |

**Table 6.** Proposed level 4 increments

| Abbreviation | Label | Description | Maps to Level 3 Increment |
|---|---|---|---|
| N4 | International gateway | Switch the connects to networks overseas | FC |
| B1 | Broadband level 1 - access node | Network component providing an interface between the access network and the core broadband network (e.g. DSLAM) | FC |
| B2 | Broadband level 2 - aggregation node | Network component aggregating traffic from a number of access nodes but not providing routing capabilities | FC |
| B3 | Broadband level 3 - BRAS | Network component providing access control to the network and routing traffic onto the core network | FC |
| B4 | Broadband level 4 - core router | Network component routing broadband traffic within the core network | FC |
| TR-DC | Transmission domestic (capacity) | Transmission domestic (capacity) | FC |
| TR-DL | Transmission domestic (length) | Transmission domestic (length) | FC |
| TR-INT | Transmission international | Transmission between the operator's network and overseas networks | FC |
| FIX-OTH | Other fixed network | Network components delivering other fixed services and capabilities | FC |

**Table 6.** Proposed level 4 increments

| Abbreviation | Label | Description | Maps to Level 3 Increment |
|---|---|---|---|
| M-BSS | Base station subsystem | The GSM base station subsystem and equivalents (e.g. BTS and BSC) | MA |
| M-MSC | Mobile switching centre | Voice switches for mobile traffic | MC |
| M-MPD | Mobile packet data network | Core packet data network for mobile | MC |
| M-LR | Mobile location registers | Location registers in the mobile network (e.g. HLR and VLR) | MC |
| M-SMS | SMS messaging centre | SMS message centre | MC |
| M-OTH | Other mobile network | Network components delivering other fixed services and capabilities | MC |
| RET | Retail activities | Activities driven by the provision of retail services to end users (e.g. Sales & Marketing, Billing & Collection and Customer Care) | RAO |
| WS | Wholesale activities | Activities driven by the provision of wholesale services to other operators (e.g. wholesale product management and interconnect billing) | RAO |
| OTH | Other activities | Other activities not concerned with the provision of telecommunications services | RAO |

**Table 6.** Proposed level 4 increments

| Abbreviation | Label | Description | Maps to Level 3 Increment |
|---|---|---|---|

Source: Frontier Economics

**Table 7.** Proposed level 3 increments

| Abbreviation | Label | Description | Maps to Level 2 Increment |
|---|---|---|---|
| FA | Fixed access | Fixed access network | FN |
| FC | Fixed core | Fixed core network | FN |
| MA | Mobile access | Mobile access network | MN |
| MC | Mobile core | Mobile core network | MN |
| RAO | Retail and other | Non-network activities | RAO |

Source: Frontier Economics

**Table 8.** Proposed level 2 increments

| Abbreviation | Label | Description | Maps to Level 1 Increment |
|---|---|---|---|
| FN | Fixed network | Fixed network | NET |
| MN | Mobile network | Mobile network | NET |
| RAO | Retail and other | Non-network activities | RAO |

Source: Frontier Economics

**Table 9.** Proposed level 1 increments

| Abbreviation | Label | Description |
|---|---|---|
| NET | Network | Network activities |
| RAO | Retail and other | Non-network activities |

Source: Frontier Economics

# Annex 4: LRAIC cost categories

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| **Fixed network components** | | |
| ACF001 | Main distribution frame | FAD |
| ACF002 | Remote concentrator | CVR01 |
| ACF003 | Digital local exchange | CVR02 |
| ACF004 | Digital tandem exchange | N3 |
| ACF005 | International switch centre | N4 |
| ACF006 | VOIP soft switch or media gateway | N3 |
| ACF007 | Network management system | FIX-OTH |
| ACF008 | Intelligent network platform | FIX-OTH |
| ACF009 | Co-axial cable | FAS |
| ACF010 | Twisted pair cable | FAD |
| ACF011 | Access fibre | FAD |
| ACF012 | HFC optical node | N1 |
| ACF013 | Point to point wireless | FAD |
| ACF014 | Point to multi-point wireless | FAS |
| ACF015 | Pre-wiring of client premises and first time installations | FAD |
| ACF016 | DSLAM | CVR03 |
| ACF017 | MSAN | CVR04 |
| ACF018 | Cable head end equipment - television broadcast | FIX-OTH |
| ACF019 | Cable head end equipment - DOCSIS receiver | B1 |

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| ACF020 | Cable head end equipment - Telephony | N1 |
| ACF021 | Packet switched aggregation node | B2 |
| ACF022 | Packet switched router | B3 |
| ACF023 | Broadband remote access server | B4 |
| Mobile Network Components | | |
| ACM001 | Base station (BTS) | M-BSS |
| ACM002 | Base station controller (BSC) | M-BSS |
| ACM003 | Mobile switching centre (MSC) | M-MSC |
| ACM004 | GPR, GGSN and SGSN | M-MPD |
| ACM005 | Short message service centre (SMSC) | M-SMS |
| ACM006 | Voice mail system (VMS) | M-OTH |
| ACM007 | Home location register (HLR) | M-LR |
| ACM008 | Network management system (NMS) | M-OTH |
| ACM009 | Signal transfer point | M-MSC |
| ACM010 | BTS to BSC link | M-BSS |
| **Network Transmission Infrastructure and Support Equipment** | | |
| NI01 | Duct | CVR05 |
| NI02 | Local loop poles | FAD |
| NI03 | SS7 | NET |
| NI04 | Transmission Infrastructure | TR-DC |
| NI06 | Transmission equipment - SDH | TR-DC |
| NI07 | Transmission equipment - PDH | TR-DC |
| NI08 | Power equipment | |

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| NI09 | Network buildings | CVR06 |
| NI10 | Masts& towers | CVR07 |
| NI11 | Network land | CVR05 |
| NI12 | Motor vehicles - network | CVR06 |
| NI13 | Fibre cables (core) | TR-DL |
| NI14 | Microwave transmission equipment (core) | TR-DL |
| **Non network assets** | | |
| OE01 | Non-network buildings | |
| OE02 | Land - non network | |
| OE03 | Furniture and office equipment | |
| OE04 | Training equipment | |
| OE05 | Vehicles - non-network | |
| OE06 | Payphones | OTH |
| OE07 | IT /General purpose computers | |
| OE08 | Network management | |
| OE09 | Marketing, retail, customer support | RET |
| OE10 | Customer premise equipment - fixed | OTH |
| OE11 | Customer premise equipment - mobile | OTH |
| OE12 | Prepaid service platform | RET |
| OE13 | Billing system | RET |
| OE14 | Customer management system | RET |
| OE15 | Interconnect billing | WS |
| **Network Activities** | | |

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| NA01 | Network - Executive Management | |
| NA02 | Network strategy, planning and procurement | |
| NA03 | Network management | |
| NA04 | Network field operations - outside plant | |
| NA05 | Network field operations - core | |
| **Product Management** | | |
| PM01 | Retail product management | RET |
| PM02 | Marketing and communications | RET |
| PM03 | Sales | RET |
| PM04 | Customer care | RET |
| PM05 | Billing and collection | RET |
| PM06 | Wholesale product management | WS |
| **Support Activities** | | |
| SA01 | Facilities management | |
| SA02 | HR Services and training | |
| SA03 | Finance | |
| SA04 | IT | |
| SA05 | Procurement | |
| SA06 | General management, Corporate Affairs and Regulatory | |
| **Network operational expenditure** | | |
| NET01 | Utilities (energy and fuel) | |
| NET02 | Site rental costs | |

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| NET03 | Network maintenance fees | |
| NET04 | Frequency fees | |
| NET05 | Other regulatory fees | |
| NET06 | Network insurance costs | |
| NET07 | Network transportation | |
| NET08 | Leased transmission | |
| NET09 | Leased building (co-location) space | |
| NET10 | Leased mast/tower (sharing) | |
| NET11 | Other network costs | |
| General and administration expenses | | |
| GA01 | Building rent (non network) | |
| GA02 | Building expenses (non network) | |
| GA03 | Consumables | |
| GA04 | Insurance costs (non-network) | |
| GA05 | Travel expenses | |
| Direct costs and costs of sales | | |
| SA01 | Customer acquisition costs | RET |
| SA02 | Equipment buy in costs | OTH |
| SA03 | Fixed termination | RET |
| SA04 | International termination | RET |
| SA05 | Mobile termination | RET |
| SA06 | Roaming charges | RET |
| SA07 | Number portability database queries | |

**Table 10.** Proposed LRAIC Cost Categories

| Abbreviation | Cost category | CVR or Level 4 Increment |
|---|---|---|
| SA08 | Distribution costs | RET |
| SA09 | Marketing and promotions costs | RET |
| SA10 | Printing, Delivery and collection costs | RET |
| SA11 | Bad debt | RET |
| **Balance Sheet Items** | | |
| BS01 | Cash and cash equivalents | |
| BS02 | Investments | OTH |
| BS03 | Inventory - Network | |
| BS04 | Inventory - Non Network | OTH |
| BS05 | AR - Wholesale | WS |
| BS06 | AR - Retail | RET |
| BS07 | Short term loans | |
| BS08 | AP - Employees | |
| BS09 | AP - Trade Creditors | |
| BS10 | Provisions | |
| BS11 | Vat Payable | |
| BS12 | Vat Receivable | |
| BS13 | Deferred Income | RET |

Source: Frontier Economics

# Annex 5: Required CVRs

**Table 11.** Proposed CVRs for which concessionaires will be required to provide inputs

| Abbreviation | CVR | Drivers |
|---|---|---|
| CVR01 | Fixed voice (TDM) concentrator | Voice lines<br>Voice traffic |
| CVR02 | Fixed voice (TDM) switch | Voice lines<br>Voice traffic |
| CVR03 | DSLAM | DSL lines<br>Broadband bandwidth |
| CVR04 | MSAN | Voice lines<br>Voice traffic<br>DSL lines<br>Broadband bandwidth |
| CVR05 | Duct | Cable diameter |
| CVR06 | Network buildings | Floorspace |
| CVR07 | Masts and towers | Transceivers |

Source: Frontier Economics

# Annex 6: Network Services

**Table 12.** Defined Network Services

| Abbreviation | Service | Units |
|---|---|---|
| **Fixed access services** | | |
| FAS01 | Narrowband PSTN access line | Number of lines |
| FAS02 | Narrowband ISDN BRA line | Number of channels |
| FAS03 | Broadband access line (asymmetric) | Number of lines |
| FAS04 | Broadcast television subscriber | Number of lines |
| FAS05 | Metro Ethernet access | Number of lines |
| FAS06 | Fully unbundled loop | Number of lines |
| FAS07 | Shared access unbundled loop | Number of lines |
| FAS08 | Domestic retail leased circuit | T1-equivalents |
| FAS09 | International retail leased circuit | T1-equivalents |
| FAS10 | Domestic wholesale leased circuit | T1-equivalents |
| FAS11 | International wholesale leased circuit | T1-equivalents |
| FAS12 | Wholesale partial private circuit - local end | T1-equivalents |
| FAS13 | Wholesale partial private circuit - trunk segment | T1-equivalents |
| FAS14 | Other services | Number of subscribers |
| Fixed call services | | |
| FCS01 | Voice - fixed to fixed (onnet) | Minutes |
| FCS02 | Voice - fixed to fixed (offnet) | Minutes |
| FCS03 | International call from fixed | Minutes |
| FCS04 | Call to domestic mobile from fixed | Minutes |
| FCS05 | Dial up Internet access from fixed | Minutes |

**Table 12.** Defined Network Services

| Abbreviation | Service | Units |
|---|---|---|
| FCS06 | Other retail calls from fixed | Minutes |
| FCS07 | Wholesale domestic fixed call origination | Minutes |
| FCS08 | Wholesale internation fixed call origination | Minutes |
| FCS09 | Domestic fixed call termination | Minutes |
| FCS10 | International fixed call termination | Minutes |
| FCS11 | Transit between domestic operators | Minutes |
| FCS12 | Transit from international to domestic | Minutes |
| FCS13 | Transit from domestic to international | Minutes |
| Mobile services | | |
| MOB01 | Mobile subscribers (active) | Number of subscribers |
| MOB02 | Mobile to mobile voice calls - on-net | Minutes (per second basis) |
| MOB03 | Mobile to mobile voice calls - domestic off net | Minutes (per second basis) |
| MOB04 | Mobile to fixed calls - domestic | Minutes (per second basis) |
| MOB05 | Mobile to international calls | Minutes (per second basis) |
| MOB06 | Wholesale mobile call origination - domestic | Minutes (per second basis) |
| MOB07 | Wholesale mobile call origination - international | Minutes (per second basis) |
| MOB08 | Domestic mobile call termination | Minutes (per second basis) |
| MOB09 | International call termination | Minutes (per second basis) |

**Table 12.** Defined Network Services

| Abbreviation | Service | Units |
|---|---|---|
| MOB10 | SMS - originated | Messages |
| MOB11 | SMS - terminated | Messages |
| MOB12 | MMS - originated | Messages |
| MOB13 | MMS - termination | Messages |
| MOB14 | Packet switched data (GPRS) | Mbytes |
| MOB15 | Packet switched data (EVDO) | Mbytes |

Source: Frontier Economics

# Annexe 6: Decisions on Recommendations

The following summarizes the comments and recommendations received from stakeholders on the first draft of the LRAIC Specification Paper (dated September 1st 2009), and the decisions made by TATT as incorporated in this revised document (dated December 22nd 2009).

| Document Sub-Section | Submission Made By: Stakeholder Category[6] | Comments Received | Recommendations Made | TATT's Decisions |
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| **General** | | | | |
| General: 1.1 – 3.1 | TSTT | The Telecommunications Authority of Trinidad and Tobago (TATT) has proposed implementing a costing methodology and is seeking comment on "Top Down Long Run Average Incremental Cost (LRAIC) Model Specification Paper" and "Current Cost Accounting Reference Paper". TATT has engaged Frontier Economics as consultants to assist in this undertaking. Telecommunications Services of Trinidad and Tobago (TSTT) hereby provides its comments on these proposals. | Discontinue the pursuit of ex-ante regulatory regimes and shift the focus more towards ex-post regulatory measures appropriately suited to the rapidly changing Telecommunications environment in Trinidad and | Almost every jurisdiction with liberalised telecommunications market relies to an extent on ex ante regulation. While some jurisdictions, for example EU countries, have withdrawn some ex ante regulation of retail services, this has been due to effective ex |

[6] Regional regulatory or Governmental agencies, Existing service and/ or network provider and affiliates, Potential service and/ or network providers and affiliates, Service/ Network Provider Associations/ Clubs/ Groups, General Public

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| | | Before entering into a discussion and detailed commentary on the specifics of what TATT is here proposing, TSTT wishes to enter a general observation on the overall direction and effect of this regulatory initiative: TATT is here proposing that all the telecommunications operators in the country expend considerable amounts of time and money to build regulatory tools that will be detrimental to the interests of the country's consumers, the protection of whom is the ostensible reason for the regulation that TATT is supposed to conduct. If the proposed regulation is indeed detrimental to the country's consumers, then it should not be done, and the tools that TATT is building to implement that regulation should not be built, regardless of the cost involved. However, there can also be no question that the proposed tools are costly tools. Even if the proposed regulatory intervention were somehow to be seen as providing some benefits to consumers, it would need to be justified as producing benefits that are greater than the costs involved, and that is just not the case with these proposed regulations and regulatory tools.<br><br>The economic regulation that TATT is authorized to undertake | Tobago | ante regulation of wholesale access services.<br><br>Even in jurisdictions where there a number of network operators and retail service providers, network operators have been deemed to still maintain a monopoly over termination of calls to subscribers on their networks and as such termination is subject to ex ante regulation.<br><br>Under the Telecommunications Act, concessionaires are required to provide access to their networks and interconnection at charges that reflect underlying costs. The need for a cost model was also identified |

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| | | has as its principal objective the protection of consumers and the promotion of competition. In the absence of effective competition, TATT is authorized to intervene to bring about the benefits that a competitive outcome would produce. In other words, TATT's regulation is to serve as a proxy for marketplace forces, if those market forces are not effective. However, if those marketplace forces are present and achieving their desired beneficial effects, then there is no need for TATT to intervene with the kind of tools that it is here proposing to impose on the country's operators.<br><br>With this initiative, TATT is requiring of the entire telecommunications sector, all the principal operators in the country, to undertake significant expenditure of their investors' time and money to build these regulatory tools. TATT itself is spending considerable public resources in contracting external consultants. Because of the considerable costs involved, the stakes are high on the wager that TATT is placing with its proposal. By imposing a solution before it has determined (1) that there is a problem to be solved and (2) that the solution it proposes is the appropriate one for the specific problem | | as part of the first interconnection dispute between TSTT and Digicel in which the Arbitration Panel recommended that "the Authority consider developing a sector specific cost model for the purposes of considering whether proposed charges comply with the regulatory framework or for setting charges if so required."<br><br>Having one cost model that covers a range of wholesale and retail services can help to reduce the burden on concessionaires and the regulator where cost information is required on a number of services for both ex post and ex ante regulation. Further, having one cost model can help to provide the concessionaires with more certainty |

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| | | identified, TATT risks both public resources and private sector resources on an endeavour that may turn out in the end to have been for nothing. TSTT has urged in previous communications with TATT that a relevant market analysis be undertaken first, before imposing expensive and intrusive regulatory interventions. In this examination of relevant markets, TATT should determine to what extent there are competitive alternatives for the services offered in the telecommunications sector. For the major categories of services, TSTT points out that there are effective competitive alternatives present today in Trinidad and Tobago. For voice telephony, besides the traditional landline services offered by TSTT, mobile services are available from other providers that consumers consider as attractive substitutes for landline services. Voice over Internet Protocol (VoIP) services are available as competitive alternatives using the Internet networks and are widely used. Data (Internet) services are available from a variety of network providers in Trinidad and Tobago, including from TSTT's own network, cable television networks, and mobile telephony networks.<br><br>This convergence of networks and services is not unique to | | and can allow TATT to assess interconnection disputes and proposed regulation more rapidly and in a more consistent way than conducting a costing or benchmarking exercise on a case by case basis.<br><br>TSTT argues that regulators in other jurisdictions have "largely abandoned" the use of cost modelling and CCA revaluation as a result of convergence. It is not clear which specific examples TSTT is referring to as these regulatory measures are still employed in a number of jurisdictions in the Caribbean, Europe and the Middle East (including in small jurisdictions such as Cayman Islands, Bahrain and Guernsey). |

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| | | Trinidad and Tobago. It is being seen throughout the world. The developed country jurisdictions that in years past had adopted regulatory tools similar to those that TATT is now proposing, have largely abandoned the use of these tools, primarily because they have recognized that this convergence is important and it supplants the need for these intrusive regulatory tools. Now what we see is that TATT is mimicking other jurisdictions without giving much thought for the rationale that should be considered first to justify the use of these tools. The presence of actual effective competition obviates the need for intrusive regulatory intervention that was designed in a much different, earlier time to compensate for what was perceived then to be the absence of effective competition.<br><br>TATT's own statement of its modelling objectives supports the view that these regulatory tools are intended for use after, not before, a competition problem has been found to exist. According to TATT, the costing model is designed for:<br><br>• Determining the rates for accessing unbundled facilities (that is itself a remedy to be used only when there is a demand for such unbundling and where competitive | | The approach proposed for T&T reflects the resource constraints faced by concessionaires. In particular the methodology does not require the implementation of detailed engineering models for network elements which are required in other top down LRIC models or in bottom up LRIC models.<br><br>The LRAIC models are developed on a top-down basis which means that they take cost data for a given concessionaire and allocate costs between services using a consistent methodology. This means that both the model inputs and outputs will be specific to each concessionaire. Given the differences in network |

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| | | alternatives do not exist, which is not the case in Trinidad and Tobago);<br>• Determining the rates for telecommunications services in which there is a monopoly or a dominant provider in an uncontested market (which is not the case in Trinidad and Tobago);<br>• Determining rates for telecommunications services provided by a dominant provider in a contested market (which is not the case in Trinidad and Tobago);<br>• Detecting unfair cross subsidies or anti-competitive prices (which have not been shown to be the case yet, and which ultimately should be dealt with in competitive markets by the same competition law that governs the other competitive markets in Trinidad and Tobago).<br>The costing model is also designed to be used for determining interconnection rates. This may well be a regulatory function that | | structure and the services delivered it would be impossible to produce a single cost model for the industry as a whole.<br><br>The degree to which differences in calculated costs for similar services are reflected in regulated prices may arise when decisions are being made on price controls. The Authority will make the necessary policy decision, if and when needed, as it pertains to the use of the output from the model.<br><br>**Anticompetitive subsidies**<br>The LRAIC model will allow the calculation of unit network service costs across all services on a |

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| | | TATT should continue to take a role in mediating disputes between competitive providers. However, if this were the only modelling objective, and it does appear to be the only one for which a demonstrated need could be shown, then it could be achieved easily with much less costly measures than those being proposed here by TATT.<br><br>The Current Cost Accounting proposal is being put forward to provide cost inputs to the Long Run Average Incremental Cost model. As a general observation, if the LRAIC model is an unwarranted and unnecessary regulatory intervention, then the inputs to that model (the CCA proposal) are unnecessary as well. TSTT and the other telecommunications operators are already required to maintain books and records in their statutory accounts. TATT's CCA proposal would require all the operators to establish and maintain over time an additional, separate set of books and records covering all their operations. In other words, each asset would appear twice and be valued twice, once in the statutory accounts and again in the CCA accounts | | consistent basis. This will provide one source of inputs to investigations of potential anti-competitive practices. Given the wide range of potential future investigations it is not possible to exactly specify how the LRAIC results will be used or whether further costing information would be required to make determinations. |
| General | ICNTT | ICNTT notes little concern for the use of the principles | | There will be a separate model for |

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| | | articulated in the specification document as a means of developing a cost model for the multi-modal market that characterizes the Trinidad and Tobago context. However TATT should consider the following is establishing this framework:<br>(i) the applicability of some of the broad assumptions made about network topologies, and IN use in the development of the model infrastructures on which calculations are then based;<br>(ii) due to the paucity of carrier capacity in resources based primarily on developing regulatory-specific financial accounts, engineering models and economic trends, it may be advantageous to the general market that the tool developed by the Authority is<br>a. flexible enough to treat with the vagaries of the multi-modal environment;<br>b. is simple enough so as not to unduly burden the carriers, else there is the risk that the framework will remain unused;<br>c. provides for the majority of participants, and is not geared to treat with only the incumbent. | | each concessionaire, reflecting their network structure, costs and demand for services based on a common model template. The results for each concessionaire will thus represent the costs for that concessionaire. This approach differs from that use in some other jurisdictions where a single hybrid industry model representative of a number of networks (typically mobile networks) has been developed with the results being a representative "average" cost for the industry.<br>Given the range of technologies used by the concessionaires, the template model will be sufficiently flexible to reflect the different technologies used while |

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| | | | | harmonising the principles and methodology as far as possible. |
| General | Windward | Windward Telecom Limited appreciates the opportunity to provide a few comments with regard to the Authority's September 1, 2009 draft Top Down Long Run Average Incremental Costs (LRAIC) Model Specification Paper. At the outset I must commend the Authority and its advisor Frontier Consulting on the development of a professional and comprehensive approach to a rather mundane, but essential issue. Thirty years ago I was deeply involved in the development of the Canadian Radio-television and Telecommunications Commission's original costing models. | The Authority should also give serious consideration at the outset to a review every three or four years to ensure that the model reflects changing network architectures and service offerings. | The Authority will endeavour to ensure that the models submitted by the concessionaires reflect the current network architectures and service offerings. Given the uncertainties over the rate of future technical developments any revisions will take place as appropriate rather than based on a fixed periodic timetable. |
| General | Columbus | With all these myriad of issues present, it may be too onerous on the concessionaires to comply with all the requests of this new method. The IRAIC Model has many details that need extensive attention to clarify to facilitate its correct implementation and use so this would put strains on manpower, staffing, and acquisition of adequate core competencies to operate | The authority may wish to consider a longer time to enforce mandatory adoption of the IRAIC Model. The period for first submission is February 2010 but the minutiae of the model needs a lot of | The model will be populated on an annual basis covering each concessionaire's financial reporting year. The model will initially be populated with data for the latest financial reporting year at that point. There will be no requirement |

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| | | | clarification and adjustments on the concessionaires part to fully adapt and adopt the proposed model. | to populate the model for earlier time periods. |
| **Section 1- Introduction** | | | | |
| Section 1.2 | Windward | The definition of Modem Equivalent Assets (MEA) should be expanded and will require some form of biennial or triennial review to ensure that a carrier's specific cost structures do not encompass the cost of both legacy network elements and new platforms. Case in point: the 2007 imposition of TSIT's network Nortel PVG platform upon interconnecting carriers when the specified legacy Nortel Optera would have sufficed. Interconnection carriers now pay for the conversion of Digital to TDM traffic and back again. There has to be consensus amongst carriers and the Authority as to what network topology is "modern." Windward suggests that the Authority convene an industry Carrier Steering Committee similar to the Canadian model to determine on an ongoing basis the appropriate technical interfaces. | | The modern equivalent asset principle is a theoretic ideal. In practice, top down CCA-LRAIC models are based to a large extent on the actual network technology and topology with technological progress captured through the CCA revaluation. This compares to a bottom up approach which may explicitly be based on assumptions about the MEA technology. |

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| Section 1.2 | Windward | Prior to the development of the initial LRAIC, the determination of the Weighted Average Cost of Capital should be the subject of an open public hearing reflecting input from all carriers due to the disparity in cost of capital amongst various carriers | | The detailed methodology and parameters used to determine the cost of capital will be subject to consultation at a later date<br><br>Given the limited amount of direct data available for the concessionaires, the estimated cost of capital will rely to a great extent on benchmarks derived from operators in other jurisdictions.<br><br>The cost of capital is associated with the corresponding assets operated by the concessionaire, rather than the concessionaire itself. Given the likely use of benchmarking information the degree to which the cost of capital for different types of assets can be determined is likely to be limited. |

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| | | | | However in some other jurisdictions different costs of capital have been determined for fixed assets and for mobile assets.<br>To the extent that the operators from which benchmarks are derived also have sunk costs, any risk premium associated with these sunk costs will be implicitly included in the benchmarks. |
| Section 1.3.1 Capital Cost | Windward | As evidenced by the Canadian example, it will be necessary for all carriers to provide a going-in submission so that other carriers can verify [audit) the proper allocation of cost elements prior to the determination of causal-based pricing or universal service fee charges | | The Authority will assess the information provided from the concessionaires for consistency and credibility. However, under Section 80 of the Act, it will not be possible to publish information or make it available to other concessionaires as a matter of course as such |
| Section 1.4- Implementation | Windward | The timeline appears reasonable, but all Authority CCA data findings should be published for regulatory transparency. Any | | |

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| | | carrier seeking any form of subsidization should be required to justify such requests in the public domain. Any carrier providing a wholesale service offering in an uncompetitive market segment should also be subject to public scrutiny to ensure causal cost pricing or appropriate markups and benchmarking | | information would be confidential. Under Section 50 o the Act, the Authority may exercise its Inspector powers in order to verify the data provided. |
| | Columbus | This section is very detailed and self-explanatory in terms of setting up the model specifications set forth in the subsequent sections in the consultative document | | |
| **Section 2- LARIC Principles** | | | | |
| Pg 9, Section 2.2<br>Summary Principles | ICNTT | The description of the model of "scorched node" LRAIC seems to be applicable for the determination of incremental cost of the usage of nodes in a scenario where the fixed common and joint costs are attributable to the substantive owner of the node. While this seems reasonable for the determination of costs in situations such as core network resource sharing (e.g. inter-network transient connection), ICNTT reserves its applicability in the instance of non-managed resource wholesale (e.g FC LLU) cost determination. In that instance, ICNTT believes that the | | The choice of the LRAIC cost standard was previously consulted on by TATT and a series of decisions were made on the implementation of the LRAIC cost standard which are reflected in this consultation |

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| | | LRAIC model may inappropriately discount costs that should be considered in the provision of the service. | | |
| Section 2.2 Current Cost | Windward | The key word here is consistency. In particular, the LRAlC model must develop a consistent benchmark for network technical redundancy so that carriers do not have an incentive to overprovision their networks, thereby inflating the capital and operating costs. | | As part of the model implementation the Authority will be producing an efficiency study which will address issues of potentially inefficient operating cots and investments. This will be consulted on separately. |
| | Columbus | The majority of the principles are easily understood. An area of ambiguity exists in the allocation of fixed costs and joint costs and their apportionment to different products. Also guidance on how the EPMU will be calculated is needed in some detail to clearly exemplify how it works. | Guidance is requested from the TATT on how these principles will work in practicality | As the model is developed the Authority will seek to ensure that concessionaires gain a full understanding on the calculations underlying the LRAIC cost model. |

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| **Section 3- LARIC Model Outputs** | | | | |
| | Columbus | Temporal boundaries are not apparent in this section or any part of this reference paper It is not apparent whether this would be calculated from 2009 or is to be calculated from various periods preceding 2009 | Due to the problematic nature of getting detailed accurate information the further back in time you go, the authority should request information that is more current as it would speed up and simplify implementation | The model will be populated on an annual basis covering each concessionaire's financial reporting year. The model will initially be populated with data for the latest financial reporting year at that point. There will be no requirement to populate the model for earlier time periods. |
| Section 3.1 Ex Ante Regulatory Requirements | Windward | Table 2 Service Offerings should be expanded to include a separate billing and collection category to accommodate those carriers who wish to undertake their own billing and collection functions which otherwise might be bundled within the international mobile or fixed origination category | | The LRAIC model will attempt to attribute costs of each of the concessionaire to individual network services. Network services are the access and conveyance services underlying both wholesale and retail services provided to other operators and end users respectively. The costs of these |

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| | | | | services exclude any retail or wholesale specific costs such as product management and customer care.<br>Any interconnection specific billing costs are identified as a wholesale cost and as such may be recovered from wholesale network services. |
| **Section 4- Network Technologies to be Modeled** | | | | |
| | Columbus | This section was a bit parochial in its scope in that it seems to discuss mobile phone access technologies and core network components and not the equipment and technologies associated with the cable TV aspect of the concessionaire spectrum | It would be of great assistance if a discussion about the technologies involved from a cable provider perspective | Given the range of technologies used by the concessionaires, the template model will be sufficiently flexible to reflect the different technologies used while harmonising the principles and methodology as far as possible.<br>The LRAIC templates supplied to |

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| | | | | the concessionaires with this paper include a number of cable television specific cost categories. The Authority and its consultants will work with the concessionaires during the implementation process to ensure that as far as possible the models reflect the cost structures of the individual concessionaires. |
| Pg. 21, Sec 5.2<br>Definition of Network Elements | ICNTT | It is unclear why the incremental elements for mobile voice and data services are segmented from the fixed equivalent, when at the core, the networks will be indifferential – or at least moreso than TDM networks and their Cable/DOCSIS equivalent. | It is recommended that either:<br>(i) the segmentation recognizes only the separation between fixed and mobile access services, and all core element costs be ubiquitous between fixed and mobile networks; or<br>(ii) a further segmentation | While the long terms trend is towards convergence currently, there is limited convergence meaning the need to keep the fixed and mobile core network elements separated remains at least in the short term. Nevertheless, the model will be sufficiently flexible so that it will be able to model the convergence of the fixed and mobile core in the medium term. |

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| | | | between TDM and DOCSIS networks is included in the determination and definition of network elements | TATT will provide additional guidance on this as the way in which convergence takes place becomes clearer. |
| Section 4.1.2Mobile Access Technologies | Windward | See comment J above with respect to the definition of Modern Equivalent Access. | | |
| Section 4.2 Core Network Technologies | Windward | In this instance, it appears as if the Authority's conclusion that "voice traffic is largely switched using traditional TDM switches" is outdated and incorrect based upon the Authority' $ insistence that Windward pay for TSTT's Nortel PVG platform in July 2007. Serious consideration should be given to the exclusion of many legacy elements from the LRAlC model given that in many instances, such assets are fully depreciated and nearing the end of its service life | | |
| **Section 5- Increments** | | | | |
| (a) Definition of Network Element | Columbus | Defining network elements may be difficult as all assets are | A possible way to avert this | Where concessionaires find it |

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| | | bundled in different categories as compared to LRAIC categories set out in The consultative document. In addition, the operational expenses example billing costs and customer service costs are very difficult to categorize. The difficulty in categorization of costs stems from the convergence of cross-departmental<br>benefits gain from interrelationships that exist between departments in Columbus communications, thus leading to the Question how are these synergies to be captured.<br><br>One to one mapping between costs, assets, and increments are | situation is to apportion all of the assets pertaining to the network elements and use the revenue generation as an activity base to separate costs. Another approach could be if the authority considers Columbus's obstacle as well as other concessionaire's obstacles and recommend alternative solutions that alt concessionaires could benefit from.<br><br>Again use the total final revenue as a way to ascribe relevant costs to there relevant categories. This would be possible because revenue is already separated via the general | difficult to map financial data directly into the defined cost categories the Authority will liaise with the concessionaire in order to ensure the input date reflects as fully as possible the cost structure of the concessionaire. This may require some pre-processing of information, for example the allocation of the costs of personnel that carry out a range of functions across these functions.<br><br>Where components are used by multiple services, the allocation between the services will be on the basis of an appropriate volume driver such as bandwidth used by each service.<br><br>Total final revenue is not an appropriate way of allocating costs |

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| (b) | | recommended to be used. This can be difficult seeing that our asset register does not separate switches, lines, and ducting between services. Another concern is in calculating the WACC .A concern evident in the calculation of the WACC is how the loan amounts are spent on different areas in the operation and how are they to be separated and apportioned to facilitate an accurate EPMU. | ledger. This would be an activity base that could be used in the separation of costs or the authority could look at other bases available to it via their consultants | since it does not reflect cost causality. Further, if the model results are used to set regulated prices, using revenue as an allocation base creates a logical circularity. |
| Section 5.2 Leased Line Services | Windward | Windward strongly suggests the separation of leased line services into two groups consisting of services provided to commercial customers and those bulk capacity services provided to wholesale carriers due to the disparate costs of providing such services to these distinct customer groups. Such segregation would eliminate the incentive for dominant carriers to misapportion costs on a per megabit basis. | | A large proportion of costs for commercial customers and wholesale carriers will be joint between the two sets of services. The use of drivers based on cost causality to attribute costs between services should restrict the ability of concessionaries to unduly discriminate in cost recovery. |
| Section 5.2.2 Fixed | Windward | See comment 8 above. In the Trinidad context Windward believes that transit switches and international gateway switches | | In some networks there may be separate transit and international |

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| Narrowband Conveyance | | are one and the same. Again the report reflects an outdated view of the actual network topology | | gateway switches. However we accept that in a number of networks both functions are carried out within a single physical switch.<br><br>Within the LRAIC methodology such 'collapsing' of layers in the network hierarchy can by allocating the costs of the relevant switch with dual functionality (for example allocating to one or other cost category and ensure the routing factors reflect the dual use. |
| Pg. 23/24<br><br>5.2.3 Fixed Broadband Services | ICNTT | The lack of clarity above is deepened here. With regard to narrowband conveyance, the paper outlines the key components of the TDM network from edge-core facilities (MDF's) to the international gateway. Such distinction does not seem to be made with the fixed Broadband network components. There does not seem to be the appropriate equivalence of consideration of the utilization of resources that would include the | ICNTT recommends a re-evaluation of the assumptions made regarding varying network topologies and the minimum Intelligent network nodes required for the provision of particular, specified groups of | While the long terms trend is towards convergence currently, there is limited convergence meaning the need to keep the fixed and mobile core network elements separated remains at least in the short term. Nevertheless, the |

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| | | aforementioned international gateway.<br><br>The paper further proposes to make some distinction between lines connected to the Class V Exchange directly and via Remote Switching Centres through the use of weighting factors. There does not seem to be appropriate consideration that in the instance of a remote subscriber connected to a DSLAM, that DSLAM may be deployed either at the Core or Remote Switching locations. Accordingly, the weighting factors utilised in the TDM architecture should also be considered in the context of the Broadband core architecture. | telecommunications services | model will be sufficiently flexible so that it will be able to model the convergence of the fixed and mobile core in the medium term. TATT will provide additional guidance on this as the way in which convergence takes place becomes clearer. |
| Pg. 25, Sec 5.2.4<br><br>Leased Lines | ICNTT | The discourse on leased lines, in conjunction with the limited discourse of Fixed Access, reinforce ICNTT's interpretation that this model does not adequately address the variations of FU LLU, one of the variants of LLU that TATT has proposed to initiate that programme. As discussed further in the response to the LLU Framework, the success of an LLU | | The Authority will make the necessary policy decision, if and when needed, as it pertains to the use of the output from the model for setting LLU prices. The analysis underlying these policy decisions will need to strike a balance |

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| | | framework is based on the wholesale prices allowed, and the associated cost-recovery of investment thereby allowed.<br><br>TATT posited that while through the implementation of LLU there may be constraints on technological investment, there is also the concomitant incentive to reduce costs and that LLU's success in Trinidad and Tobago will be based on balancing the incentives against the constraints such that the best case outcomes are achieved.<br><br>Taking these opinions as the base for conceptual consideration, there must be re-evaluation of whether the fundamental basis behind the LRAIC model is appropriate for application with respect to LLU. As such was developed based on the costing of services for interconnection – therefore it was geared to model the approximate cost of facilitating incremental usage of capacity on facilities (of a network) which are also used at the same time, for the same purpose by the interconnection service provider. Accordingly, in that conceptual framework, cost recovery could be entirely forward-looking as any historic costs ***should*** be recovered by the commercial operations of the | | between the factors identified by ICNTT, along with other factors. |

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| | | network owner, the interconnection service provider.<br><br>While this paradigm can be stretched to also be applied to the costing of Line Sharing LLU, this fundamental paradigm begins to breakdown on considering the costing of FU LLU. In this model, the facility owner/ access provider does not use the facility concurrently with the access requester. There is no longer a case of recovery of incremental capacity on the facility. Instead, the model should allow the recovery of the cost of the facility, less most of any profit that can be obtained from its operation. Any other consideration of costs, especially those which include forward-looking only determination of cost-base - would doom the incumbent to subsidizing the cost of assets utilised by the new entrant, which will have a distortionary effect on the market and bring to reality in Trinidad and Tobago the failures in LLU implementation that TATT has itself recognized. | | |
| Pg 24, Sec 5.2.5 | ICNTT | Again, there seems to be little recognition that in the instance of the converged service provider, the nodes identified would be connected by resources which are also utilised by the fixed core | ICNTT recommends a re-evaluation of the assumptions made regarding varying network | The LRAIC model will be flexible in order to deal with the technology in place. Where necessary, the |

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| Mobile Networks<br><br>CDMA Networks | | network. As such weighting factors used in the transmission of narrowband and data-based services should be mirrored in the determination of appropriate activity based costing of the mobile core networks.<br><br>This challenge is further exacerbated in that the CDMA core reference architecture is even more closely aligned to the TDM fixed architecture than the reference GSM architecture – for example, CDMA data supporting core networks do not have SGSN's and GGSN's and do not use the MSC's HLR, but instead reflect the use of RAID's, BRAS's and other nodes more akin to a fixed data-centric telecoms network. | topologies and the minimum Intelligent network nodes required for the provision of particular, specified groups of telecommunications networks and services | model will use usage and routing factors to reflect how the usage of network elements changes over time as convergence increases.<br><br>The model is currently defined to reflect the structure of the range of concessionaires in the market, some of whom operate legacy networks while others have rolled out networks relatively easily. In the latter case a number of the cost categories allowed for in the specification will not be required by the concessionaire when implementing the model. |
| Page 26.<br>Defining the increment | ICNTT | The presumption that the fixed network utilizes the majority of transmission capacity is unproven, especially in the context of TATT's market review which shows that the incumbent, an | TATT should review the basis of this assumption about the source of the majority of its | TATT will review the increment structure to ensure that the attribution of costs to the |

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| hierarchy | | operator with a converged suite of services and networks, makes the majority of its revenue – and possibly moves most of its traffic – in relation to the mobile aspect of its business. | traffic. | transmission network best reflects cost causality. This may reflect the operational structure of concessionaires delivering both fixed and mobile services rather than the relative proportion of traffic generated by fixed and mobile customers. |
| **Section 6- LARIC Model Inputs** | | | | |
| p. 29 – 6.1 **Base Cost**<br>The Authority requires that concessionaires provide the base costs for the LRAIC model. These costs will consist | TSTT | <u>Access Deficit</u><br>Using TATT's definition of access deficit (difference between access revenues and incremental costs), we find there is evidence that TSTT has currently a substantial access deficit. | <u>Access Deficit</u><br>Assuming the existence of an access deficit for TSTT, what would be the appropriate measures that the Authority is | <u>Access deficit</u><br>The model would help determine the existence or non-existence of an access deficit and if such is found to exist, the Authority would make an |

[7] We have used two cost estimated figures from the USA. The latest incremental cost estimate for a telephone line estimated by the FCC's HCPM model is a weighted average for the 50 states of USD 21.4 per month per line. Using this cost estimated we find that TSTT's access deficit would be 20% of total access revenues. Using the weighted average cost estimate for those states with less than 600,000 lines each, the average LRAIC cost elevates to USD 27 per month per line, which applied to TSTT would amount to an access deficit of 40%.

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| of operating expenditure, CCA information for fixed assets and balance sheet items. | | Since we do not have yet a LRAIC for access lines for TSTT, we use as a proxy international estimates coming from the USA. A simple calculation of TSTT's access deficit using long run average incremental costs (LRAIC) figures from the USA shows that TSTT access deficit is equal approximately to 20% to 40% of total access revenues.[7] | envisioning to deal with this situation?<br><br>If there were an access deficit, this would be caused by the Authority's decision of not letting TSTT to raise its access rates. Would the Authority allow TSTT raise rates at least equal to efficient costs? Otherwise TSTT's access service would be receiving cross subsidies from other services, which means that there is a combination of services whose revenues are above their stand | appropriate policy decision and consult accordingly. |

[8] Hausman, J. "Regulated costs and prices in telecommunications." In G. Madden and S. Savage eds. *The International Handbook of Telecommunications Economics Volume II*. 2000 Edward Elgar. Chapter 2.

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| | | Sunk costs<br><br>The Authority has completely disregarded the existence of **sunk costs** in its proposed Base Cost. Sunk costs are costs that cannot be recovered when the economic activity ceases. TSTT considers that the Base Cost needs to take into account sunk costs and irreversible investments incurred in the past. By setting rates based on just current costs and historical costs disregarded, the Authority is incurring in a very important regulatory mistake. Any pricing rule that does not allow recovery today of costs previously sunk, deters current investment. Sunk costs do matter in decision making when those costs have yet to be sunk. An efficient level of investment requires that the returns to that | alone costs. How does the Authority intend to correct the presence of cross subsidization?<br><br>Sunk costs<br><br>The Autority has to recognize the existence of sunk costs as relevant costs in telecommunications. It can be done explicitly in the Base Cost or indirectly by adding a mark-up on the cost of capital to allow for the risk associated with investment in sunk assets (see below comments on cost of capital). | Sunk costs<br><br>Sunk costs are the costs related to assets that cannot be used for another economic activity other than the one it was originally intended for. Examples include access lines to individual houses that are no longer required. The |

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| | | investment are anticipated to include a payback of sunk costs.<br><br>Disregarding sunk costs, the Authority is adopting the perfect contestability standard (i.e. there is free entry and exit, with no sunk costs.) In the telecommunication industry, however, there are very large sunk costs. Thus the correct paradigm is one in which there is free entry, but entry involves sunk costs. Nowadays, even inventors of the perfect contestability theory acknowledge that sunk costs must be considered in setting prices of regulated services:<br><br>"Professor William Baumol, an inventor of contestability theory and a supporter of the TSLRIC approach to regulation, has now recognized that sunk costs must be considered in a proper regulatory approach owing to the 'profound implications for both theory and practice.'<br><br>…Thus, Baumol agrees that the options value of investment is a real cost that regulators must take into account of if they are to make the correct decisions. | | Long Run in LARIC cost models indicates that the model does not solely consider those costs that are variable or avoidable in the short run but considers all costs including sunk costs.<br><br>The efficiency study which will be carried out as part of the implementation will determine whether sunk costs should be included in the cost base. In carrying out this study TATT will consider to what extent such costs were efficiently incurred.<br><br><u>Instruments for costing and pricing/</u> |

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| | | Baumol agrees that the application of real option theory to the regulation of ILECs is potentially important, given the presence of sunk and irreversible investment. Regulators should take note of these considerations because their current TSLRIC approach assumes that sunk and irreversible investments are not present."[8]<br><br><u>Instruments for costing and pricing</u><br>The Authority has mentioned the need to estimate CCA measures and accounting separation in order to detect unfair cross subsidies and establish prices for those services for which competition has not been developed. However, the detection and measurement of cross-subsidies must be distinguished from setting prices.<br><br><u>Cross-subsidies</u><br>On cross-subsidies, the obvious question is how to detect anti | | The LRAIC model, being based on the concessionaires' own cost bases and demand, will inherently include economies of scope in the result unit costs.<br>The Authority will make the necessary policy decisions on the use of the output from the model for identifying anti-competitive practices including undue cross-subsidies. Given the wide potential scope of competition investigations it is not possible to definitively determine the approach to be taken in advance of any complaint.<br>.<br>**General concepts to specific regulations (DCM)** |

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| | | competitive cross-subsidies. The Authority has not explained when a cross-subsidy would be considered unfair or anti competitive. TSTT assumes that Authority would detect cross-subsidies following the appropriate tests suggested by the relevant economic literature i.e. detect the range of subsidy-free prices or in other words those prices who are situated between direct long-run incremental costs and stand-alone costs. At the central core of these two types of costs is the presence of common costs. Common costs are pervasive in telecommunications. Joint production of several services with common resources is the central difficulty of cost separations accounting in telecommunications. Common costs are caused by cost sub-additivity. If so, the accounting separation system or any other measurement of costs must be devised in such a way that it would be able to identify and measure very precisely direct incremental costs and common costs. Thus, for testing for cross subsidies the system must be capable of recording costs measures where no allocation of common costs has been performed for the services to be analyzed. | Instruments for costing and pricing<br>-The Authority needs to define how it would detect and measure anti competitive cross- | The versions of the CCA reference paper and LRAIC specification paper currently being consulted on already include information on the approach that will be adopted by TATT in the revaluation of assets and the costing methodology. The detailed implementation will be developed with the aid of the concessionaires and will include documentation of the calculation used. The detailed implementation will also be the subject of further consultation. |

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| | | 7.6.1 Bundling and inter-platform competition<br><br>The Authority needs to recognize that inter-platform competition has already begun in the country. Technological advances have allowed that facilities based competition has already been introduced in full motion in T&T as it has happen in other countries. Currently, in addition to TSTT there are other facilities-based competitors in the market, such as cable networks and wireless networks providing a range of similar services to consumers. This is the kind of competition that benefits consumers since it is facilities-based competition.<br><br>One of the most salient characteristic of this type of inter-platform competition is the offering of bundles of services. The rationale behind bundles of services from the supply side is that there are economies of scope. In both, its reference paper (TD-LRAIC and CCA), the Authority has not explained how the Authority intends to incorporate economies of scope in its proposed regulatory instruments (CCA and LRAIC model). | subsidies. | |

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| | | From general concepts to specific regulations<br><br>Even when the key principles laid out by the Authority to construct TD-LRAIC could in principle be one step in the right direction, TSTT deems important that the Authority first has to develop a Detailed Costing Manual (DCM) to go from high level conceptual principles to specific practical formulas. The DCM has to be first discussed publicly with the industry and other interested parties.<br><br>In other countries the consultation process on costing methodologies and later their implementation have taken years before any meaningful results were obtained (i.e. U.K., Canada, USA, other EU countries, etc.) | | |

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| | | | -TSTT request from the Authority clarification on how it intends to deal with bundling of services provided by operators in an environment of inter-platform competition?<br><br>-TSTT needs price flexibility to respond to prices that competitors set freely in a liberalized telecommunication market in the country. If there were a price cap regime in place on TSTT's set of regulated services, TSTT would have the adequate flexibility as long as it complies with the limits imposed by the price cap regime. But, the obligation for TSTT to inform the Authority | |

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| | | | with 30 days notice in advance to change a regulated price would handicap TSTT to respond to price competition bring about by TSTT's competitors, who do not have regulated prices.<br><br><u>From general concepts to specific regulations</u><br><br><u>Need of more detailed methodology</u><br><br>If the Authority insists on the need to develod accounting systems and costing measures based on current costs, the Authority still needs | |

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| | | | to elaborate a Detailed Costing Manual (DCM), then put it to public consultation before any cost implementation could take place. For instance, the Authority would need to define for TSTT what are the services included in the CCA and Accounting System; what are the detailed attribution methods to be applied to revenues, costs, assets and liabilities among services; what is the design of the regulatory accounts system, which constitutes an intermediate instrument to link the company's financial accounting with that of the regulatory accounting; the design of reports that the AS system will produce regularly, | |

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| | | | and the storage needs for financial and non-financial information which the company itself should carry out for auditing or modifications of the AS system. | |
| p. 30 – 6.2 **Cost of Capital**<br>The Authority will determine the cost of capital to be used in the LRAIC model using a WACC calculation with the capital asset pricing method (CAPM) used to estimate the cost of equity | TSTT | The Authority is proposing to use the traditional cost of capital estimate using the CAPM method. However, there are some conceptual and practical problems associated with it.<br>For instance, nowadays it is widely recognized in the academic and regulatory fields that this traditional way to estimate cost of capital underestimates the actual cost of capital since it is omitting economic depreciation due to technological progress and the uncertainty derived of the sunk and irreversible nature of important investments in telecommunications. | In its costs of capital formulation the Authority should take into account:<br>-Economic depreciation (due to declining asset prices, reductions in output, increases in operating costs) and,<br>-A mark-up over costs to allow for the risk associated with investment in sunk and irreversible investments. | In the Costing Methodology a decision was made to adopt CCA tilted straight line depreciation and the reasons set out for this approach were detailled<br>Given the limited amount of direct data available for the concessionaires, the estimated cost of capital will rely to a great extent on benchmarks derived from operators in other jurisdictions.<br>The cost of capital is associated with the corresponding assets |

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| | | | TSTT requires clarification from the Authority as whether it plans to estimate a WACC on an operator basis or industry average. | operated by the concessionaire, rather than the concessionaire itself. Given the likely use of benchmarking information the degree to which the cost of capital for different types of assets can be determined is likely to be limited. However in some other jurisdictions different costs of capital have been determined for fixed assets and for mobile assets.<br><br>To the extent that the operators from which benchmarks are derived also have sunk costs, any risk premium associated with these sunk costs will be implicitly included in the benchmarks.<br><br>The detailed methodology and parameters used to determine the cost of capital will be subject to |

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| | | | | consultation at a later date |
| Section 6.2 Cost of Capital | Windward | In many jurisdictions the regulators (refer to Canada's National Energy Board September 2009 decision) have reverted to a less structured definition of capital which permits each carrier to optimize [reduce] their cost of capital and provides for incentive returns above the WACC based upon attainment of certain performance indicators. Based upon my 36 years capital market experience and the significant differences in cost and availability of capital in the Caribbean Region and other developed markets, I believe that this topic should be the topic of further discussion before enactment. Application of a CAPM risk free ~ rate based upon US Government bonds is<br>Inappropriate.. | | US Government bond rates are used to estimate the risk free rate for investors in T&T as such investors are likely to assess investment opportunities including investments in the United States. For these investors, US Government bonds represent the risk free rate. TATT's estimate of the cost of capital will take account of country specific risk by including data on T&T Government bonds. Examples of countries which may provide appropriate benchmarks for T&T in order to estimate beta will be provided later in the model development process. |
| Cost of Capital | Columbus | The issue with this has been mention in 5(b) in the issue of | Further guidance on the | As described above, the model |

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| | | WACC and how the spending on different expenses will affect segmentation. The use of CVR"S, WR's, exogenous drivers and endogenous drivers needs to be displayed in a real life scenario to make the process adoption less acrimonious | practical nature of these requested outputs are needed. If the authorities can provide individual concessionaires complementary dedicated training in the practical use of the system, this would go a long way to speed up the adaptation to these new accounting procedures | specification has taken account of the specific characteristics of the telecoms industry in Trinidad and Tobago. This means that the specification has a lower number of CVRs than would be specified in larger jurisdictions. Where CVRs are required straight line through the origin may provide suitable approximations initially. This should not result in significant resource implications for the operators..<br><br>TATT clarifies that the drivers identified here relate to the factors determining the number of network elements required rather than the cost of individual network elements. TATT has added clarification on |

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| | | | | this in the LRAIC specification document. |
| Pg 30<br>6.2.1 Cost of equity | ICNTT | ICNTT agrees with the approach of defining the risk-free rate based on an external, sector independent benchmark. However we would like clarification of why the risk free rate is based on US Government bonds as opposed to TT Government bonds. The latter is better reflective of the domestic market forces as opposed to that of another jurisdiction. Similarly, ICNTT would like some appreciation of which "comparable countries" will be utilised to determine Beta. | | US Government bond rates are used to estimate the risk free rate for investors in T&T as such investors are likely to assess investment opportunities including investments in the United States. For these investors, US Government bonds represent the risk free rate. TATT's estimate of the cost of capital will take account of country specific risk by including data on T&T Government bonds. Examples of countries which may provide appropriate benchmarks for T&T in order to estimate beta will be provided later in the model development process. |

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| Pg 31<br>Drivers<br><br>Pg 33<br>Direct increment-related drivers | ICNTT | While ICNTT agrees in principle to the concept of exogenous and endogenous cost drivers, it seeks clarity on the examples provided in the definition of exogenous and endogenous drivers to the various cost elements. The example given of a BSS cost being directly related to the traffic on the market is inherently flawed. Equipment costs are based on prices set by the vendor, not demand by the customer. Accordingly, ICNTT would argue that the cost of the BSS itself is based on the balance of the negotiation/ procurement capacity of the firm, (an endogenous driver) while the number of BSS purchased may be driven by exogenous factors, such as traffic demand. | ICNTT recommends a re-evaluation of the examples cited for exogenous drivers, and how such is to be implemented in the model proposed.<br><br>TATT may consider whether nodes such as BSS's be considered more applicable under endogenous network drivers on pg 34. | While the unit costs of the network components referred to are dependent on negotiations with suppliers, the dimension of the elements and through this the cost of the components are dependent on the level of demand which is an exogenous driver. Thus the Authority proposes to maintain the specification as initially defined. |
| Section 6.4 Cost Drivers | Windward | Given that many of these cost driving elements will vary from year to year, it is unclear as to whether Of not each carrier will be subject to an annual audit and subsequent review | | We do not expect the cost drivers used to vary significantly from year to year (although the values of these drivers will of course vary).<br>The information supplied by operators, including driver values, will be inspected by the Authority |

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| | | | | each year. However we do not propose to require an audit opinion on data submissions as we believe that this would not be proportionate. |
| p. 39 **CVRs**<br>The Authority requires concessionaries to document CVRs using a common format consisting of:<br>• name and number of the CVR;<br>• cost driver;<br>• list of cost categories which use the CVR;<br>• description of the general | TSTT | The Authority proposes to develop Cost-Volume Relationships (CVRs) based on engineering models and activity based costing (ABC). This would demand on the concessionaries extensive use of resources, time as well as labor and financial resources dedicated for these tasks<br>International experience elsewhere shows that in most cases the estimation of CVRs has been controversial and contentious. An alternative is to implement cost allocations based on simple expense factors derived from existing ABC systems. Indeed this has been the case in the Caribbean region, the OECS and Cayman have both approached the subject of operating cost | TSTT recommends the use of expense factors rather than developing CVRs.<br>TSTT requires clarification from the Authority as to whether it plans to estimate CVRs on an operator basis or industry average. | As described above, the model specification has taken account of the specific characteristics of the telecoms industry in Trinidad and Tobago. This means that the specification has a lower number of CVRs than would be specified in larger jurisdictions. Where CVRs are required straight line through the origin may provide suitable approximations initially. This should not result in significant resource implications for the operators.. |

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| form of the CVR (including graph)<br>•explanation of the rationale and assumptions underpinning the CVR;<br>•methodology for the derivation of the CVR; and<br>• sources of data. | | allocation in their LRIC models using expense factors. | | A Top Down LRAIC methodology as required by the Costing Methodology is inconsistent with the use of expense factors to estimate operational expenditure. The OECS and Cayman models referred implemented a different costing methodology (bottom up or hybrid LRIC). |
| Section 6.6 Endogenous CVRs and VVRs | Windward | Windward again questions the use of TDM technology as the base case. Our softswitch energy consumption is constant irrespective of the number of switch minutes processed | | As explained above, the inclusion of legacy technologies is require in order to enable the model to be flexible enough to model all operators. The particular cost volume relationships for individual concessionaires may vary, reflecting the technology used, and data submitted by each concessionaire |

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| | | | | should reflect this. |
| **Section 7- LARIC Model Calculation** | | | | |
| **Section 7.3 CCA Cost Input** | Windward | Development of CCA cost elements may be very time consuming to calculate and the Authority should give consideration to determination of industry wide thresholds for carious capital cost elements to prevent over provisioning. | | The efficiency study will seek to identify and inefficiencies in the concessionaires' cost bases. |
| | Columbus | The dependencies and overall structure explicitly displayed in this section is generic in detail and needs actual real life scenario examples to fully clarify its workings.. | Guidance is needed to map the generic model to the actual workings of the present models in operation of all concessionaires to clarify how the conversions will look to current cost accounting. | As the model is developed the Authority will seek to ensure that concessionaires gain a full understanding on the calculations underlying the LRAIC cost model. |

# Annexe 7: Decisions on recommendations - second round

The following summarizes the comments and recommendations received from stakeholders on the second draft of the LRAIC Specification Paper (dated December 2009), and the decisions made by TATT as incorporated in this revised document (dated 1st March 2010).

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| **General** | | | | |
| General | TSTT | TSTT welcomes the opportunity to respond to the Authority's second round consultation on the Top Down Long Run Average Incremental Cost (LRAIC) Model Specification Paper. Whilst in this response TSTT chooses not to rehash its previous comments, this does not necessarily mean TSTT agrees with the Authority's position as articulated in its response.<br><br>TSTT commends the Authority for its consideration in adopting an approach to model development that reduces the burden | None. | The Authority notes TSTT response. |

[9] Regional regulatory or Governmental agencies, Existing service and/ or network provider and affiliates, Potential service and/ or network providers and affiliates, Service/ Network Provider Associations/ Clubs/ Groups, General Public

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| | | placed on operators.<br>TSTT is also pleased to note that the Authority is open to and, indeed, has welcomed further discussions on various aspects of the cost model development; this TSTT believes would auger well for the development of a cost model that is transparent and reflective of an efficient operator.<br>In this submission TSTT's comments are centered on the Network Element categories, Cost categories and CVRs chosen by the Authority. | | |
| General | Columbus | It is commendable that the telecommunications authority is seeking to make competition in the telecommunications industry equitable, but it should be noted that it is difficult to identify and measure all of the shifts in demand and cost causation involved in instigating competition let alone to forecast them in advance. It is understood that involved in the regulatory issue in the establishment of the LRAIC & CCA comes down to the question of cost definition, cost measurement, cost allocation and cost recovery. It is hoped by Columbus that the authority | Guidance is requested from the TATT on how the CCA will work in reality and this can be done by furnishing the concessionaires with hands on training sessions using data from the relevant concessionaire in question to show exactly how some of the | TATT notes the difficulties that Columbus envisages that it will face in completing the data requests.<br>TATT will provide a more detailed CCA and LRAIC data request. This will consist of Excel files and detailed practical guidance on how to prepare the data required. In |

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| | | provides hands on training session to mitigate each models' assimilation issues. | more complex issues with implementation can and will be sorted out in actuality and not only theoretically as it is in your guidance notes. | particular, the written guidelines contain details of data sources that can be used (for example, the fixed asset register, general ledger, network engineering department, publicly available sources and so on).<br><br>TATT will provide the opportunity to concessionaires to meet with TATT staff and its consultants in order to discuss the data collection process. TATT staff will also be able to support concessionaires in the data collection process on an ongoing basis. |
| General | Columbus | In principle it would be desirable if the authority could develop a broad data base of proxy costs from as many countries and also many companies historical accounts compared to the CCA and LRAIC models so that concessionaires can see how it all works | The authority could develop a broad data base of proxy costs from as many countries and also companies' historical accounts | While TATT recognises that the necessary data preparation is an will require considerable concessionaire involvement, TATT maintains that |

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| | | out in a theoretically and a complimentarily practical manner. This could form a kind of econometric regression model or statistical correlation analysis of costs in almost any environment. With this we would be able to reliably compare results from different jurisdictions and help concessionaires come to conclusions about the effect of interconnection costs, variations in labor, topography and other factors that may affect the way concessionaires see this onerous process. | compared to the current cost accounts and LRAIC models so that concessionaires can see how it all works out in a symbiotic manner with the normal historical accounts generated by the concessionaire. | it is better to develop a model that is based on the costs faced by each concessionaire in Trinidad and Tobago. It is for this reason that TATT requires information from each of the concessionaires. Producing a version of the model for each of the concessionaires will help to ensure that the outputs of the model reflect the costs and operating environment faced by the concessionaires. This will help to ensure that the decisions based on the outputs of the model will be better informed.<br><br>In addition, there is very limited availability of the data that would be necessary to perform an econometric or statistical analysis since there are so many factors that |

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| | | | | drive costs. This makes this type of exercise hard to do with any degree of reliability and therefore there would be a high risk that the results of such an analysis would not reflect the costs faced by concessionaires. |
| **Section 1** | | | | |
| 1.3 Need for operator input | Columbus | The model will be populated on an annual basis covering each concessionaire's financial reporting year. The model will initially be populated with data for the latest financial reporting year at that point. There will be no requirement to populate the model for earlier time periods. This statement made by the authority answers questions posed by Columbus about information from previous accounting periods being requested but raises another issue in the verification of data submitted by concessionaires. Will the services of external auditors be needed for verification of information and if so will the authority bear the expense or | Clarification of how the information from the concessionaire will be verified. It should be done on a case by case basis and not by a generic method seeing that the concessionaires are heterogeneous in nature. | External auditors will not be required to verify the data submitted by concessionaires. This is because TATT recognizes that this would be very costly to concessionaires and would not be proportionate.<br>TATT proposes to verify the inputs used in the LRAIC model on a case by case basis. TATT has no |

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| | | the concessionaire. | | expectation that the data submitted by concessionaires should be identical since TATT recognizes that concessionaires face a variety of operating conditions. However, we would expect there to be some consistency between some of the data submitted. For example, we would expect unit labour costs and unit vehicle costs to be broadly similar.<br><br>TATT also proposes to verify that the magnitude of information supplied is broadly in line with international experience.<br><br>In future years, TATT will compare the data submitted by concessionaires in previous years as we would not expect there to be very significant changes unless |

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| | | | | concessionaires are able to give objective explanations. |
| 1.3 Need for operator input | Columbus | There will be a separate model for each concessionaire, reflecting their network<br><br>structure, costs and demand for services based on a common model template. The results for each concessionaire will thus represent the costs for that concessionaire. This approach differs from that used in some other jurisdictions where a single hybrid industry model representative of a number of networks (typically mobile networks) has been developed with the results being a representative average" cost for the industry. When will the separate model for each concessionaire be provided or has it already been provided in the generic excel template sent to the concessionaire. | Clarity needed on whether the template sent to the concessionaire in the excel format is the final draft the relevant concessionaire will be working with. | The LRAIC data template in Microsoft Excel format was provided as part of the consultation process as a draft. As concessionaires have responded to the two rounds of consultation, the LRAIC model specification and therefore the data requirements have changed. TATT will be issuing a revised data request which will consist of an Excel file and detailed written guidelines. This will also reflect the comments from concessionaires requesting further practical advice on participating in the modeling process.<br><br>Concessionaires' responses to the |

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| | | | | data request will be used as inputs to the versions of the LRAIC models. The LRAIC model itself will not be provided to the concessionaires. |
| 1.4 Overview of the LRAIC modelling process and the CCA revaluation study | Columbus | The overview of the data collection process has a chronological time lay out of the implementation of the LRAIC and CCA models. It would be instrumental to concessionaires to know if this time line is fixed or is subject to variation if faced with logistical and finalization concerns by the concessionaire in the implementation and gathering of information for LRAIC and CCA models. | The authority needs to provide concessionaires with information about any time extension that may or may not be available if the data collection and implementation process becomes constrained by unforeseen circumstances and anomalies in the process. | The LRAIC model timeline is designed to balance the requirement to have a detailed cost model for the purposes of regulatory decision making and to allow concessionaires to provide data for the model so that it better reflects costs faced by them.<br>TATT proposes a deadline for submitting data of 30 April 2010.<br>At this stage, TATT does not envisage any need to further revise or extend the timeline for data submission or for the model |

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| | | | | development. |
| **Section 3** | | | | |
| 3.2 Ex post competition cases | Columbus | In some cases adverse competitive behavior is not pre-empted and regulated accordingly. In such cases regulators or competition authorities often face the need to assess whether prices have been consistently set at adverse levels. The above statement made by the authority needs some clarification. Concerns may arise if information already supplied to the authority from a previous historical accounting period will be used in anticompetitive pricing studies and or result in subsequent penalties for concessionaires. | Clarity on the penalties or any action that may be attributed to ex post competition cases and ways concessionaires can avoid such incidents or actions from occurring. | The way in which the model will be used will vary from case to case and it is difficult to provide detailed guidelines on how it may be used to assess anticompetitive behaviour and/or to determine the level of any fines. This is because the nature of ex post competition cases vary greatly and it is not possible to predict exactly what information will be required from the LRAIC model.<br><br>Further, the purpose of this consultation is to determine the costing methodology rather than to determine exactly how the model |

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| | | | | will be used. |
| **Annexe 2 – Define network elements** | | | | |
| Annexe 2 | TSTT | TSTT agrees with the Authority's list of definitions, although not exhaustive, the list captures the key elements of an operator's network. TSTT may, however, have additional elements which are not on the Authority's list but notes the Authority's willingness to include additional elements in light of sufficient evidence. | TSTT looks forward to further dialogue with the Authority in defining the network elements of the LRAIC model.<br>TSTT encourages and looks forward to subsequent dialogue with the Authority in detailing the lists of increments that should be employed in the model. | The Authority notes TSTT response. |
| **Annexe 3 – Defined increments** | | | | |
| Annexe 3 | TSTT | TSTT is in general agreement with the definitions of increments posed by the Authority and notes that the lists are not exhaustive, for example, the 'Fixed Wireless' increment is absent | TSTT encourages and looks forward to subsequent dialogue with the Authority in detailing the lists of increments that | Separating "Fixed Wireless" would not appear to cause any difficulties and would make the model more |

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| | | from the list. | should be employed in the model. | transparent<br>TATT proposes to add this to the model specification. |
| **Annexe 4 – LRAIC cost categories** | | | | |
| Annexe 4 | TSTT | TSTT is in general agreement with the Authority's lists of cost categories. However, TSTT would be grateful if the Authority could provide further clarification of the following categories:<br>NC18 – DSLAM/MSAN:- TSTT is unclear as to the reason why the Authority would couple the MSAN element together with the DSLAM when the two serve different functions. A DSLAM provides access connections for DSL (Broadband) services and a MSAN, even though it may house a DSLAM, which most times are supplied as a stand alone unit, provides greater functionality. An MSAN also provides voice access connectivity and may sometimes be supplied with an integrated DSLAM, which, nonetheless, should be treated separately. | The Authority should separately define the DSLAM and MSAN network elements.<br>TSTT seeks clarity as to why DC03-05 do not carry equivalent wholesale increments | Separating MSANs and DSLAMs would not appear to cause any difficulties and would make the model more transparent. TATT will therefore create these as separate network categories.<br>Fixed/international/mobile termination (DC03-05) are identified as retail costs to exclude them from the network costing (as they are not network costs). TATT |

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| | | DC03 – 05 – Fixed, International and Mobile Termination:- TSTT notes that these are identified as being Ret (Retail) increments. TSTT agrees that the cost of termination is a component of the retail prices offered to customers; however, they also form major wholesale increments. | | proposes that no change will be made to the LRAIC specification in this respect. |
| **Annexe 5 – Defined CVRs** | | | | |
| Annexe 5 | TSTT | CVR23 – Procurement<br>Procurement costs are driven by both retail and network activities, but the Authority has assigned only a 'Network Dimension' driver. | TSTT recommends that the Authority split the Procurement Cost category into two cost elements with two separate CVRs, where one category captures the Network related procurement cost and the other captures the Retail related costs. | Separating the different types of procurement would not appear to cause any difficulties and would make the model more transparent. TATT will therefore add this to the revised LRAIC specification. |