



A Consultative Document

The Proposed Methodology for an Efficiency Study

For the Long Run Average Incremental Cost (LRAIC) Model

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1 Overview

Frontier Economics (“Frontier”) has been engaged by the Telecommunications Authority of Trinidad and Tobago (“the Authority”) to assist in implementation of the Costing Methodology¹. This methodology requires modelling the forward looking long run average incremental cost (LRAIC) of telecommunications networks in Trinidad and Tobago on a top down basis. The Costing Methodology requires the Authority to undertake an efficiency study for all dominant concessionaires.²

This document sets out the proposed approach for the efficiency study of concessionaires in Trinidad and Tobago. The resulting efficiency adjustment terms will feed into the LRAIC calculations for concessionaires.

The Authority intends to undertake two consultations on the efficiency analysis: an initial consultation providing a first overview on the likely approach, followed by a second consultation which provides more details on the approach (including some indicative overviews on the likely benchmarking samples). This report is the main input to the second consultation document. As such, it resembles an update to a previous report prepared for TATT, taking into account the comments received from concessionaires on the initial consultation.

1.1 Efficiency and the LRAIC model

The LRAIC model will produce estimates of the costs faced by concessionaires in Trinidad and Tobago based on top down data provided by the concessionaires. The alternative approach, to set prices using a ‘bottom up’ approach, modelling a hypothetical efficient operator, was considered as part of the development of the costing methodology³ but a ‘top down’ approach was considered to provide a more robust estimate of costs.

Since being based on information on concessionaires’ actual cost base and network structure, this data may include inefficiently incurred costs arising from potential current inefficiencies in operations or past inefficiencies in investment. Although the LRAIC model is based on current cost accounting (CCA) data (rather than historic costs), this CCA revaluation process does not control for any potential inefficiencies of concessionaires. As set out in the CCA Reference

¹ “The Costing Methodology for the Telecommunications Sector”, 29 May 2008

² See Section 5.1 of “The Costing Methodology for the Telecommunications Sector”, 29 May 2008

³ “The Costing Methodology for the Telecommunications Sector”, 29 May 2008

Paper⁴, the CCA revaluation process will be based on an indexation approach (i.e. adjusting the unit costs incurred by concessionaires at the time of purchasing the equipment to current price levels for this equipment). This could result in the regulated prices determined using top down costing information being set above an efficient level.

As such, when using top down models as the basis for setting regulated prices regulatory authorities need to make judgements about whether the costs reported by the operator are or were efficiently incurred. In the case where following a study of efficiency there is reasonable certainty that costs are above an efficient level, regulators may make downwards “efficiency adjustments” based on the results of the study. The objective of the efficiency study is to estimate the extent to which each concessionaire is efficient. This will be carried out by comparing the reported costs to a group of benchmark operators. The output of the efficiency study is an efficiency adjustment factor which will be applied to the top down estimate of costs in order to estimate the costs that would be incurred by an efficient concessionaire. Such adjustment factors can either be applied to the cost inputs to the model, so that the model represents the costs of an efficient operator, or to the unit cost estimates resulting from the model so that prices do not reflect any inefficient costs included in the top-down model.

To date, the Authority has not made any determinations on how efficiency should be measured. There are a range of possible methodologies for determining the level of efficiency of concessionaires in Trinidad and Tobago. The most appropriate methodology should take account of the relatively small size of concessionaires and the limited nature of data available. This report sets out the Authority’s proposed approach to estimating the efficiency factors for the LRAIC modelling exercise.

The Authority will make the necessary policy decisions, if and when needed, as it pertains to the use of the output from this exercise.

1.2 Overview of the overall process

To ensure maximum transparency on the process of developing efficiency adjustment factors and in order to allow stakeholders to comment on the proposed approach, the Authority has engaged in a consultative process in accordance with its Procedures for Consultation in the Telecommunications and Broadcasting Sectors.

- **First-round consultation.** The Authority published an initial consultative document providing a first overview on the likely approach for the efficiency

⁴ "Current Cost Accounting Reference Paper Guidelines for Concessionaires for the development of CCA Studies", 01 March 2010

analysis on 13th May 2010⁵. Interested parties were invited to comment on this initial consultation document, with the initial deadline of 25th June 2010 being extended to 30th July 2010 in response to requests by selected concessionaires. The Authority received responses from two concessionaires, CCTL and TSTT.

- **Second-round consultation.** Taking account of the comments received on the initial consultation and further research into the publicly available information required for the analysis, the Authority has prepared a second consultative document. This document aims to provide further details on the approach taken and how the main findings of this analysis (i.e. the concessionaire-specific efficiency adjustment factors) will feed into the LRAIC model. This document further provides an indicative overview of the likely benchmarking samples underlying the fixed, mobile, and cable operator efficiency analyses.

Interested parties have until November 29th 2010 to respond to this second consultation. After this process is closed, the Authority will finalise its approach to measuring efficiency, taking into account any comments received during the entire consultation process. The required efficiency adjustment factors, if any, will then be derived for each concessionaire based on the final benchmarking approach. These values may feed into the LRAIC model calculations as the Authority deems necessary. An overview of the overall process is presented in the table below.

⁵ "The Proposed Methodology for an Efficiency Study", 13 May 2010

Table 1. Overview of the efficiency analysis process		
Consultation step	Role of Authority/Frontier	Timeline
First consultation	The Authority provided a first overview of the proposed approach	Interested parties were invited to respond to this consultation until the 25th of June
Second consultation	The Authority provides, amongst others: ▣ a more detailed description of the proposed approach, taking into account any responses to the initial consultation, ▣ an indicative overview of the likely benchmarking samples for the fixed, mobile and cable operator efficiency analyses, and ▣ further explanation on how the efficiency results will be used in the LRAIC analysis.	Interested parties are invited to respond to this consultation by the 29 th November 2010.
Determine efficiency adjustment factors	Subsequent to the second consultation, the Authority will ▣ finalise its approach, based on comments received and ▣ determine efficiency adjustment factors for each concessionaire.	
Input efficiency parameters into LRAIC model	Based on the results of the efficiency analysis, the Authority may input the final efficiency parameters into LRAIC model and sense check outputs.	

1.3 Overview of this Consultative Document

The remainder of this document is structured as follows.

- Section 2 contains a discussion on what the Authority means by efficiency in the context of the telecommunications sector and approaches on how to measure it.
- Section 3 sets out the Authority's proposed approach for Trinidad and Tobago, an adjusted efficiency benchmarking analysis. Within this section, the Authority further provides an indicative overview of the likely benchmarking samples for the efficiency analyses.

Further details on selected elements of the proposed approach are then presented in Annex 1 to Annex 3.

2 Efficiency and how to measure it

Below the Authority provides some background to the proposed approach for the efficiency study. Firstly, the Authority outlines what is meant by efficiency in the context of the telecommunications sector. This is followed by an overview of common approaches of measuring it. In their responses to the initial consultation document, concessionaires requested, amongst others, a more extensive discussion on the available approaches to determine operators' efficiency levels, including the main advantages and disadvantages associated with each of them. As such, the section below builds on the discussion contained in the initial consultation document, but also aims to provide the requested further detail.

2.1 What is efficiency?

In general, utility regulation is expected to minimise the potential abuse of market power of companies as such abuse may lead to inefficiencies and/or distortions within the market under consideration.

There are three main efficiency concepts of particular relevance to the regulation of telecommunication services.

- **Productive efficiency** relates to an efficient use of economic resources so that production takes place at minimum cost.
- **Allocative efficiency** occurs when resources are allocated across different products in a way that maximizes the net benefit attained by customers through the consumption of such products.
- **Dynamic efficiency** occurs when productive and allocative efficiency is maximized over time. This concept especially takes investment and innovations into account.

Economic theory suggests that cost-based pricing (based on an efficient operator) of regulated telecommunication services leads to an economic efficient outcome. As such, this requires achieving both, productive and allocative efficiency. Furthermore, in the longer run, price regulation also needs to take dynamic efficiency into account.

The efficiency study aims to ensure that any regulated prices, based on the Authority's LRAIC model, are not only cost oriented, but also represent an efficient level of costs⁶.

⁶ See Section 5.1(2.0) of "The Costing Methodology for the Telecommunications Sector", 29 May 2008

The level of costs of a communications operator will be partially determined by variables that the company has control over (such as, operational decisions, number of staff, and its choice of technology). However, there will also be variables over which the company has no influence (including, for example, its geographic, topographic or demographic operating environment). When determining the efficiency of that company, it is therefore important to isolate, as much as possible, the impact of those endogenous factors under the control of management on the company's performance, whilst controlling for any factors, exogenous to the company. This requires the application of quantitative techniques, which can be differentiated on two dimensions:

- absolute vs. relative efficiency analyses; and
- total factor vs. partial efficiency analyses.

Each of these dimensions is further discussed below.

2.1.1 Absolute vs. relative efficiency

The efficiency of a company can be assessed by comparison with an independently derived absolute level of efficient costs, or by comparing its costs to that of other comparable companies. Whereas the former requires a rigorous bottom up assessment of the company's cost base and operations (for example, as undertaken as part of a bottom-up LRAIC model), the latter is commonly achieved by conducting a benchmarking study, potentially with the help of econometric techniques.

When reviewing the available options for conducting the efficiency analysis in the context of the LRAIC modelling exercise in Trinidad and Tobago, the Authority has considered both, a relative efficiency and an absolute efficiency approach. The main advantages and disadvantages associated with relative and absolute efficiency analyses are summarised in the table below.

Table 2. Main advantages and disadvantages of an absolute and relative efficiency approach

	Main advantages	Main disadvantages
Absolute efficiency analysis	▢ Determines efficiency on detailed cost and operational data from each concessionaire (bottom-up analysis) ▢ May lead to robust efficiency estimates (subject to availability of robust and detailed input data)	▢ Complex and time consuming approach ▢ Demanding data requirement, especially of costing and operational information of the concessionaires that is unlikely to be available in the current state of the accounting separation process
Relative efficiency analysis	▢ Top-down approach that relies on actual observable cost data of other operators ▢ Less detailed data requirements from concessionaires ▢ Econometric techniques enable to control for main exogenous factors	▢ Measures relative performance and thus may not directly reflect the individual situation of the concessionaires. ▢ Requires financial and operational data from other operators

After careful deliberation (including comments received in response to the initial consultation), the Authority considers a relative efficiency analysis favourable to an absolute efficiency study. Conducting an absolute efficiency analysis is a complex and time consuming undertaking, requiring very detailed costing and operational information for each concessionaire. Such exercises tend to be inaccurate as they require making bottom up estimates of costs which tend to have wide error margins. This often leads to difficulties in interpreting the results of these studies, due to the uncertainty as to whether the observed differences between the operator's absolute level of costs and the efficient level of costs are due to inefficiency or simply estimation errors.

2.1.2 Total factor vs. partial efficiency analyses

A communications operator's total costs are commonly driven by a wide range of factors and it generally provides a wide range of 'outputs' (i.e., retail and wholesale services including, for example, connection services, call services and data services). As such, it is desirable to assess the operator's overall efficiency

level by taking into account the full range of inputs and outputs. A Total Factor (TFP) approach attempts to model the complete relationship between the level of inputs and the total output of the firm. This analysis can be undertaken either on a cross-sectional basis or on a time series basis.

TFP is commonly considered to be the differences in output not explained by the differences in inputs used in production. For example, if two companies use the same amount of inputs (such as, capital, labour and supporting activities) but achieve different levels of output (such as, access lines, call minutes and interconnection traffic) it is assumed that these differences in output are due to differences in TFP.⁷ As such, the relative level of TFP is determined by how efficiently and intensely the inputs are used to generate outputs. A TFP approach can be implemented in two ways.

- **Cross-sectional analysis.** Under this approach overall productivity an explicit or implicit model of the relationship between total inputs and total outputs of operators is set up and applied across a range of operators. For each operator the level of output is a function of a combination of the inputs and the TFP of the operator. By comparing the relative productivity of operators against the operator that appears to have the highest productivity (i.e. appears to be most efficient), the level of inefficiency of the operators of interest can be determined. The analysis is commonly based on a single year (i.e. static productivity), however, the analysis can also be undertaken based on a multi-year time period as this may make the results more robust. Undertaking a cross-sectional TFP analysis requires a significant amount of operational and financial data in order to accurately model the complete relationship between inputs and outputs.⁸
- **Time series analysis.** An alternative approach is to compare changes in the aggregate level of inputs over time against changes in the aggregate level of outputs over time for a single company. Differences between the two rates of change are assumed to be due to changes in TFP. As changes in inputs and outputs over time for an operator are relatively small (compared to the much large differences between operators in a cross-sectional approach) the specification of the underlying model relating inputs and outputs is less critical. In addition since only information is required on the operator of

⁷ One example for a production function (applying a Cobb Douglas form) would be

$$\text{Output} = \text{TFP} * \text{Labour}^{\alpha} * \text{Capital}^{\beta}$$

with TFP explaining the output that can not be explained by the use of labour and capital.

⁸ Most comparative TFP analysis for communication operators relies on financial and operational data on US operators (LECs), published by the U.S. Federal Communications Commission.

interest, data should be readily available. This approach only informs on the productivity movements of the operator over time which may provide information on the expected future rate of productivity gains, which is often used in the context of price cap regulation. It does not, however, enable an assessment of the operator's level of efficiency at a given point in time as required by the costing methodology.⁹

An alternative approach is to determine an operator's efficiency based on partial productivity ratios, which look to measure relationships between key inputs and key outputs. Although falling short of capturing the overall productivity of the company, this approach is attractive due to its practicality, transparency and widely understood outputs. For example, common productivity ratios in the telecommunications sector include a measure of the costs per line and lines per employee.

When reviewing the available options for conducting the efficiency analysis in the context of the LRAIC modelling exercise in Trinidad and Tobago, the Authority has considered both, a TFP and partial efficiency analysis approach. The main advantages and disadvantages associated with both approaches are summarised in the table below.

⁹ This approach has been applied by the OUR in Jamaica as part of the recent price cap determination for Cable and Wireless Jamaica. : <http://www.our.org.jm/images/stories/content/Telecommunications/Consultation/Documents/P%20rice%20Cap%20Plan%20for%20CWJ%20-%20Consultative%20Document%20-%20August%204,%202008.pdf>

Table 3. Main advantages and disadvantages of TFP vs. partial factor productivity approaches

	Main advantages	Main disadvantages
Total factor productivity		
<i>Cross sectional TFP analysis</i>	□ Approach based on sound economic theory and available empirical evidence □ Aims to measure overall performance of concessionaires	□ Significant data requirements for both concessionaires and comparator companies (the latter is seldom publically available) □ Data availability limits set of comparator companies (often only US carrier data is available)¹⁰ □ Requires determining the correct production function that reflects the actual interrelation between input and output. □ Limitations in the context of multi-product companies, such as communications operators¹¹
<i>Time series TFP analysis</i>	□ Approach based on sound economic theory and available empirical evidence □ Aims to measure overall performance of concessionaires	□ Requirements for historical data for concessionaires □ Requires determining the correct production function that reflects the actual interrelation between input and output, although less critical than for cross-sectional approach. □ Limitations in the context

¹⁰ As stated above, most comparative TFP analysis for communication operators relies on data on US operators (LECs). Although sufficiently detailed, the Authority considers this data not to resemble a good basis for an efficiency analysis in Trinidad and Tobago.

¹¹ Normally, TFP estimation estimates the output of a single product firm as a function of an input combination. If a company produces multiple-products –as most telecommunication companies do– the production depends on different input combinations of different inputs. This makes the estimations more difficult.

		of multi-product companies, such as communications operators ¹²
		□ This approach only shows the efficiency developments of a single concessionaire over time. It does therefore not provide any insight into the concessionaire's performance relative to the feasible efficiency frontier.
Partial factor productivity	□ Commonly applied approach, based on well defined methodologies □ Requires less input data from concessionaires (relative to comparative TFP analysis)	□ Concept does not necessarily cover overall productivity of concessionaires including any trade offs between inputs

After careful deliberation (including comments received in response to the initial consultation), the Authority considers a partial efficiency analysis favourable to a TFP based approach. Despite the theoretical appeal of TFP analysis, the Authority considers the likely practical limitations when implementing such an analysis to outweigh the expected benefits associated with TFP. In particular, the significant data requirements for both concessionaires and comparator companies and resulting implications on the set of comparator operators (i.e. US communications operators only) under the cross sectional TFP approach, are considered to pose significant practical limitations to such an analysis in the context of Trinidad and Tobago. Although TFP time series analysis for each concessionaire is likely to be feasible, this approach provides no information on the level of efficiency for each concessionaire at a single point in time as required by the costing methodology. Furthermore, adopting a partial efficiency analysis is in line with international precedent.¹³

¹² Normally, TFP estimation estimates the output of a single product firm as a function of an input combination. If a company produces multiple-products –as most telecommunication companies do– the production depends on different input combinations of different inputs. This makes the estimations more difficult.

¹³ Examples of regulatory authorities that have chosen to apply a benchmarking approach are Jersey and Guernsey. (<http://www.regutil.gg/docs/OUR0908.pdf>;

However, the Authority also recognises the potential limitations of the preferred, partial efficiency approach. As such, it will take this into account when determining any efficiency adjustment factors for the LRAIC model.

2.2 Approaches to measuring relative efficiency

There are a range of methodologies to determine the relative efficiency of telecommunications operators. These fall into the two main categories:

- econometric analysis; and
- benchmarking analysis.

Both categories are discussed in more detail below.

2.2.1 Econometric analysis

The relative efficiency of telecommunications operators can be estimated by undertaking an econometric analysis of the operator's costs. This is undertaken by developing an econometric model which aims to test and measure the relationship between a dependent variable (i.e., the operator's costs) and several independent variables (i.e., its outputs and other likely cost drivers, such as operational geographic and demographic variables and regulatory obligations). These independent variables commonly comprise both, factors that are under the control of the operator (such as, number of staff and coverage level) as well as exogenous factors (such as, demographic characteristics or economic variables). As such they are designed to separately identify and quantify three components of cost differences:

- variations due to factors outside the company's control;
- errors in measurement of costs; and
- genuine inefficiencies.

There are several econometric techniques available, varying in the degree of complexity and resulting efficiency estimates.

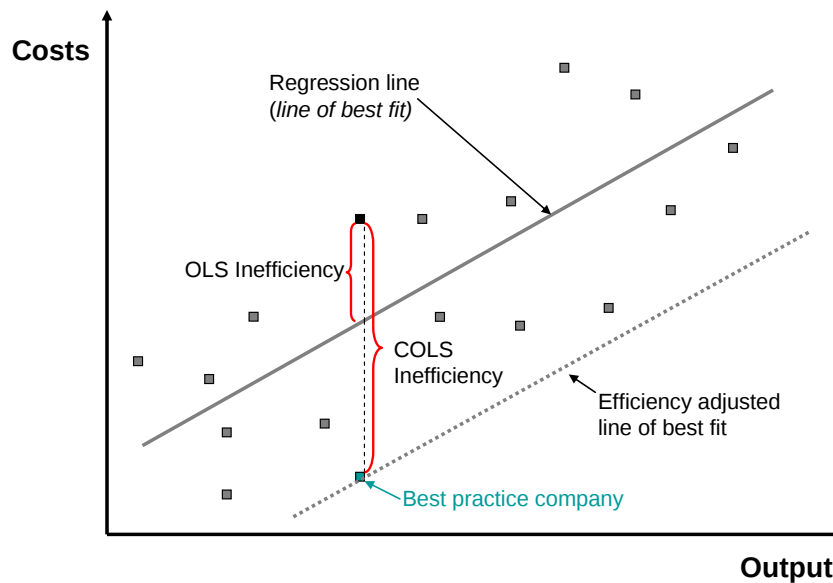
- **Ordinary Least Squares (OLS).** This is the most typical, and basic econometric method. Under this approach, a 'line of best fit' is obtained which minimises the (squared) distance between it and the actual observations. This is illustrated in **Figure 1**.

http://www.icra.je/pdf/080729%20not-md-JT%20Price%20control%20Final-v1%20_2_.pdf. The Authority also understands that Bahamas, Malta and South Africa also applied this approach in the past.

- **Corrected Ordinary Least Squares (COLS).** Under a COLS approach a best practice benchmark is developed through a parallel downward shift of the OLS line of best fit so that the curve passes through the point representing the company with the lowest average cost (given the output combination). This leads to larger inefficiency values than under the OLS approach (see **Figure 1**).
- **Stochastic Frontier Analysis (SFA).** The more recent stochastic frontier approach to efficiency measurement recognises that not all of the difference between a firm's actual costs and the line of best fit is due to inefficiency. Some of it may be explained by purely random or stochastic events (such as, unusual weather conditions or unexpected changes in demand) or measurement errors. Consequently, the error component in the model is made up of two elements - genuine inefficiency and random fluctuations.

The figure below provides an illustrative example of how efficiency is measured under regression analysis (OLS and COLS).

Figure 1. Benchmarking using OLS and COLS regression analysis



Unlike non-parametric methods (i.e. benchmarking analyses), econometric analysis can be subject to hypothesis testing to determine the robustness of results. However, in the telecommunications industry, parametric techniques are severely limited by the lack of granular data.

2.2.2 Benchmarking analysis

An alternative approach to estimating relative efficiency of telecommunications operators is to undertake a benchmarking analysis. Benchmarking is a useful tool for reviewing the relative performance of an operator by comparing its required inputs to produce a given level of outputs with those used by other operators (in that country or across several countries). The resulting productivity figures for each operator can then be used to assess the efficiency of that operator compared to others. Benchmarking can either be undertaken on a basis of a single indicator (e.g. lines per employee or costs per line) or by taking several indicators into account (i.e. by applying a Data Envelopment Analysis technique¹⁴).

Benchmarking is a particularly practical approach to measuring relative efficiency and is a widely used tool in the context of telecommunications regulation, especially in less mature regulatory environments. It can be undertaken on a national or international basis. International benchmarks are useful when there are no comparable national operators within the country. However, there are a number of concessionaires in Trinidad and Tobago which may provide useful comparators for each other. In particular, the advantages of national benchmarks include:

- concessionaires within Trinidad and Tobago face similar market conditions (i.e., exogenous factors); and
- the required data can be collected by the Authority on a consistent basis.

However, undertaking national benchmarks also has a number of limitations, not the least being the limited sample size. Furthermore, it would require assessing the efficiency of concessionaires which all have distinct networks, market shares and thus cost structures. This is likely to result in distorted efficiency adjustment factors. Furthermore, some of the potential issues of an international operator sample can be overcome during the sample selection process (i.e., by aiming to only include operators which face similar market conditions as the concessionaires).

A further constraint on international benchmarks is commonly the financial and operational data availability for suitable comparator companies. As regulatory accounts are only available for a very limited set of jurisdictions, an efficiency benchmarking study often needs to rely on statutory accounting information.

¹⁴ The Data Envelopment Analysis (DEA) is a generalisation of the partial data analysis. The DEA program identifies efficient companies for each partial output-input dimension. A linear combination is then used to determine an efficiency frontier from these 'best-practice' companies. Finally, each company is compared to a virtual company on the efficiency frontier which has similar structural conditions (i.e., a point on the frontier that is closest to the company). The inefficiency of that company is then defined by the distance to the efficiency frontier.

This requires the accounts to be publically available, as well as the required information to be presented in a sufficiently disaggregated format.¹⁵

Adjusted benchmarking

Recognising the limitations of a standard benchmarking approach outlined above, has led to the development of the adjusted benchmarking approach. This approach attempts to control for the exogenously driven differences between operators included in the sample by adjusting the actual incurred costs of each comparator operator and thus, it is likely to provide more informative results. In particular, there are a number of factors that are not within the control of concessionaires and result from unavoidable specific operating conditions. As such, it resembles a blended approach of the standard benchmarking analysis and econometric analysis.

The adjusted benchmark approach is performed in two steps:

- **Determination of required adjustment factors.** As a first step, a regression analysis is undertaken to determine the required adjustment factors for each comparator operator. The regression estimates the statistical relationship, if any, between the costs of an operator and exogenous factors that an operator has no influence over.¹⁶ Examples for these independent variables include, amongst others, variables covering the geographic and economic environment differences across the operators under consideration. Based on the established statistical relationship between the costs and the relevant cost drivers, an operator-specific adjustment factor for each of these cost drivers is calculated, reflecting how much the costs of the comparator operator needs to be adjusted to control for the observed differences in operating environments relative to the benchmarked operator.
- **Determination of adjusted cost measures.** Once the required adjustment factors have been identified, they are applied to the unadjusted costs of each comparator operator. The resulting adjusted cost measures therefore reflect the cost that each comparator operator would have faced, if it were to operate in the same environment as the benchmarked operator. As such, only the costs of the comparator operators are adjusted, whereas the cost of the benchmarked operator(s) remains unchanged. The aim is therefore to develop a comparable set of costs or performance measures that takes account of any operational differences.

¹⁵ The cost and output information needs to be available on segment level for multiple service operators (i.e., fixed segment, mobile segment, cable segment) and country specific.

¹⁶ Regression analysis allows to (i) test whether there is any statistically significant relationship between any dependent variable and the independent variable and, if so, (ii) to estimate the size and direction of this relationship.

Although the adjusted benchmarking approach seeks to overcome some of the main shortcomings of a conventional benchmarking approach, there are also certain disadvantages associated with such an approach. For example, as with the econometric approaches discussed above, a potential disadvantage associated with an adjusted benchmarking approach is the sample size of cost data of comparator operators which is required for the regression analysis. As this data has to be extracted from publically available sources, the availability might be limited. Furthermore, the aim of the estimation is to try to find a relationship between potential cost drivers of operators. However, some of these potential cost drivers are not easily captured in a variable, for example the regulatory environment of operators. Therefore, some of these potential cost drivers cannot be easily estimated.¹⁷

Note that, in addition to overcoming this shortcoming of the conventional benchmarking approach, the adjusted benchmarking approach still shares all the advantages associated with the conventional benchmarking approach (i.e., ensuring transparency since being based on publicly available data)

Recognising the limitations of a standard benchmarking approach outlined above has led to the development of the adjusted benchmarking approach. This approach attempts to control for the differences between operators included in the sample and thus, it is likely to provide more informative results. In particular, there are a number of factors that are out of the control of the concessionaire and result from unavoidable specific operating conditions.

Under this approach, the cost ratios of each operator are calculated and then adjusted for differences in the operational, geographic, and economic environment across the operators under consideration.

2.2.3 Proposed approach

When determining the most suitable approach for conducting the efficiency analysis in the context of the LRAIC modelling exercise in Trinidad and Tobago, the Authority has considered all benchmarking and econometric approaches set out above. The main advantages and disadvantages associated with each of them are summarised in the table below.

¹⁷ See section 3.2 for further detail.

Table 4. Main advantages and disadvantages of the different approaches to measuring relative efficiency

	Main advantages	Main disadvantages
Ordinary Least Squares (OLS) Corrected Ordinary Least Squares (COLS)	□ Allows for simultaneous test significance of and estimate the impact of endogenous and exogenous cost drivers	□ The estimations need to be founded on an underlying econometric model. OLS and COLS models can test whether a hypothesis generated from a theoretical model can be rejected or confirmed. For this, a theoretically based hypothesis is necessary. □ To generate robust results a data set of sufficient size and granularity is required
Stochastic Frontier Analysis (SFA)	□ Takes into account that the difference between a firm's actual costs and the line of best fit is not necessarily due to inefficiency by taking random or stochastic events or measurement errors into account.	□ Relies on a strong statistical assumption on the distribution of the error terms, which is difficult to verify¹⁸ □ As for OLS and COLS, this approach requires a sample of sufficient size and granularity
Standard Benchmarking	□ An easy to apply approach which can provide indicative insights into the relative performance of an operator (based on partial performance ratios) □ Enhanced benchmarking techniques (e.g. DEA) allow for taking several indicators into account □ Tested and applied in utility regulation	□ Requires a homogeneous sample in order to be able to attribute any observed performance differences within the sample to the operators (rather than being externally driven) □ In heterogeneous samples, it is difficult to interpret any observed performances differences within the sample as these may be driven by exogenous factors
Adjusted Benchmarking	□ Advanced benchmarking approach aiming to control for exogenous cost drivers in heterogeneous benchmarking samples	□ Unlikely to control for all exogenous cost drivers (as such, some observed performance differences may be driven by exogenous factors)

¹⁸ The decomposition between the genuine inefficiency and the error term is driven by the assumption on the distributions of the errors. The appropriateness of these assumptions cannot be measured.

- Transparent approach, based on publicly available information for comparator operators
 - Required financial and operator data may not always be available
 - Tested and applied in telecommunications regulation
-

Taking into account the advantages and disadvantages of each approach set out above, the Authority proposes to adopt an adjusted benchmarking approach. This approach appears most suited in the current regulatory and operational environment in Trinidad and Tobago given the availability of data.

The analysis will focus on cost efficiency for the main drivers of cost (i.e., average cost per subscriber for mobile operators, average costs per line for fixed operators, and average cost per homes passed for cable operators) and labour productivity (i.e. lines per employee) measures.

In line with the requirements set out in the Costing Methodology, the Authority sees a general necessity to undertake an efficiency analysis for all concessionaires. There is very limited comparator data on fixed wireless operators available in the public domain, which made developing a suitable set of comparators for the relevant concessionaires difficult. However, the Authority believes that excluding these operators from the analysis is less of a concern since they are recent entrants to the telecommunications market. Generally regulated prices in liberalised markets are set with reference to estimates of efficient costs for established operators. This leads to incentives for entrants that are similar to those in a competitive market with entry only being rational if they have lower costs than the established operators and with strong incentives for entrants to operate efficiently. Furthermore, as fixed wireless technologies are not mature technologies as of yet, there is only limited comparator data available in the public domain, which would make developing a suitable set of comparators for the relevant concessionaires difficult. As such, taking the data availability and the current market development into account, the efficiency analysis focuses on fixed wireline network operators, mobile network operators and cable (HFC) network operators only.¹⁹

In light of the current market environment and the benefits associated with a national comparison highlighted above, the Authority will further undertake an efficiency benchmark between the two mobile concessionaires (i.e., TSTT's

¹⁹ This decision may be reviewed on a regular basis in the coming years, taking into consideration any market developments and data availability for other concessionaires.

mobile business and Digicel) and the two cable concessionaires (i.e., CCTL and ICNTT).

Furthermore, it is important to note that undertaking an efficiency analysis does not necessarily result in an efficiency adjustment factor for each concessionaire for the LRAIC model as the need for such adjustment factors will depend on the result of the efficiency analysis. For example, if a concessionaire performs well relative to its peer group within the benchmarking sample, no adjustment factor is required. However, if a concessionaire is outperformed by its peer group, this would lead to an efficiency adjustment factor taken into consideration in its LRAIC model.

The proposed approach is summarised in the table below.

Table 5. Overview of the proposed efficiency analysis approach

Concessionaire	National vs. international comparison	Cost/Outputs measure
Fixed operator (TSTT's fixed business)	International benchmarking	Average cost per line Lines per employee
Mobile operators (TSTT's mobile business, Digicel)	National and international benchmarking	Average cost per subscriber ²⁰
Cable operators (ICNTT and CCTL)	National and international benchmarking	Average cost per home passed
All other operators	None	N/A

This decision is in line with experiences in other jurisdictions, where adjusted benchmarking was applied initially.²¹ However, it is also helpful to apply a similar approach for a number of years to ensure predictability and regulatory consistency. However, the Authority may review this decision from time to time

²⁰ The Authority recognizes that traffic is an important driver for mobile networks. However, to ensure a maximum benchmarking sample, the Authority has opted for an average cost per subscriber measure and has controlled for the impact of average usage within the cost adjustment process, as described in Section 3 below.

²¹ As stated in a previous footnote, examples of regulatory authorities that have chosen to apply a benchmarking approach are Jersey and Guernsey. The Authority also understands that Bahamas, Malta and South Africa also applied this approach in the past.

taking into account developments in the market, in the cost information available to the Authority from the concessionaires and the availability of benchmark data.

3 Adjusted benchmarking approach

Below the Authority sets out its preferred approach of determining the efficiency adjustments for the LRAIC model, known as the adjusted benchmarking approach. This involves the five main analysis steps set out in **Figure 2**.

Figure 2. Adjusted benchmarking analysis steps



Source: Frontier Economics

Each step is discussed in more detail below providing an overview of the analysis undertaken within each step as well as providing initial results from the efficiency analysis in the context of Trinidad and Tobago. Further details on selected analysis steps are then presented in Annex 1 to Annex 3.

The information presented in the remainder of this document is indicative only as the Authority is still in the process of undertaking the efficiency analysis. Upon conclusion of this consultation period, the Authority will, taking into consideration any comments received from concessionaires, finalise its approach and develop any required efficiency adjustment factors on the basis of this approach.

3.1 Step 1: Determining the appropriate sample

As an initial step, it is important to identify comparator operators with similar economic and market environments where possible. This could be in terms of:

- network technology used to provide the telecommunications services (i.e., single fixed network operator, single mobile networks operator, and joint fixed and mobile network operators);

- economic development of the relevant jurisdiction (i.e., GDP per capita adjusted for purchasing power parity)²²;
- telecommunications service take-up levels the relevant jurisdiction (i.e., mobile and fixed voice penetration rates);
- total market size of the relevant jurisdiction (i.e., total mobile and fixed connections); and
- demography of the relevant jurisdiction (i.e., total population or number of households, population density and share of urban population).

Taking the above factors into consideration, a suitable benchmarking sample for concessionaires was determined.

3.1.1 Approach taken by the Authority

After reviewing the available evidence, the Authority determined seven selection criteria by which the appropriate benchmarking country sample shall be determined. In addition to determining the set of criteria, it is necessary to set upper and lower limits for each. These applied limits define the acceptable degree of variation on each parameter within the benchmarking sample for the country to be considered similar.

Each country was then assessed against the upper and lower limits chosen for each of the seven characteristics and, it was awarded with a point for similarity to Trinidad and Tobago. Therefore, a country very similar to Trinidad and Tobago would have been evaluated with seven points.

The seven characteristics the Authority has taken into account and the associated sample selection criteria are presented in the table below.

²² Applying Purchasing Power Parity (PPP) currency values allow uniformity of monetary values across countries by controlling for, amongst others, different levels of average income across countries.

Table 6. Country sample selection criteria

Country characteristics	Sample selection criteria
GDP per capita (PPP adjusted)	+/- 20% (relative to Trinidad and Tobago)
Area	+/- 120% (relative to Trinidad and Tobago)
Population density	+/- 30% (relative to Trinidad and Tobago)
Fixed penetration rate	+/- 30% (relative to Trinidad and Tobago)
Mobile penetration rate	+/- 30% (relative to Trinidad and Tobago)
Caribbean country	binary option awarding each Caribbean country 1 point
Island state	binary option awarding each island state 1 point

Evaluating countries by these characteristics generated a list of benchmarking countries which are similar to Trinidad and Tobago. A list of these 62 potential benchmarking countries with a minimum of two out of seven characteristics similar to Trinidad and Tobago is presented in Annex 1.

In a next step the Authority assessed the availability of operational and financial information for the fixed, mobile and cable operators active in these potential benchmarking countries. This data collection exercise was constrained by two issues: (i) many operators do not publish statutory accounts (which are generally the only source of information for financial data) or (ii) the published accounts are not sufficiently disaggregated (i.e., providing separate financial information for each country and business segment of the operator).²³ Therefore, to ensure developing a sufficiently large benchmarking sample, the country benchmarking sample was widened beyond the initial set of preferred benchmarking country sample.²⁴

This exercise resulted in the benchmarking samples for the fixed, mobile and cable operator efficiency analysis presented in the table below.

²³ Many communications operators are active in more than one jurisdiction and/or more than one business segment (i.e. fixed voice services, mobile voice services, data services and cable TV services). However, their published statutory accounts do not necessarily provide financial information disaggregated into each of these geographic and business units.

²⁴ This was particularly the case for the cable benchmarking sample where the search had to be widened to all cable operators active worldwide.

Table 7. Fixed, mobile and cable operator benchmarking sample (excl. concessionaires)

	Fixed operator benchmark	Mobile operator benchmark	Cable operator benchmark
1	Telecom Argentina	Telecom Argentina	Austra (Australia)
2	BTC Bermuda	M3 Bermudas	Cable Bahamas
3	BTO Bulgaria	BTO Bulgaria	Telnet (Belgium)
4	T-Hrvatski Telekom (Croatia)	Entel Chile	Cogeco (Canada)
5	Telefonica Czech Republic	T-Hrvatski Telekom (Croatia)	Unity Media (Germany)
6	Eesti Telekom (Estonia)	T-mobile (Czech Republic)	Icable (Hong Kong)
7	OTE Greece	O2 (Czech Republic)	J:Com (Japan)
8	Cable & Wireless Guernsey	Eesti Telekom (Estonia)	Cabelmas (Mexico)
9	Invitel (Hungary)	Magyar Telekom (Hungary)	Cablevision (Mexico)
10	Magyar Telekom (Hungary)	Meteor (Ireland)	Megacable (Mexico)
11	Eircom (Ireland)	Jordan Telecom	Ziggo (Netherlands)
12	Jordan Telecom	ONE (Macedonia)	Multimedia Polska Gdynia
13	Lattelecom (Latvia)	TP SA Poland	Cabovisão (Cogeco Portugal)
14	TEO Lithuania	Slovak Telekom (Slovakia)	Zon Multimedia (Portugal)
15	Telmex (Mexico)	CANTV (Venezuela)	Ono (Spain)
16	TP SA (Poland)	Cable and Wireless (Guernsey)	Virgin Media (United Kingdom)
17	Slovak Telekom (Slovakia)		Charter Communications (United States)
18	CANTV (Venezuela)		Time Warner Cable (United States)

3.2 Step 2: Identification of output and cost measures

The adjusted efficiency benchmarking will be undertaken on the basis of cost efficiency and labour productivity measures. The former compares the costs per unit of output produced across operators and the latter compares total units of output per unit of labour.

There are, in theory, several output and cost measures applicable in the context of telecommunications service provision. However, in practice, the choice will be determined by data availability for each measure and the identification of the output measure that can be considered the main driver of cost.

3.2.1 Output measures

There are several output measures that could form the basis for the benchmarking analysis including, amongst others:

- total number of access lines;
- total number of homes passed;
- coverage of the network in terms of area;
- total voice traffic;
- total data traffic;
- total number of SMS and MMS sent; and
- percentage of fixed access lines that are leased circuits.

After careful deliberation and taking data availability into account, the Authority has decided to use:

- the number of access lines as the main output measure for fixed operators;²⁵
- the number of subscribers as the main output measure for mobile operators;²⁶ and
- the number of homes passed as the main output measure for the cable network.²⁷

In all cases this reflects that most of the costs of fixed, mobile and cable operators are related to the access network, for which the key cost drivers are the number of lines in fixed wire line networks and call traffic for mobile networks.

The Authority recognises that the remaining output measures may also be important cost drivers. Subject to data availability, it will aim to take these measures into account in the analysis, as part of the adjustment process.

²⁵ The number of fixed access lines for telecommunications operators are commonly reported in operators' financial accounts, propriety third party databases and other publicly available data sources. This is not consistently the case for the other output measures listed above.

²⁶ The Authority recognises that the average annual voice traffic per connection to also be an important output measure for mobile operators. However, due to limited data availability of average usage information, it has decided to use an average cost per subscriber measure and control for the impact of average usage on costs within the cost adjustment process, discussed in the next Section.

²⁷ The number of homes passed is a common measure for the network size of a cable operator and therefore a suitable output measure.

3.2.2 Cost measures

A suitable cost measure should reflect the total level of costs and must be publicly available on a reliable basis for all operators within the benchmarking sample. The Authority considers a total cost measure based on operating expenditure, plus depreciation costs, plus a return on capital employed (ROCE) as most suited. This is due to the following:

- ▣ operating cost information is commonly publicly available from audited financial accounts;
- ▣ the measure includes depreciation as the costs of using tangible assets over several periods. Depreciation ensures that these costs are allocated to periods in which the tangible assets are used;
- ▣ it excludes cost items such as taxes which are typically considered to be outside the control of the firm and therefore do not relate to efficiency;
- ▣ it also excludes exceptional items that do not represent the underlying trend in operating costs; and
- ▣ the ROCE captures the required return on any investment made independently of the financial structure of the operators and should result in the measured cost being invariant under build or buy decisions.

Note that the ROCE is not readily available in financial accounts. As such, it is necessary to derive it based on the weighted average cost of capital (WACC) and the net assets of each operator as stated in the balance sheet of each operators' financial accounts. All but the WACC is commonly available in financial accounts. To ensure consistency²⁸, the relevant WACC values for Trinidad and Tobago, as currently being determined by the Authority,²⁹ will be applied across all operators within the sample (i.e. the WACC for a fixed business will be used in the fixed wireline benchmarking and the mobile-specific WACC will be applied within the mobile benchmarking analysis).

For concessionaires, the relevant cost measure is informed by the disaggregated data from the costing exercise.³⁰ The total costs of all comparator operators are

²⁸ Applying the same WACC across all operators within the benchmarking sample helps to control for underlying differences in risk premia across countries which are not within the control of the operators.

²⁹ The Authority is currently determining appropriate WACC values for concessionaires. For further details please refer to the separate consultation on the WACC analysis (<http://www.tatt.org.tt/Consultations/ConsultativeDocuments.aspx>). The efficiency analysis will use the final WACC values arising from this process.

³⁰ Note, to ensure consistency within the benchmarking analysis, the costing data used for concessionaires is also based on statutory accounts information and further data provided as part of the CCA and LRAIC data submissions. All costing information reflects historic costs.

converted into Trinidadian Dollars, based on year end exchange rates (at market rates).

Given the above, the total costs measure underlying all three efficiency benchmarking analyses is based on the following formula:

$$Total\ costs = Operating\ costs + Depreciation + WACC * Net\ Assets$$

3.2.3 Resulting output and average cost values of comparator operators

Within this section, the Authority presents an overview of the unadjusted total average cost values and output measures of each comparator operator currently contained in the three benchmarking samples. These are as follows:

- ▣ unadjusted total cost per line of fixed operators (presented in **Figure 3**);
- ▣ average lines per employee of fixed operators (presented in **Figure 4**);
- ▣ unadjusted total cost per subscriber of mobile operators (presented in **Figure 5**); and
- ▣ unadjusted total cost per home passed of cable operators (presented in **Figure 6**)

Note that for confidentiality reasons, the corresponding total cost measures for concessionaires are not included in the graphs.

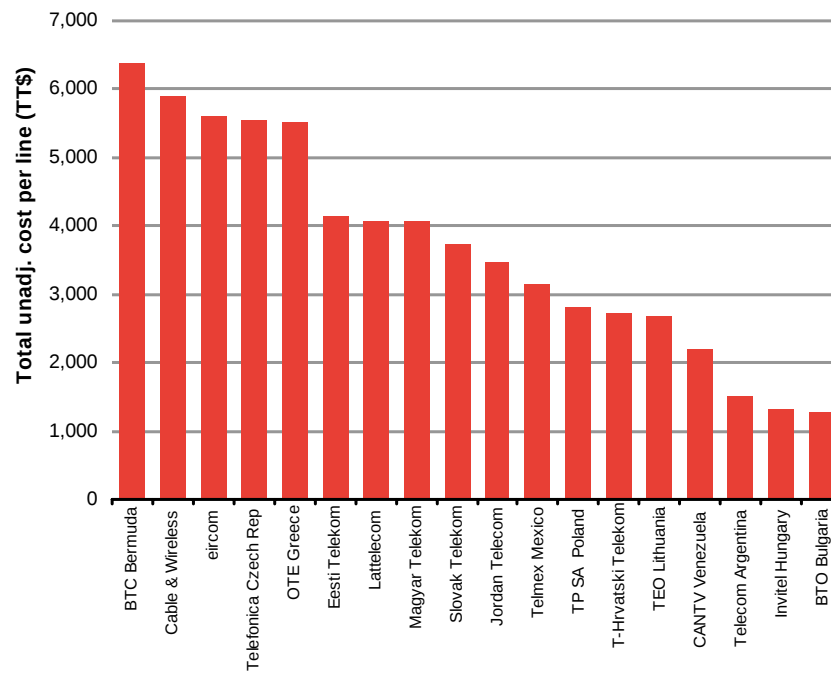
Figure 3. Total unadjusted costs per line (TT\$) – Fixed operator benchmark

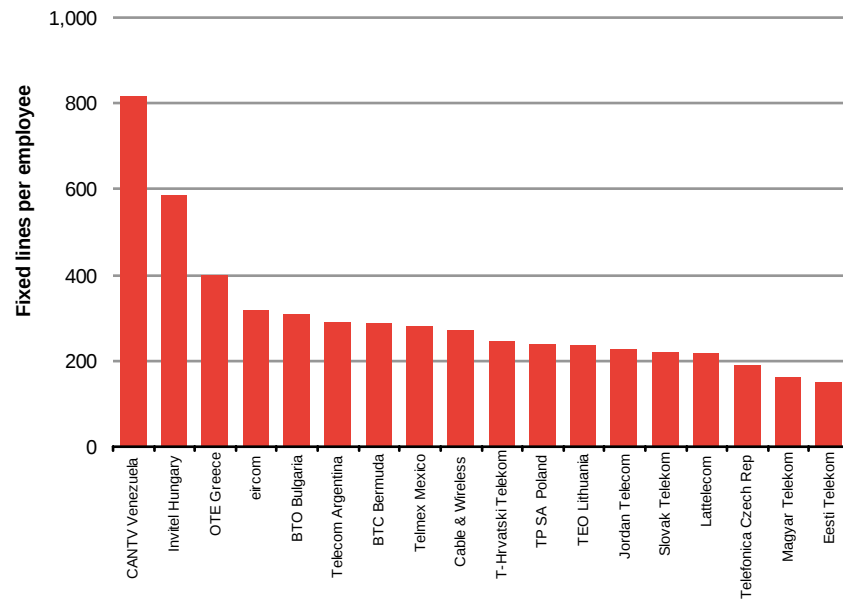
Figure 4. Fixed lines per employee – Fixed operator benchmark

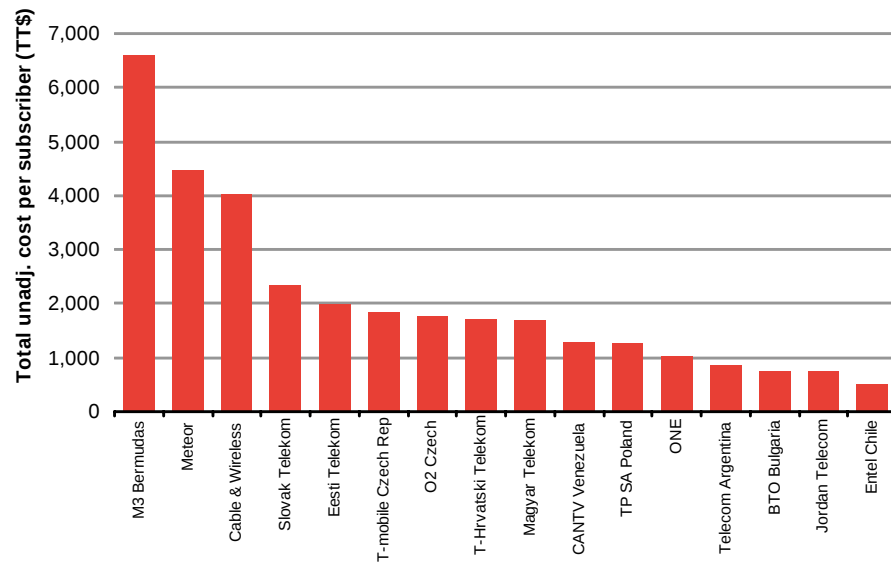
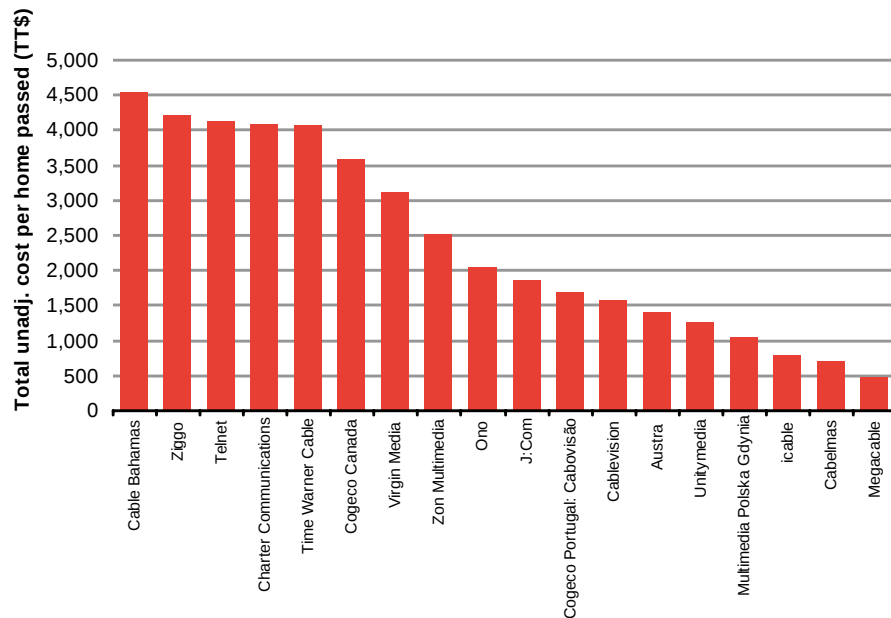
Figure 5. Total unadjusted costs per subscriber (TT\$) - Mobile operator benchmark

Figure 6. Total unadjusted cost per home passed (TT\$) - Cable operator benchmark

3.3 Step 3: Identification of cost adjustments

The aim of the cost adjustments is to account for any differences in the observed cost of the operators within the sample that are not attributable to the operators themselves (i.e., are caused by exogenous factors such as their operating environment).³¹ Ideally one would want to control for all exogenous cost drivers. However, in practice, the possible adjustments are dependent on the availability of the information required to undertake the adjustments. Below, the Authority sets out the potential cost drivers considered within the efficiency analysis. Further potential cost drivers that could not be controlled for are then presented in Annex 2.

³¹ As the Authority was limited in the choice of its preferred country benchmark sample by the underlying data availability, this step to adjust for operator specific heterogeneity is especially important.

3.3.1 Cost drivers considered within the benchmarking analysis

The table below provides an overview of the potential cost adjustments the Authority has considered as part of its efficiency analysis. For each potential cost driver the expected impact on total costs is outlined.

Table 8. Potential cost adjustments considered within the benchmarking analysis

Potential cost driver	Expected impact on costs
Total population	The larger the total population, the higher the total network costs ³²
Geographic network coverage(homes passed for cable network)	A more extensive geographic coverage is likely to lead to higher total costs
Population density	A lower population density will require many smaller exchanges which increases the total network cost
GDP per capita	A higher GDP per capita will normally increase total operational costs
Urbanisation	A higher urbanisation will normally decrease the total costs ³³
Penetration	A higher penetration will normally increase total costs
Area	A country with a larger area will normally incur higher costs than other network operators.

The required data for the potential adjustments above was sourced from publicly available information (including operators' annual accounts) and third party proprietary databases³⁴.

The Authority recognises that average labour costs are likely to differ across the countries within the benchmarking samples. As such, any resulting impact would ideally be controlled for directly within the analysis. However, due to data

³² Ideally this should reflect the network coverage of the relevant operator. In the absence of this information the total land area of a country will be used.

³³ There are commonly two diverging effects of urbanisation on fixed network operators' costs: (i) higher population density in urban areas reduces the average cost per line, and (ii) the majority of fixed network infrastructure in urban areas requires underground cabling which is more expensive than areal cabling. Overall, the former effect outweighs the latter within the benchmarking sample, as many jurisdictions within the sample do not require underground cabling in urban areas.

³⁴ such as, the ITU World Telecommunication/ICT Indicators database and GlobalComms database

availability, the impact of average labour cost on operators' total costs could not be established. However, due to the high correlation between GDP per capita and wage rates, the impact of labour costs is indirectly captured within the analysis (via the GDP per capita adjustment factor).

Based on the list above, the Authority has tested the statistical significance of each potential cost driver set out above. This was undertaken separately for each of the three benchmarking samples. Testing the statistical significance and the resulting direction and size of any relationship is best undertaken with the help of regression analysis.

Regression analysis in the context of cost adjustment factors

A regression analysis allows testing for the existence of any statistical relationship between operators' costs (i.e. as a 'dependent' variable) and a range of potential exogenous (and endogenous) cost drivers (referred to as 'independent' variables).³⁵ This relationship may be tested on the basis of total costs or some average cost measure such as average costs per line or cost per home passed. Examples for independent variables that are not under control of the operators include, amongst others variables covering the geographic, regulatory and economic environment differences across the operators under consideration.

An econometric form for this estimation is a linear estimation approach. The coefficients of the independent variables can be interpreted: The coefficient of an independent variable indicates the unit change in average costs that result from an increase of one unit of the independent variable.

$$\text{average costs} = \alpha + \beta_1(\text{geographic var}) + \beta_2(\text{regulatory var}) + \beta_3(\text{economic var}) + u$$

The regression analysis therefore allows one to determine:

- ▣ whether there is any statistical significant relationship between the cost measure and a potential cost driver; and if so,
- ▣ what the relevant size and direction of this relationship is (via the regression coefficient).

Within its analysis, the Authority has tested the statistical relationship of all the potential cost drivers listed in **Table 8** above. This also involved testing different combinations of potential dependent and independent variables and testing various functional forms of the cost regression. Based on the outcome of this

³⁵ In theory, the regression analysis can test for both exogenous cost drivers and endogenous cost drivers (i.e. factors which are under the control of the operators, such as total number of staff). This is commonly undertaken as part of the econometric efficiency analysis approaches discussed in Section 2.2.1 above.

process and the best possible model specification for each of the three benchmarking samples was chosen. The resulting regression coefficients for each of the three benchmarking samples are presented in **Table 9**.

Table 9. Statistical relevant exogenous cost drivers

Coefficient	Fixed operator benchmark	Mobile operator benchmark	Cable operator benchmark
Area	<i>Not statistically significant</i>	<i>Not statistically significant</i>	<i>Not statistically significant</i>
Urbanisation	-2,726.25	<i>Not statistically significant</i>	<i>Not statistically significant</i>
Population density	<i>Not statistically significant</i>	<i>Not statistically significant</i>	<i>Not statistically significant</i>
Penetration	<i>Not statistically significant</i>	<i>Not statistically significant</i>	3,597.64
GDP p.c.	0.07	0.09	0.04
Population	<i>Not statistically significant</i>	<i>Not statistically significant</i>	<i>Not statistically significant</i>
Homes passed	<i>Not statistically significant</i>	<i>Not statistically significant</i>	<i>Not statistically significant</i>
Average usage	<i>Not statistically significant</i>	-2.76	<i>Not statistically significant</i>

The information presented in the table above can be interpreted as follows. In the case of the fixed operator benchmarking sample an increase of the GDP per capita by one unit will increase the average costs per line by 0.07 units.

3.4 Step 4: Deriving the adjusted total costs measure

The adjusted cost measures for each comparator operator³⁶ are derived by applying each of the relevant operator-specific adjustment factors³⁷ to its unadjusted costs (as set out in Section 3.2 above). As mentioned previously, there is no need to adjust the cost values of concessionaires as the adjustment approach aims to make the costs of the comparator operators more reflective of the costs incurred when operating in Trinidad and Tobago.

³⁶ i.e., average cost per line for fixed operators, average cost per subscriber for mobile operators and average cost per home passed

³⁷ i.e., the percentage difference of the relevant variable relative to the Trinidad and Tobago operators times the variable coefficient

The analysis steps required in deriving the adjusted cost measures is illustrated in the text box below.

Illustrative example of how the adjusted cost measures are derived

The benchmarking sample specific regression analysis (discussed in Section 3.3.2 above) helps to identify the set of statistical significant exogenous cost drivers. It further provides direction and the degree of the underlying impact on costs via the regression coefficient.

Based on the above information, the adjusted cost measure for each comparator operator within that sample can be derived based on the following analysis steps:

1. For each cost driver and operator, the underlying percentage difference between the operator's country and Trinidad and Tobago is calculated.

$$\text{Difference}_{\text{Country A}} = \frac{(\text{Area}_{T\&T} - \text{Area}_{\text{Country A}})}{\text{Area}_{\text{Country A}}}$$

2. The operator-specific adjustment factor is derived by multiplying the regression coefficient of the cost driver with the corresponding percentage difference to Trinidad and Tobago

$$\text{Area adjustment factor}_{\text{Country A}} = \text{Coefficient}_{\text{Area}} * (\text{Difference}_{\text{Country A}})$$

3. A small number of adjustment factors can have a very large impact on the costs. Therefore a cap of -100% is applied to ensure that no one single adjustment factor has a too large of an impact.
4. A total adjustment factor for each operator is derived by adding up all individual, operator-specific adjustment factors calculated for each relevant cost driver

$$\text{Total adj. factor}_{\text{Country A}} = (\text{Area adj. factor}_{\text{Country A}}) + (\text{Pop adj. factor}_{\text{Country A}}) + (\text{Penetration adj. factor}_{\text{Country A}})$$

5. If required, a lower limit of -100% is applied to ensure that the adjusted cost levels remain positive

This total adjustment factors are then applied to the operator's unadjusted total costs.

Each adjustment factor may either increase or decrease the total cost of the benchmark operator so that the resulting adjusted total costs of that operator are more reflective of the cost that it would incur in an operating environment as faced by concessionaires. For example, the cost adjustments undertaken within the fixed benchmarking sample leads to a total cost adjustment of -22.8% for the

fixed operator in Guernsey and a 184.3% increase in the adjusted costs for the Bulgarian fixed operator.

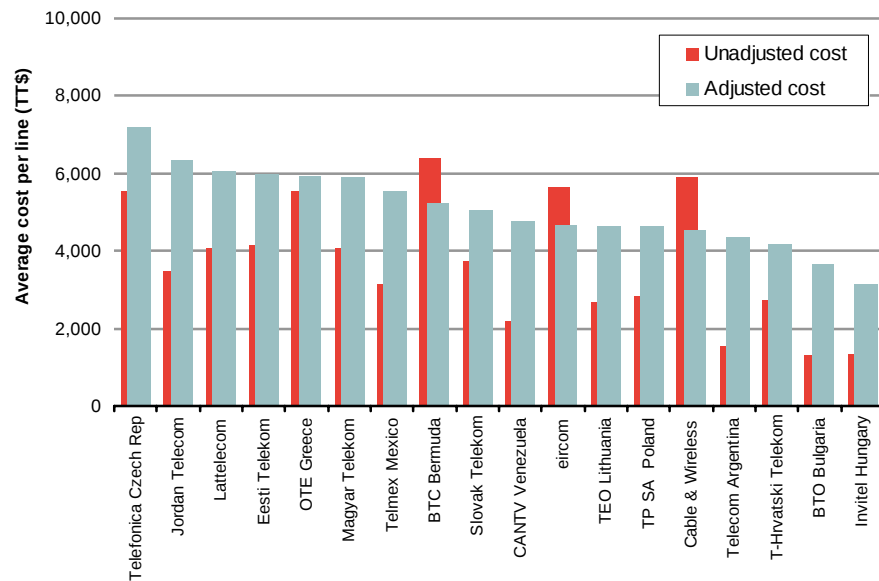
Irrespective of the initial selection process outlined in Section 3.1, some adjustment factors can have a large impact due to the difference between the countries in the benchmarking sample and Trinidad and Tobago. Data was typically available for operators in larger jurisdictions and as such the size of Trinidad and Tobago, in terms of area, total fixed and mobile subscribers and other economic indicators, is towards the lower end of the range for the sample. For example, the difference in total land area across the sample is likely to lead to very large adjustment factors for some operators within the benchmarking sample. Therefore, as mentioned in the illustrative example above, the Authority applied a lower boundary for the adjustment factor. Each individual adjustment factor was limited to - 100%.³⁸

In the remainder of this section, the Authority sets out the adjusted (and unadjusted) cost measures derived for each of the three efficiency benchmarking analyses. These adjusted cost measures will form the basis of the efficiency benchmarking analysis for the fixed, mobile and cable operators (i.e. to which the concessionaires' financial performance will be measured against). As mentioned previously, for confidentiality reasons the cost measures for concessionaires are not reported in this document.

Fixed operator benchmark

Figure 7 below presents the unadjusted and adjusted costs per line for each of the comparator operator contained in the fixed operator benchmark.

³⁸ To ensure that all adjusted cost values were greater than zero, a lower limit of -100% was applied to the total adjustment factor for each comparator operator.

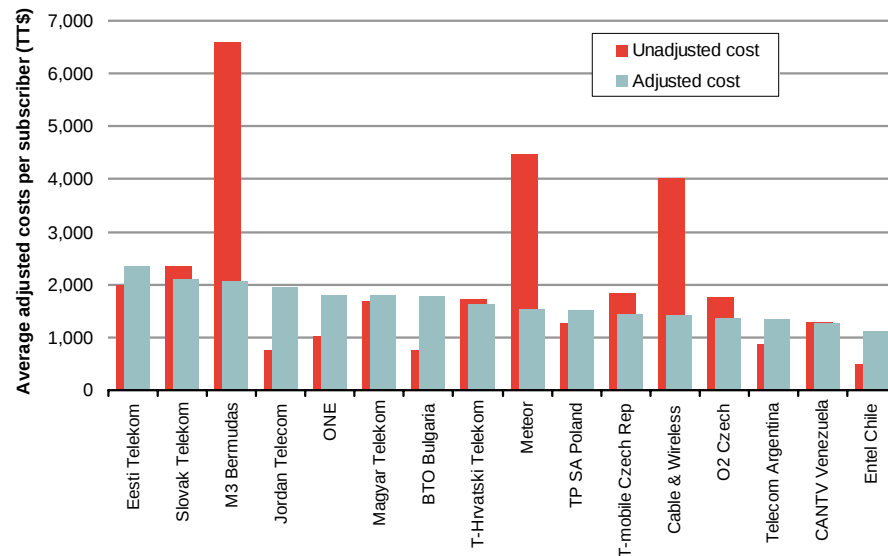
Figure 7. Adjusted and unadjusted costs per line - Fixed operator benchmark

As illustrated in the graph above, the cost adjustment process has resulted in seven comparator operators' cost being downward adjusted, with the remaining eleven unadjusted cost values requiring overall upward adjustments. The resulting adjusted cost per line values range from TT\$ 3,159 average costs per line for Invitel in Hungary to TT\$ 7,176 average cost per line for Telefonica in the Czech Republic.

Mobile operator benchmark

The graph below sets out the unadjusted and adjusted costs per subscriber for each of the comparator operator contained in the mobile operator benchmark.

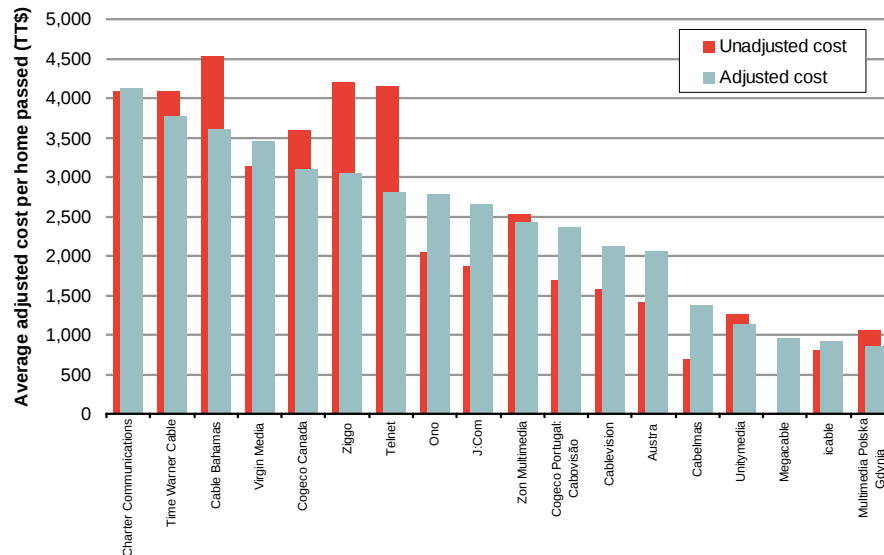
Figure 8. Adjusted and unadjusted costs per subscriber – Mobile operator benchmark



The adjustment of mobile operators' costs has resulted in some costs per subscriber values being adjusted upwards; however, most were adjusted downwards. The resulting adjusted cost values range from TT\$ 2,340 per subscriber for Eesti Telekom in Estonia to nearly TT\$ 1,100 per subscriber for Entel in Chile.

Cable operator benchmark

The costs per home passed of cable operators were also adjusted in the previously described way. Again the adjustment undertaken by the Authority resulted in downwards as well as upwards adjustments to the comparator operators. As presented in **Figure 9** below, the resulting adjusted costs per home passed vary between TT\$ 860 for Multimedia Polska in Poland and TT\$ 4,130 for Charter Communications in the United States.

Figure 9. Cable market: Adjusted and unadjusted costs per home passed

3.5 Step 5: Deriving relative efficiency of concessionaires

As a final step, the relative cost and operational performance of concessionaires is assessed. This is undertaken by measuring concessionaires' average cost levels and lines per employee, relative to those exhibited by the relevant set of comparator operators. This requires three further analysis steps:

- ▣ ranking the adjusted cost and operational values of the set of comparator operators (i.e. in ascending order for the average cost and descending order for the lines per employee);
- ▣ defining a target level for each sample to which the concessionaires' performance will be assessed against; and
- ▣ determining the concessionaire's current performance relative to that target level (i.e. the observed difference between its performance and that exhibited by the defined operator).

This is further illustrated in the text box below.

Illustrative example of deriving relative efficiency values

Assume the average costs per minute of two mobile concessionaires are TT\$ 1.10 and TT\$ 1.40, respectively. In addition, the following adjusted costs per minute of comparator operators were generated as part of the adjusted benchmarking approach:

Comparator operator	Adjusted average cost per min	
Operator 1	TT\$ 1.00	Upper quartile
Operator 2	TT\$ 1.30	
Operator 3	TT\$ 1.35	Middle upper quartile
Operator 4	TT\$ 1.41	
Operator 5	TT\$ 1.43	Middle lower quartile
Operator 6	TT\$ 1.45	
Operator 7	TT\$ 1.49	Lower quartile
Operator 8	TT\$ 1.50	

Further assuming that the relevant efficiency target is defined as the average performance of the upper quartile operator, this would result in an efficiency target of TT\$1.15 per minute [i.e. $(TT\$1.00 + TT\$1.30)/2$]

The first concessionaire, with costs per minute of TT\$ 1.10, would therefore be deemed to be sufficiently efficient, as it reported average cost below the target level (i.e. TT\$ 1.10 per min. vs. TT\$ 1.15 per min). Thus, no further efficiency adjustments would be required for that particular concessionaire.

In contrast, the second concessionaire's average costs are approximately 18% above the required target level [i.e. $(TT\$1.40 - TT\$ 1.15) / TT\$1.40 = 18\%$].

Key to the entire process is defining the target level, as this determines the strictness of the efficiency analysis. Common efficiency target levels are, amongst others, the median, upper quartile, quantile or decile cost across all comparator operators. This is illustrated further on the basis of the average cost per line benchmarking data presented in the previous section. For example, defining the efficiency target level for the relevant concessionaire (i.e. TSTT's fixed business) as:

- the median cost observed across all comparator operator would result in a target level of TT\$ 5,029 per line;

- the most efficient cost contained in the upper quartile of all comparator operators would increase the target level to TT\$ 4,627 per line; and
- the most efficient costs contained in the upper decile of all comparator operators would further increase the target level to TT\$ 4,176 per line.

It is important to note that the above process will result in zero efficiency adjustment factors for concessionaires which currently outperform their target level (i.e., the concessionaire is deemed to be sufficiently efficient). For example, if the relevant efficiency target for fixed wireline concessionaires was set to be the most efficient cost contained in the upper quartile of the sample of comparator operators and a concessionaire would exhibit a average cost per line below TT\$ 4,627 per line, this would trigger no further efficiency requirements for that concessionaire.

The Authority generally recognizes the need to control, as much as possible, for any exogenous cost differences within the efficiency benchmarking sample. It has endeavoured to do so by means of:

- selecting the appropriate set of comparator companies (i.e. Step 1 of the proposed approach); and
- adjusting the total cost of each comparator company within the sample to control for any potential, exogenous cost difference (i.e. Step 3 and 4 of the proposed approach).

Although the above aim to control for as many external cost differences as possible, both analysis steps are constrained by the underlying data availability. As such, some of the observed differences in the (adjusted) cost/output measures are likely to not be reflective of concessionaires' relative efficiency but instead be driven but external cost drivers not fully being controlled for within the analysis. Recognizing this potential limitation, the Authority endeavours to ensure that any efficiency adjustments applied to the LRAIC model outputs represent a conservative measure of concessionaires' relative inefficiency. This is can be achieved by setting a less strict efficiency target level for concessionaires.

Taking the above into account, the Authority has decided to apply the median cost of all comparator operators within each of the three benchmarking samples as the relevant efficiency target. The Authority considers that taking into account the strengths and weaknesses of the currently chosen approach this efficiency target level represents a fair and reasonable target for concessionaires.

Applying this target level, results in the efficiency targets for concessionaires as set out in the table below.

Table 10. Relative efficiency targets by concessionaire

Concessionaire	Relative efficiency targets
Fixed operator (TSTT's fixed business)	TT\$ 5,029 average cost per line
	247 lines per employee
Mobile operators (TSTT's mobile business, Digicel)	TT\$ 1,621 average cost per subscriber
Cable operators (ICNTT and CCTL)	TT\$ 2,651 average cost per home passed
All other operators	None

The results of the efficiency analysis will be used to provide the best estimate of the level of efficient costs as set out in the Costing Methodology. When determining the appropriate level of prices the Authority will use this as one input but may combine this with other evidence in order to set forward looking prices. For example when setting a multi-year price control it may also be appropriate to forecast the future rate of productivity growth, for example based on a TFP time series approach.

Application of efficiency adjustment factor in the LRAIC model

The choice of adjusting either the inputs or the outputs (by the same efficiency adjustment factor) should, in principle, have no bearing on the overall results. The Authority is minded to apply the efficiency adjustment factor, if required, to the unit cost estimates, resulting from the LRAIC model. The Authority is of the view that adjusting the LRAIC model outputs (rather than inputs) represents the most transparent approach.

Annex 1: Benchmarking country selection

Table 11. Benchmarking country list

Country	Points	Country	Points
Antigua and Barbuda	5	Chile	2
St. Lucia	5	Comoros	2
St. Vincent and the Grenadines	5	Croatia	2
Barbados	4	Dominican Republic	2
Grenada	4	Estonia	2
Jamaica	4	Finland	2
Seychelles	4	Germany	2
St. Kitts and Nevis	4	Guernsey	2
Bermuda	4	Haiti	2
Cyprus	3	Hong Kong	2
Czech Republic	3	Iceland	2
Dominica	3	Ireland	2
El Salvador	3	Israel	2
Hungary	3	Italy	2
Kuwait	3	Jersey	2
Luxembourg	3	Kazakhstan	2
Maldives	3	Kiribati	2
Malta	3	Latvia	2
Mauritius	3	Lebanon	2
Poland	3	Lithuania	2
Portugal	3	New Zealand	2
Qatar	3	Philippines	2
Singapore	3	Romania	2
Slovakia	3	São Tomé and Príncipe	2
United Kingdom	3	Saudi Arabia	2
Argentina	2	Sri Lanka	2
Australia	2	Taiwan	2
Bahamas	2	Ukraine	2
Bahrain	2	Uruguay	2
Bosnia and Herzegovina	2	Venezuela	2
Bulgaria	2	Vietnam	2

Annex 2: Additional potential cost drivers

In addition to the cost adjustment factors taken into consideration within the efficiency analysis, there are further potential exogenous cost drivers which ideally, if found to be statistically significant, should be included in the analysis. However, data availability on these factors has not allowed the Authority to test for the relevance of these factors for the efficiency benchmarking analyses. The table below provides an overview of some of the main potential additional cost drivers and their expected impact on total costs.

Table 12. Potential further cost drivers

Cost adjustment	Impact on costs
Total traffic and/or average traffic per line	Higher (average) traffic will drive total costs upwards due to extra transmission capacity requirements.
Subscriber growth	Operators with fast growing subscriber growth are likely to have a higher capital expenditure than those in matured market environment
Percentage of traffic in the busy hour	Many networks are designed to meet peak demand. Thus, a higher share is likely to increase average costs
Traffic mix	Different types of traffic utilise the network differently and those may have different unit cost
Per minute interconnection charges³⁹	Higher unit interconnection charges lead to higher interconnection outpayments and thus higher total costs.
Average labour costs	Labour costs are an important element of total operating costs. However, the impact of labour cost on total costs is not straightforward. ▪ On the one hand, an operator's choice of capital and labour will vary according to wages rates and capital prices. As most capital equipment is internationally traded, it is likely that for a given level of output, more labour input is applied in lower wage countries. ▪ But, on the other hand, low wage countries could at best replicate the labour-to-capital ratio of operators in developed countries and thereby have lower total costs.⁴⁰ This suggests that, when replicating the developed country's labour-to-capital ratio, this would result in lower total costs for an operator in a low wage country and thus, would make this operator appear relatively

³⁹ This adjustment is subject to data availability.

⁴⁰ Low wage countries have to pay the same capital prices but only lower labour costs.

more efficient.

Although it would have been conclusive to control for potential labour cost differences within the analysis directly, this was not possible (due to a lack of available data).

However, the Authority is of the view that including GDP per capita as one of the adjustment factors should implicitly control for the labour cost effect.

Annex 3: Overview of benchmarking samples

Table 13. Fixed operator benchmarking sample (excluding concessionaires)

Country	Operator	Total unadjusted costs (TT\$ millions)	Lines	Employees	Total unadjusted costs per line (TT\$ per line)	Lines per employees	Total adjusted costs per line (TT\$ per line)
Bermuda	BTC Bermuda	366	57,400	200	6,378	287	5,227
Czech Republic	Telefonica Czech Rep	9,822	1,771,000	9,384	5,546	189	7,176
Croatia	T-Hrvatski Telekom	4,056	1,491,622	6,044	2,719	247	4,176
Bulgaria	BTO Bulgaria	2,607	2,030,000	6,552	1,284	310	3,651
Hungary	Invitel Hungary	1,125	845,000	1,440	1,331	587	3,159
Hungary	Magyar Telekom	7,070	1,740,619	10,828	4,062	161	5,889
Poland	TP SA Poland	19,880	7,033,000	29,249	2,827	240	4,627
Latvia	Lattelecom	2,282	560,000	2,576	4,076	217	6,058
Estonia	Eesti Telekom	1,475	357,000	2,371	4,131	151	5,958
Jordan	Jordan Telecom	1,746	501,000	2,206	3,485	227	6,332
Slovakia	Slovak Telekom	4,121	1,100,700	5,000	3,744	220	5,029
Venezuela	CANTV Venezuela	10,965	4,999,630	6,124	2,193	816	4,761
Argentina	Telecom Argentina	6,615	4,364,000	15,000	1,516	291	4,323
Mexico	Telmex Mexico	49,902	15,882,000	56,796	3,142	280	5,528
Greece	OTE Greece	27,531	4,992,180	12,506	5,515	399	5,929
Lithuania	TEO Lithuania	1,940	722,000	3,060	2,687	236	4,634
Guernsey	Cable & Wireless	335	56,827	210	5,890	271	4,545
Ireland	eircom	11,370	2,022,000	6,363	5,623	318	4,667

Table 14. Mobile operator benchmarking sample(excluding concessionaires

Country	Operator	Total unadjusted costs (TT\$ millions)	Total subscribers (in thousands)	Total unadjusted costs per subscriber (TT\$ per subscriber)	Total adj. costs per subscriber (TT\$ per subscriber)
Guernsey	Cable & Wireless	180	45	4,016	1,413
Bermuda	M3 Bermudas	124	19	6,598	2,052
Czech Republic	T-mobile Czech Rep	10,072	5,464	1,843	1,422
Czech Republic	O2 Czech	9,699	5,498	1,764	1,362
Bulgaria	BTO Bulgaria	1,136	1,500	757	1,771
Hungary	Magyar Telekom	8,620	5,120	1,684	1,792
Estonia	Eesti Telekom	1,522	767	1,984	2,338
Croatia	T-Hrvatski Telekom	4,879	2,859	1,707	1,621
Poland	TP SA Poland	17,237	13,774	1,251	1,526
Slovakia	Slovak Telekom	5,542	2,376	2,332	2,110
Jordan	Jordan Telecom	1,458	1,939	752	1,953
Venezuela	CANTV Venezuela	12,171	9,502	1,281	1,254
Argentina	Telecom Argentina	14,022	16,300	860	1,345
Chile	Entel Chile	8,212	16,300	504	1,101
Ireland	Meteor	4,603	1,030	4,467	1,531
Macedonia	ONE	768	747	1,028	1,803

Table 15. Cable operator benchmarking sample (excluding concessionaires)

Country	Operator	Total unadjusted costs (TT\$ millions)	Total homes passed (in thousands)	Total unadjusted costs per home passed (TT\$ per home passed)	Total adj. costs per home passed (TT\$ per home passed)
Poland	Multimedia Polska Gdynia	1,156	1,100	1,051	857
Portugal	Zon Multimedia	7,870	3,117	2,525	2,421
United Kingdom	Virgin Media	39,062	12,500	3,125	3,442
Spain	Ono	14,337	7,000	2,048	2,789
Belgium	Telnet	11,598	2,800	4,142	2,805
Japan	J:Com	22,852	12,240	1,867	2,651
Australia	Austra	3,517	2,500	1,407	2,060
Netherlands	Ziggo	17,137	4,075	4,205	3,042
United States	Time Warner Cable	109,205	26,766	4,080	3,773
Mexico	Megacable	2,206	4,599	480	954
Hong Kong	icable	1,774	2,238	792	912
Canada	Cogeco Canada	5,619	1,565	3,590	3,095
Portugal	Cogeco Portugal: Cabovisão	1,530	905	1,691	2,361
United States	Charter Communications	48,617	11,900	4,085	4,135
Mexico	Cabelmas	1,919	2,738	701	1,377
Mexico	Cablevision	2,951	1,869	1,579	2,119
Germany	Unitymedia	11,099	8,786	1,263	1,134
Bahamas	Cable Bahamas	485	107	4,542	3,616

ANNEX 4: Decisions on Recommendations

The following summarizes the comments and recommendations received from stakeholders on the first draft of this document (dated May 13th 2010), and the decisions made by TATT as incorporated in this revised document (dated October 26th 2010).

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT’s Decisions
GENERAL	TSTT	In its introductory comment, TSTT welcomes the opportunity to comment on consultation document. It further sets out the main concerns with the overall document, namely that the current proposal “<i>lacks the academic rigor, transparency and forward looking features</i>”. In particular, TSTT considers the current document: ▪ to lack sufficient references to support the theoretical approach; ▪ on numerous occasions not to provide a sound justification for the proposed approach; ▪ to undervalue the process and thus importance of the efficiency study; and not to include sufficient details to provide confidence in the results.		The Authority has recognised TSTT’s concern about the potential limited detail on selected elements of its proposed approach. The second consultation document sets out the proposed approach in more detail. The second document further aims to address the main issues raised by concessionaires in response to the first consultation document. The four points raised by TSTT in its introductory comment are also addressed in more detail in the

⁴¹ 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

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT’s Decisions
				Authority’s responses to TSTT’s remaining comments set out below.
	CCTL	In reference to Section 2.2.3 of the consultation document (where the Authority states that the efficiency analysis will primarily focus on fixed and mobile operators, as only limited data is available for fixed wireless and cable operators and regulated prices in liberalized markets are set with reference to estimates of efficient costs of established operators), CCTL asks the Authority to clarify why the company is being required to expend time and resources to participate in the development of the <u>cost modelling process</u> if this is not necessary.		The Costing Methodology published by the Authority on May 29th 2008, specifies the Authority’s objectives for establishing the cost modelling process for regulatory purposes. One reason put forward for the purpose of the costing model is that it would allow the Authority to detect unfair cross subsidies or any act of anti-competitive pricing. Given that CCTL holds a fixed domestic concession, and provides three services on the same network and is a major operator in one of those services, the purposes of the cost model are very relevant. Since the initial consultation document was published, the Authority has continued to gather information from other CATV operators to allow for a robust benchmark sample. More details will be

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT's Decisions
				provided in the second round consultative document
Section 1 - Overview				
1. Overview	TSTT	In reference the 'Costing Methodology' (2008) and the 'Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago' (2010), and the Telecommunications Act, TSTT raises concern about two areas: ▪ Process. TSTT states that a single round of consultation is not in line with the general consultation procedure as stipulated in Section 18 (4) of the Telecommunications Act and Section 6.2 of the 'Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago'. As such, TSTT urges the Authority to undertake at least one more round of consultation on the efficiency study. ▪ Timelines. TSTT notes that the proposed time line, presented on page 4 of the consultation document is shorter than the 18 month time line presented in Section 5.1 of the Costing Methodology document. TSTT is "<i>disappointed the Authority failed to include the appropriate timeline in accordance with the costing methodology but even more disappointed in the Authority's blatant attempt to reduce the timeline.</i>"	We concur with the process explained in Section 6.2 of the Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago (2010) document. Thus, TSTT urges the Authority given the nature of this document is a consultation at least one more round of consultation should be offered to complete the two stage process. TSTT recommends that the Authority amend the current consultation including the eighteen (18) months period.	The Authority sets out below its responses to TSTT's comments on the process and timeline. ▪ Process. The Authority agrees with TSTT that a single round of consultation would not be appropriate in this context, and not in line with the general consultation procedure. It would like to assure concessionaires that it was never its intention to only consult once on the proposed efficiency study. As stated above, a second consultation document will be published at the end of October or early November 2010. This document provides further details on the proposed approach, as well as aims to address, where possible, the main

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				comments received from concessionaires on the initial consultation document. The Authority is of the view that this process provides sufficient transparency for all concessionaires on the proposed efficiency analysis as well as it allows all interested parties to comment on its proposed approach. ▪ Timelines. The timeline presented in the Costing Methodology document was indicative and high-level only and the Authority is not bound by it. The Authority would further like to remind TTST that, when Frontier Economics was engaged to assist the Authority in developing the LRAIC model, the overall work plan for the project (including the indicative timeline for the efficiency workstream) was communicated to concessionaires at the

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT's Decisions
				introductory meetings.
1.1 Efficiency and the LRAIC model	CCTL	CCTL requests further clarification on the results of the efficiency analysis will be used in the process of making pricing decisions which are based on the model outputs.	TATT needs to state clearly how the results of this exercise will be used in the process of making pricing decisions which are based on the model outputs.	The Authority has recognised CCTL's request for further details on how the efficiency analysis results will feed into the LRAIC cost model and how they will be reflected in the Authority's pricing decisions. The second consultation document sets out in more detail the proposed approach as well as how the efficiency results are used. The second document further aims to address the main issues raised by concessionaires in response to the initial document.
1.1 Efficiency and the LRAIC model (Cont'd)	TSTT	TSTT refers to the Authority's statement that a top down LRAIC model, since being based on concessionaires' actual costs, may require further efficiency adjustments to ensure that any resulting regulated prices are only reflective of efficiently incurred costs. TSTT then claims that the Authority proposes an efficiency study to adjust downward: 1. <u>The outputs of the LRAIC model (i.e. the average incremental unit cost estimates for each service).</u> TSTT provides the following example: “[...] if the incremental	We note, the forward looking costs assumption is already taking account of any inefficiency from TSTT's operations either incurred today or in the past. There is no further need to adjust downwards TSTT's costs with an additional reduction	The inputs to the top-down LRAIC model may include inefficiently incurred costs since it is based on concessionaires' actual cost base and network structure. Although the LRAIC model is based on current cost accounting (CCA) data (rather than historic costs), this revaluation process

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		<i>cost of a fixed line estimated by the Authority's LRAIC model were USD 50 and the Authority finds that other operators elsewhere have a LRAIC per fixed line of USD 45, then the Authority will reduce 10% its cost estimated for TSTT."</i> 2. <u>The inputs to the LRAIC model (i.e. unit cost, quantity of an input or both).</u> TSTT provides the following example: "[...] if the unit cost of a given network equipment was reported to be USD 10 by TSTT and the Authority finds that other operators have paid USD 8 for an equivalent equipment, then the unit cost to be used in the cost model would be 20% lower than the cost reported by TSTT. Alternatively, suppose that the actual number of fixed lines per employee is 100 for TSTT but 130 for the comparator companies, therefore the Authority would reduce by 30% the number of TSTT's employees in its cost model." TSTT believes that any efficiency adjustment to inputs would be incorrect if it is applied only to some of the production inputs and not to all of them. The total cost of a company is comprised by all inputs costs. There would be a significant bias introduced in the comparison if the input adjustment is constrained just to a subset and not to all inputs. TSTT further raises two general concerns on the Authority's motivation for an efficiency study in the context of the top	of costs based on a simple benchmark comparison. We therefore question the motivation of this efficiency study. Especially since the Authority failed to provide substantive evidence that an efficiency study was developed in any other jurisdiction to improve LRAIC calculations.	does not control for any potential inefficiencies of concessionaires. As set out in the CCA Reference Paper⁴², the revaluation process will be based on an indexation approach (i.e. adjusting the unit costs incurred by concessionaires at the time of purchasing the equipment to current price levels for the equipment). As such, this process does not control for potential inefficiencies resulting from concessionaires' network structure or any operational decisions. The Authority recognises that one potential way of controlling for any of these potential inefficiencies is to develop a bottom-up LRAIC model, rather than a top-down LRAIC model. However, the Authority through a consultative process decided to adopt a top down approach, with CCA and

⁴² CCA Reference Paper March 1st 2010 - available at: <http://www.tatt.org.tt/LinkClick.aspx?fileticket=p0xTaGPjEKU%3d&tabid=120>

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT’s Decisions
		down LRAIC model exercise. ▪ Reduction in TSTT’s relevant cost base. “<i>The methodology of estimating costs under the Authority’s LRAIC cost model already disregards historical costs in favor of forward-looking costs (current prices). The main purpose to estimate forward-looking costs of TSTT’s network, according to the Authority, is to try to mimic the hypothetical situation of how much it would cost an entrant to rebuild today an efficient network to attend TSTT’s current demand. This method of valuing TSTT’s network at current prices disregards completely what TSTT actually paid for its network in the past i.e. historical costs.</i>” ▪ Treatment of sunk costs. TSTT claims that, given its forward looking nature, the LRAIC model will disregard TSTT’s sunk costs based on past investment decisions. Sunk costs can be originated from many sources. For instance, TSTT has had to invest to attend unprofitable areas or segments of the population due to mandatory coverage requirements under TSTT’s license obligations. These past investments are sunk costs for TSTT and should be recovered by the company. TSTT has also incurred in sunk costs because of changes in the competition landscape of the industry and because network investments made in the past have witnessed a declining price trend over time		efficiency studies, for a number of reasons, due to the disadvantages associated with a bottom up model⁴³. As such, the LRAIC modelling approach is no longer under consultation. The Authority further believes that TSTT’s concern that the LRAIC model will not consider any sunk cost it may have incurred is unfounded. As stated in previous consultation documents, the “Long Run” in LRAIC 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. The efficiency study will aim to analyse whether sunk cost (and any other costs) were efficiently incurred. To the extent that sunk costs (or any other costs) are efficiently incurred they will be

⁴³ The Costing Methodology for the Telecommunications Sector May 29, 2008 - available at: <http://www.tatt.org.tt/Portals/0/Documents/Costing%20Methodology.pdf>

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT’s Decisions
		due to technological change. TSTT considers that for the Authority it would be <i>“almost impossible to distinguish whether TSTT’s past investment decisions reflect imprudence and lack of managerial skills or they are simply the result of prudent decisions and good managerial skills that were right at the time they were made but due to later changes in exogenous variables to the company they become sunk”</i>. Given the above, TSTT concludes that <i>“the forward looking costs assumption is already taking account of any inefficiency from TSTT’s operations either incurred today or in the past. There is no further need to adjust downwards TSTT’s costs with an additional reduction of costs based on a simple benchmark comparison. We therefore question the motivation of this efficiency study. Especially since the Authority failed to provide substantive evidence that an efficiency study was developed in any other jurisdiction to improve LRAIC calculations.”</i>		included in the LRAIC modelling. However, any costs (or a proportion of costs) identified as not efficiently incurred should and will be excluded from the analysis. Furthermore, as the Authority will adopt a Financial Capital Maintenance (FCM) approach, this will ensure that concessionaires will receive a return on efficiently incurred costs with a CCA approach. Within its submission, TSTT further claims that the Authority would apply two downward adjustments to the LRAIC model inputs (i.e. unit cost, quantity of an input or both) and the LRAIC model outputs (i.e. the unit cost estimates for each regulated service). The Authority would like to clarify that it will only apply the efficiency adjustment once. It is minded to apply the efficiency adjustment factor, if required, to

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				the unit cost estimates, resulting from the LRAIC model. The Authority is of the view that adjusting the LRAIC model outputs (rather than inputs) represents the most transparent approach. However, the choice of adjusting either the inputs or the outputs (by the same efficiency adjustment factor) should, in principle, have no bearing on the overall results. The Authority will provide references on efficiency studies developed in other jurisdictions in the second round consultative document.
1.1 Efficiency and the LRAIC model (Cont'd)	TSTT	TSTT stated its concern about the Authority's statement that the Authority had to date " <i>not produced any guidelines on how efficiency should be measured...</i> " [p. 3 of the consultation document]	Further clarity is needed regarding this statement made by the Authority. • Is it the Authority interchanging the terms guidelines and methodology? • Is it the current draft consultation document before parties of interest the	The initial consultation document aimed at providing concessionaires with an initial overview of the Authority's proposed approach to undertaking its efficiency analysis. As stated above, the second consultation document sets out in more detail the proposed

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			proposed guidelines? • If the current document is the proposed guideline, then greater detail need to be included? • If the current document in not the proposed guideline, then the Authority would need to produce one?	approach, taking into account (where possible) any comments received on the initial consultation document.
1.2 Overview of the Overall Process	CCTL	Notwithstanding the extension of time granted to the original timeframe, CCTL is concerned about the timeframe that is allowed for the consultation on the methodology to compute an efficiency factor. This tight timeframe is further compounded by the fact that TATT is conducting consultations on two significant issues (Efficiency factor and Cost of Capital) concurrently. This is of particular concern since both consultations are interrelated, in that the output of the cost of capital process is an input to the estimation of the efficiency factor. As described in Section 3.2.2 of the consultation document. Significantly, there is also only one round of consultation before finalizing the approach for developing the efficiency factor. This seems to be in breach of TATT's own rules in terms of the process for conducting consultations. The procedures for consultations envisage at least two rounds of consultation. This	TATT should allow adequate timeframe and a minimum of two rounds of consultations before making a decision on the methodology to compute an efficiency factor.	The Authority considers the time provided to concessionaires to respond to this initial consultation as being adequate. This is particularly the case, as upon request, concessionaires (including CCTL) were provided with an extension to the original deadline of 25 June 2010. As indicated above, the Authority will prepare a second consultation document on the efficiency study.

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		second round allows respondents to see the Authority's feedback on their comments in the first round, and have the opportunity to respond before a final decision is made. This is particularly important in this instance, as the issue will not be subjected to further deliberations in another process, such as a parliamentary process. TATT will simply make a decision after a single round of consultation. CCTL is very concerned that the Authority is sacrificing transparency in this process in order to meet timelines for the LRAIC project which may be unrealistic. If this is the case, and the process to determine a critical input into the LRAIC model is short circuited due to expedience, we would be concerned as to whether we will get reliable results from the cost model. It also raises the question as to whether the best use of time and resources is being expended in pursuing the development of a cost model in this way. It is our considered view that there should be two rounds of consultation, to determine first of all whether an efficiency factor is relevant in this context, and also, how it should be calculated.		
1.2 Overview of the Overall Process (Cont'd)	TSTT	In line with its comments on Section 1.1 of the consultation document set out above, TSTT re-iterates its concern about the timeline set out in Table 1 of the consultation document. In particular, TSTT states: ▪ the need for at least one further consultation on the efficiency study; and	TSTT urges the Authority to publish at least one more consultation on the efficiency study that would apply to the LRAIC calculations.	As stated above, the second consultation contains an updated timeline for the efficiency analysis. The indicative 18 month analysis period was communicated to

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		▪ its concern about the overall, shorter timeline for the efficiency study, relative to the 18 months stated in the Costing Methodology document. TSTT states that <i>“truncating the period to complete the efficiency study sends signals to the market that the Authority’s proposal is rushed also it sends signals that the Authority is knowingly undervaluing the process.”</i> Given this, TSTT recommends that the Authority revises Table 1 of the draft consultation including the eighteen (18) month period. TSTT is further seeking clarification as to why the period to develop an efficiency study has been truncated in the absence of any sound reasoning for doing so? Also, can the Authority provide an estimate where the efficiency study falls on the timeline indicating its progress	The efficiency adjustment factors are of paramount importance and therefore should not be rushed. TSTT therefore recommends that the Authority revise table 1: overview of efficiency study timeline of the draft consultation including the eighteen (18) month period. We seek clarification as to why the period to develop an efficiency study has been truncated in the absence of any sound reasoning for doing so? Also, can the Authority provide an estimate where the efficiency study falls on the timeline indicating its progress?	concessionaires prior to determining the scope and approach of the efficiency analysis. As such, it was set sufficiently generous to allow for undertaking any possible form of analysis (including potentially more detailed network cost analyses). The Authority has now determined its proposed approach and the current work plan reflects this.

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2.1 What is Efficiency	CCTL	Efficiency is defined as the ratio of the output produced to the input used. Measuring efficiency requires the application of quantitative techniques. Generally advanced econometric approaches are used in order to get robust and reliable indicators of efficiency. The process also requires a large amount of financial and operational data, plus reliable assumptions to incorporate adjustments for environmental factors. Given the theoretical framework and quantitative requirements for developing efficiency factors, we do not believe that the document addresses these sufficiently, before concluding that a relative efficiency approach will used in this process. We accept that given that the cost model being developed by TATT is based on a top down analysis, that a relative efficiency approach is an acceptable method of deriving efficiency measures. However, in the interest of transparency we believe that there should be a full airing of the issues, that is, all the issues should be subjected to consultation. Even while we seek clarity on TATT's intentions (as noted in our general comments) CCTL is particularly concerned because as TATT admits, there are not many comparators available for hybrid fiber coax (HFC) networks. As such, we believe there will not be sufficient data publicly available to conduct a relative efficiency study on our operations. Additionally we would also want to ensure that all the endogenous factors that are specific to our operations in this market are addressed. Again, given the limited scope of this consultation, we are concerned that these issues will not be	In the interest of transparency and benefiting from diverse views, TATT should present and allow a more complete discussion of the pro and cons of the different approaches to measuring efficiency. In this discourse, specific emphasis should be given to the realities of the Trinidad and Tobago market.	The second consultation document aims to provide further details on the proposed approach for the efficiency analysis, including the particular approach for cable network operators. The document also contains a discussion on the main strength and weakness of the common approaches to undertake an efficiency analysis presented in the current document.

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		fully addressed.		
2.1 What is Efficiency (Cont'd)	TSTT	TSTT considers the Authority’s definition of the term “efficiency” to be lacking in academic rigor as TSTT is unable to distinguish what type of efficiency is being addressed in the first instance (e.g. “efficient use” of resources or inputs vs. “efficient allocation” of outputs or welfare).	TSTT recommends more detail to be included to this section outlining which type of efficiency is being considered. The Authority will need to develop some guidelines evaluating the underlying assumptions, developing a breakdown of terms of the guidelines as well as outlining a structure in which the framework of the efficiency study would undertake.	In economics, the concept of efficiency relates to the maximisation of social welfare. This is composed of the profits made by the companies and consumer welfare. Enhancing efficiency will in general lead to higher consumer welfare. There are three main efficiency concepts of particular relevance to the regulation of telecommunication services. ▪ <u>Productive efficiency</u> relates to an efficient use of economic resources so that that production takes place at minimum cost. ▪ <u>Allocative efficiency</u> occurs when resources are allocated across different products in a way that maximizes the net benefit attained by customers through the consumption of such products. ▪ <u>Dynamic efficiency</u> occurs

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				when productive and allocative efficiency is maximized over time. This concept especially takes investment and innovations into account. Economic theory suggests that cost-based pricing (based on an efficient operator) of regulated telecommunication services leads to an economic efficient outcome. As such, this requires achieving both, productive and allocative efficiency. The efficiency study aims to ensure that any regulated prices, based on the Authority's LRAIC model, are not only cost oriented, but also represent an efficient level of costs.
2.1 What is Efficiency (Cont'd) Absolute versus relative efficiency	TSTT	TSTT considers the Authority's reasoning for choosing an approach based on a relative efficiency measure (rather than an absolute efficiency measure) insufficient. It further is of the view that the relative efficiency analysis that the Authority is proposing will incur in more profound problems than the ones it argues would arise with an absolute efficiency analysis.	TSTT recommends the Authority offer more detail to this section with supporting evidence indicating the strengths and weaknesses of both approaches for greater	The Authority recognizes the need to control, as much as possible, for any exogenous cost differences within the benchmarking sample. This can be undertaken by means of:

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		TSTT is particularly concerned that an approach based on relative efficiency will need to reflect “<i>as accurately as possible the actual company it is being compared against.</i>” As such, “<i>finding group(s) of “comparable companies” will pose a greater challenge to the Authority and more will have to be considered than simply costs. For instance,</i> • <i>One company may be partly owned by government whereas another is wholly government owned.</i> • <i>During liberalization regulation may be light handed for some; while for others regulation may be heavy.</i> • <i>The time frame when the market was liberalized will also have to be considered as it will be unreasonable to compare a country that recently liberalized its market to another that liberalized its market for some time.</i> • <i>Size of market; i.e. if the market has more than three players (highly competitive), carriers could be benefiting from economies of scale more so than a country with fewer players.”</i> Given the above concerns, TSTT recommends the Authority to provide the more details on the following two issues in its second consultation document. The Authority should: • offer more detail to this section with supporting evidence indicating the strengths and weaknesses of both approaches for greater clarity; and set out the criteria for selecting comparable companies	clarity. Should the Authority use relative efficiency then a clear approach must be developed outlining the criteria for selecting comparable companies. This should be included in the second round consultation document so concessionaires and parties of interest could have an opportunity to comment on the proposed criteria	▪ selecting the appropriate set of comparator companies (i.e. Step 1 of the proposed approach); and ▪ adjusting the total cost of each comparator company within the sample to control for any potential, exogenous cost differences (i.e. Step 3 and 4 of the proposed approach). Although the above aim to control for as many external cost differences as possible, both analysis steps will be constrained by the underlying data availability. As such, some of the observed differences in the final (adjusted) cost/output measures will not be reflective of concessionaires’ relative efficiency (but instead be driven but external cost drivers not fully being controlled for within the analysis). Recognizing this potential limitation, the Authority will ensure that any final efficiency adjustments applied to the LRAIC model outputs represent a conservative

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				measure of concessionaires' relative inefficiency. This is further discussed in the second consultation document. Irrespective of the general process outlined above, the Authority does not consider the additional operational characteristics presented by TSIT to represent quantifiable, exogenous cost drivers which need to be considered in an efficiency analysis. For example, although liberalization and/or regulation is likely to lead to efficiency gains made by operators, this should not lead to any exclusion of those operators from the benchmarking analysis, as it still informs on potential efficiency gains to be made by concessionaires. Instead, these factors may need to be taken into consideration when determining the efficiency adjustment factors for the LRAIC model (based on the efficiency analysis results). However, as part of its second

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				consultation, the Authority addresses TSTT's recommendations to provide further details on the sample selection process and a more extensive discussion on the advantages and disadvantages associated with absolute and partial efficiency analysis.
2.1 What is Efficiency (Cont'd) Total Factor Vs. Partial efficiency	CCTL	TATT presents very sparse information or discussion on the more quantitative and robust techniques it presents as options normally used to calculate efficiency factors before concluding that it would use a partial efficiency approach. TATT indicates that despite the theoretical appeal of the total factor productivity (TFP) approach to calculating efficiency ratios, it is not widely used because it requires complex calculations and that many regulators have opted for partial productivity ratios. TATT has suggested the downsides of using the more econometric approaches but has not included any discussion on the downsides of using the partial efficiency approach it has selected. The Authority merely states that partial productivity ratios such as employees per line are the most common techniques used in the development of efficiency factors. While the methodology may be simple to implement, there are limitations. For example it does not fully account for the relationship between inputs and outputs. Again, TATT has simply decided to employ an approach without subjecting the	TATT should present a balanced view of the various approaches to measuring efficiency, and take account of the views of other parties before coming to a decision	As stated above, the second consultation document contains a discussion on the main strength and weakness of the common approaches to undertaking an efficiency analysis as presented in the initial document.

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		issue to consultation..		
2.1 What is Efficiency (Cont'd) Total Factor Vs. Partial efficiency	TSTT	In general, TSTT considers the most appropriate way to determine its overall efficiency would be to estimate TSTT’s total factor productivity (TFP), rather than a approach based on partial efficiency (as proposed by the Authority). It further considers the Authority’s current justification for not adopting a TFP-based approach as “weak” and “inaccurate”. As such, TSTT recommends that the Authority outline the strengths and weaknesses of both approaches with strong justification in its selection. It further challenges the Authority’s statement that many regulatory authorities have opted for partial productivity ratios, as TSTT considers estimations of TFP in regulated industries (including telecommunications) to be <i>“common practice everywhere since price regulation is usually done through price-cap mechanisms that set up productivity factors for regulated companies”</i>. As such, TSTT requests the Authority to provide evidence to support its findings. If a TFP estimation is not a viable alternative, TSTT would recommend adopting a “hybrid approach”. Under this common approach, the results of the top-down LRAIC model are compared to those based on a bottom up cost model (i.e. the absolute efficiency analysis mentioned but discarded by the Authority). A TSTT’s bottom-up cost model would determine an efficient network design and related costs to serve TSTT’s expected demands in terms of subscribers and traffic. TSTT considers that a reconciliation of a town-down model with a	Clarity in selecting partial over total factor efficiency would give a greater visibility to interested parties in the industry and raise confidence in Authority’s published results. TSTT recommends that the Authority outline the strengths and weaknesses of both approaches with strong justification in its selection. The Authority mentioned that many regulatory authorities opted for partial productivity ratio over total factor in its documents. However this is done in the absence of supporting evidence. Also this is done without understanding fully the circumstance in which these jurisdictions may have opted for partial productivity. We therefore request of the	The Authority accepts the potential merits of alternative approaches, including TSTT's preferred options. But, adopting the suggested hybrid approach of comparing bottom-up cost estimates to the top-down cost estimates is not feasible at his point of the cost modelling process. The Cost Methodology clearly sets out the Authorities decision to develop a top-down LRAIC model. It further states that the bottom-up approach is not “high priority” at this point in time. As such, the proposed “hybrid approach” is not a viable option at this stage. The Authority also further elaborate on the appropriateness of the second, alternative approach suggested by TSTT—the total factor productivity approach—in the second consultation document. However, the second consultation

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		bottom-up model applied to TSTT will provide a better guide on TSTT's costs than the Authority's proposal of comparing the results of TSTT's top-down cost model with international benchmarks, since they reflect the maximum and minimum efficient costs of TSTT's operations. TSTT concludes its comment with the following statement: <i>"If the Authority rejects the hybrid approach (both top down and bottom up) then the next viable alternative is to develop a TFP analysis using a top down approach."</i>	Authority to provide evidence to support its findings. TSTT considers that a reconciliation of a top-down model with a bottom-up model applied to TSTT will provide a better guide on TSTT's costs than the Authority's proposal of comparing the results of TSTT's top-down cost model with international benchmarks. If the Authority rejects the hybrid approach (both top down and bottom up) then the next viable alternative is to develop a TFP analysis using a top down approach.	document contains the following additional information: ▪ a discussion on the key strengths and weaknesses of the main approaches to undertake an efficiency analysis presented in the current document; and ▪ references to international precedent of adopting the Authority's proposed approach.
2.2. Approaches to Measuring Relative Efficiency	CCTL	The document outlines two main approaches to measuring relative efficiency, benchmarking and econometric analysis. It provides some limited discussion on the approaches before settling on the adjusted benchmarking approach. We believe that the	CCTL requests that TATT clarifies whether it intends to and if so, on what basis it will conduct an efficiency analysis	The Authority is planning to also undertake an adjusted benchmarking analysis for cable operators, based on the same

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		process would have benefited from a richer exchange of views and facilitate openness and transparency if the process had allowed for consultation on this issue, instead of TAT'T simply stating its views and determine a position. While benchmarking, specifically international may be a useful way forward, we do not believe that the limitations of this approach were adequately addressed in the document. Some of the limitations that we wish to cite include the following: ▪ Sufficient publicly available and relevant information ▪ Suitability of comparators As it relates to CCTL's network, TAT'T admits, and we concur that there is not a lot of information available on HFC type networks, such as CCTL's. We are therefore not clear as to whether an efficiency study will be conducted on CCTL's operations. This lack of clarity is also reinforced by the fact that in the first paragraph of the section 1 'Overview' TAT'T indicates that <i>"The costing methodology requires the Authority to undertake an efficiency study for all dominant concessionaires"</i> Further the document states that the benchmarking analysis will focus on the traditional fixed line operator in the first instance. We are not sure what is intended by this statement. We have the	of the operations of CCTL. In particular, CCTL has the following questions: 1. Will the outcome of this consultation inform the approach taken to any future analysis on HFC networks? 2. What is the timeframe for the analysis on HFC networks?	approach as for the fixed and mobile benchmarking studies. This analysis will be undertaken in parallel to the other efficiency studies. Undertaking an international benchmarking study requires the availability of the financial and operational data for a minimum set of comparator operators. Having collected the required data for a set of cable operators, the Authority is currently in the process of verifying this data in order to determine the final benchmarking sample.

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		following questions; 1. Will the outcome of this consultation inform the approach taken to any future analysis on HFC networks? 2. What is the timeframe for the analysis on HFC networks?		
2.2. Approaches to Measuring Relative Efficiency (Cont'd) 2.2.1 Benchmarking Analysis	TSTT	TSTT provides the following comments on the Authority's proposed cost/output measures for the fixed and mobile operator benchmarking (as set out in Table 2 of the consultation document): <i>"The first two metrics [average cost per fixed line and average cost per (mobile voice) minute] would come out from the Authority's LRAIC cost models. The third metric [fixed lines per employee] is easily available without the need of any cost model since TSTT's fixed lines and the number of employees is reported to the Authority by TSTT on a regular basis. Once measured these three metrics, the Authority would compare these with those coming from a sample of operators in other countries. In the case of TSTT's mobile business, the comparator operators would include also Digicel."</i>		The Authority disagrees with TSTT's comment on the proposed cost measures. Neither of the two cost measures are readily available from the relevant LRAIC model, as the LRAIC model outputs represent forward looking (CCA-based) unit costs. However, the efficiency analysis will be undertaken on the basis of concessionaire's historic costs, as submitted to the Authority as part of the CCA and LRAIC data templates. This is to ensure consistency within the benchmarking sample, as the costing information for the comparator companies is based on financial data contained in financial statements (i.e. also on a historic cost basis).
		TSTT has queried the need for an efficiency analysis of TSTT's	Within its response, TSTT	TSTT provides mobile termination

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		mobile business as this would imply that there is a presumption that TSTT’s mobile prices are going to be regulated. As far as TSTT is aware of there has not been any dominance proceeding by which TSTT has been declared dominant in any mobile market either at the retail or wholesale level that should precede price regulation or any other regulation. As such, TSTT requests further clarification on this matter and recommends that the mobile business benchmarking should be removed from the efficiency analysis TSTT claims that the Authority has advocated the use of data envelope analysis (DEA). TSTT recognizes the potential benefits of adopting a DEA approach, it recommends using DEA only as a cross checking tool.	stated: <i>“The inclusion of mobile in the benchmarking analysis may need some clarification. As matter of fact, we struggle to make sense why TSTT’s mobile business would be subjected to any efficiency examination. Mobile should be removed entirely.”</i> TSTT recommends that the Authority use the DEA for cross checking its findings rather than use it as the optimal method.	services to other concessionaires in the market. As TSTT is the only concessionaire that is able to provide mobile termination to its own network (essential facility) it is considered to be dominant in the provision of mobile termination. The Price Regulation Framework, which was finalized and published in March 2009 states ... <i>“A concessionaire which controls an essential facility shall be classified as dominant in the provision of that essential facility. The pricing of essential facilities shall be cost-based”</i>. As such an efficiency study will be required for TSTT’s mobile network. Refer to 2.3.1 of Price Regulation Framework The Authority does not intend to undertake any DEA as part of its efficiency analysis (and has not made any statement to that effect in its initial consultation document).

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2.2. Approaches to Measuring Relative Efficiency (Cont'd) 2.2.1 Adjusted Benchmarking	CCTL	TATT has proposed that it will use an adjusted benchmarking approach and that the analysis will focus on the main drivers. In terms of fixed line operators, the main drivers are given as; 1. Average cost per line (for fixed line operators) 2. Number of lines per employee (labor productivity). While the information to calculate these ratios is likely to be more readily available, we believe there are certain issues that need to be considered. For instance, outsourcing decisions can render the average number of lines per employee misleading. As such this would be an unreliable indicator. Given the differences in the architecture of traditional fixed line networks versus hybrid fiber coax (HFC) networks, the cost drivers are not the same. As such, while the average cost per line, is a key cost driver for traditional PSTN networks, this is not the case in HFC networks. As indicated earlier, TATT does make the point that the benchmarking analysis will focus on traditional fixed wire line and mobile operators in the first instance. However in Table 2 (page 10) TATT includes the comparators, average cost per home passed and average cost per connected home as indicators for HFC networks. However as there is no further explanation or analysis around the issue, CCTL is not clear as to how TATT intends to proceed in this matter. We therefore	We request that the Authority clarifies how its intentions to approach the benchmarking analysis in the case of HFC networks.	The Authority intends to, undertake an adjusted benchmarking analysis for cable operators, based on the same approach as for the fixed and mobile benchmarking studies. However, the main output measures for cable operators will be, due to data availability, the ‘average cost per home passed’.

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		request that the Authority clarifies how its intentions to proceed.		
Section 3				
3. Adjusted Benchmarking Approach	TSTT	TSTT proposes to add the following two variables to the country sample selection criteria set out by the Authority in Section 3.1 of the consultation document: • Ownership of companies (private, state-owned or partially state-owned). State-owned or partially-owned companies are usually subject to restrictions that private companies do not face. Managerial decisions are not necessarily the same in public and private companies. For instance, decisions on hiring and firing employees are more difficult in state-owned companies than private companies with full flexibility in their decisions due for instance to unions. This would affect differently the ratio of labor productivity among companies. TSTT is a partially-owned company so that the sample of comparator companies should control differences in ownership. • Age of liberalization and age of the current regulatory price regime applied to incumbent operators (price-cap or rate of return). The type of price regulation exercise to the regulated entity is a very important determinant of the degree of efficiency of the company. For instance, incumbents in the U.S. or the U.K. have operated long time in liberalized markets and have been under price cap	We note when using adjusted benchmarking a margin for error must be allowed in order to minimize the chance that a price is regulated at less than economic cost. In addition to the criteria laid out by the Authority in section 3.1 of its Document to select an appropriate sample of operators, TSTT suggests to add the following variables: • Ownership of companies (private, state-owned or partially state-owned) Age of liberalization and age of the current regulatory price regime applied to incumbent operators (price-cap or rate of return)	The Authority recognizes the need to control, as much as possible, for any exogenous cost differences within the benchmarking sample. However, the additional operational characteristics presented by TSTT will be difficult to quantify in order to include them in the efficiency analysis. Although the adjusted benchmarking approach aims to control for as many exogenous cost differences as possible, the adjustments may be constrained by the underlying data availability. As such, some of the observed differences in the final (adjusted) cost/output measures will not be reflective of concessionaires' relative efficiency (but instead be driven by external cost drivers not fully being controlled for within the analysis). Recognizing this potential limitation, the

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		regulation for many years, both factors which tend to make operators perform more efficiently. Therefore, an appropriate comparison must control for these variables. TSTT also notes when using adjusted benchmarking a margin for error must be allowed in order to minimize the chance that a price is regulated at less than economic cost.		Authority will ensure that any final efficiency adjustments applied to the LRAIC model outputs take into account the exclusion of these factors from the analysis. This will be further discussed in the second consultation document.
3.2.1 Output Measures	CCTL	The Authority has selected number of access lines as the main output measure for fixed operators. Within the context of a HFC triple play network provider, CCTL question whether number of access lines is the most appropriate measure.	The Authority needs to give further consideration to this issue in consultation with CCTL.	The Authority does not intend to use the number of access lines as an output measure in the cable operator benchmarking analysis. Instead, the analysis will be based on the number of homes passed.
3.2.2 Step 2: Cost Measures	CCTL	The cost of capital is one of the items included in the total cost measure. However the Authority is conducting both consultation processes concurrently. This goes to the issue of process raised in an earlier section of this response. CCTL believes that best regulatory practice would dictate that since the output of one process is an input into the other process, both processes should not take place at the same time.	Where the results or output of one consultation process will be an input into another process, both processes should not be done concurrently.	The Authority does not share CCTL's concern about undertaking the two consultations in parallel. The efficiency study consultation states that WACC, as specified by the Authority, will form part of the efficiency analysis. This is independent from the outcome of WACC consultation and any potential changes to the WACC calculations arising from it. The

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				final efficiency adjustment factors will be based on the final WACC estimates, relevant to the particular concessionaire under consideration. As such, the fact that the WACC consultation is not complete in no way prevents respondents from adequately responding to this consultation on the efficiency analysis.
3.2.2 Step 2: Cost measures	TSTT	TSTT raises the following concerns about the Authority's proposed measure of costs for comparator companies. ROCE measure based on unified WACC estimate. TSTT queries the application of TSTT's WACC to all comparator countries, when determining their ROCE, whilst at the same time <i>"excluding the application of all other TSTT's cost elements to comparator companies"</i>. Total cost measure. TSTT disagrees completely with the Authority's proposed measure of total costs since it does not include all relevant costs. The standard definition of total costs should include also economic depreciation (i.e. Total Costs = Operating Costs + Return on Capital + Depreciation) LRAIC cost vs. HCA accounting costs. TSTT queried how the Authority intends to compare TSTT's (forward looking) long-run average incremental costs with historical accounting	What would justify the application of TSTT's WACC to all comparator companies and at the same time excludes the application of all other TSTT's cost elements to comparator companies? Both depreciation charges and cost of capital are true 'economic costs' since they reflects the cost that a company incurs in order to remain in business and as such should be included in the efficiency study.	The Authority sets out below its response to TSTT's four queries on the proposed cost measure for comparator companies. ROCE measure based on unified WACC estimate. The Authority considers any differences in country-specific risk premia to be exogenous to operators. To control for the impact of these risk premia, requires applying the same WACC estimate across all operators. The Authority considers the Trinidad and Tobago specific WACC values

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		costs of companies abroad (as stated in their financial accounts.) Depreciation. TSTT states that depreciation values in financial statements reflect accounting depreciation (i.e. straight line) which barely resembles economic depreciation.		to be the most appropriate choice as these values since being most reflective of the required return of capital required for operators in Trinidad and Tobago. 2. Total cost measure. The Authority agrees with TSTT's proposed measure of total costs (i.e. Total Costs = Operating Costs + ROCE + Depreciation). This will be reflected in the second consultation document. 3. LRAIC cost vs. HCA accounting costs. As stated above, the Authority does <u>not</u> intend to compare TSTT's (forward looking) long-run average incremental costs with historical accounting costs of companies abroad (as stated in their financial accounts.). For comparability, the efficiency analysis will be undertaken on the basis of TSTT's historic costs, as submitted to the Authority as part of the CCA

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				and LRAIC data templates. To ensure consistency within the benchmarking sample, TSTT's total costs will determined on the same formula as applied to the (unadjusted) total cost measure for each comparator company (i.e. the formula set out above). Further details on this process will be presented in the second consultation document. 4. Depreciation. Given the approach set out above, the depreciation values of all companies within the benchmarking sample (including those of concessionaires) contained in the total cost measure will reflect the depreciation values in financial statements (i.e. accounting depreciation). This should not result in any bias in the results.
3.3 Step 3: Identification of cost adjustments	TSTT	TSTT suggests determining the relevant cost adjustment factors, discussed in Section 3.3 of the consultation document, as well as	An alternative that the Authority could more objectively use would	The Authority intends determining the relevant exogenous cost

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		their relevant weights based on a modelling approach using regression analysis of various hypothetical relationships between the level of average cost (dependent variable) and several candidate determinants (independent variables).	be to undertake a modeling approach using regression analysis of various hypothetical relationships between the level of average cost (dependent variable) and several candidate determinants (independent variables).	drivers and the relative weight of each relevant adjustment factor based on regression analysis, as suggested by TATT. Further details on the proposed approach of determining the relevant adjustment factors will be presented as part of the second consultation document.
		TSTT stresses the importance of controlling for potential differences in wages and prices among the companies within the labour productivity benchmarking based on fixed lines per employee. Even when data on number of fixed lines and number of employees for fixed operators are often easily available in the public domain, one must be careful when making comparisons of average labour productivity among companies.		The Authority recognizes wage costs representing a potential exogenous driver of a company's relative performance. However, it would expect that any impact to be most prominent is the total pay cost of operators (i.e. higher wage costs are less likely to impact on the total number of employees of a telecommunications operator, than its total pay cost, relative to other operators). There are different direct and indirect approaches to account for these differences in the efficiency analysis. The second consultation document discusses

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				the different options and describes in more details which approach was chosen by the Authority.
		TSTT is concerned that the current approach does not adequately control for the potential impact of economies of scale and scope on the benchmarking results. Due to the presence of fixed and common costs, a higher output would ensure that total costs can be spread out on larger quantities (i.e. economies of scale). Furthermore, an operator's costs may also depend on the number of services it provides (i.e. when it is less expensive to produce services jointly than separately, there exists scope economies). Due to scale economies, TSTT expects that its average incremental cost to be above those of larger companies within the benchmarking sample. Even if TSTT is equally efficient to any other competitor, TSTT will exhibit a higher average cost than its competitor due to its lower scale of production, but not because TSTT is inefficient. The Authority is not addressing correctly the issue of scale economies in its proposed benchmark of efficiency, unless the Authority is proposing to compare TSTT's indicators of efficiency with operators of the same size as TSTT or alternatively it is proposing to introduce some adjustment to the competitors' indicators measurement of efficiency to accommodate the effect of scale on its benchmarked costs. TSTT is concerned that the proposed cost/output measures do not	TSTT note by simply deducing costs relating to: • Average cost per fixed line; • Average cost per minute; and • Fixed lines per employee. These measures do not ensure comparability since any potential economies of scale and scope that may exist are not taken into account. We therefore urge the Authority to revisit its assumptions including all relevant issues relating to economies of scale and scope in the second round consultation.	The Authority recognizes that economies of scale and scope may be present in the telecommunications sector and that this may lead to differences in average costs across operators within the benchmarking sample. To determine the relevance of economies of scale in the context of the efficiency analysis, the Authority will, subject to data limitations, endeavor reviewing the relative performance of smaller operators and those of similar size to TSTT. If there is evidence to suggest that economies of scale are driving concessionaires' relative performance, this will be taken into account when determining the required efficiency adjustment factor for each concessionaire. The Authority however notes

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		ensure comparability since any potential economies of scale and scope that may exist are not taken into account.		that in the analysis undertaken to date, there was no evidence of the existence of economies of scale driving the benchmarking results.
Section 4				
3.3. Step 3: Identification of cost adjustments 3.3.1 Likely Cost Adjustments	CCTL	Given our operating experience in the Trinidad and Tobago market, there are a number of variables over which CCTl has no control which have not been included among the variables suggested by TATT. These include, ▪ The impact of illegal operators on our plant ▪ Inability or delays in gaining access to new housing and commercial developments These factors which are outside of our control significantly impact our ability to efficiently deploy infrastructure and progress our development plans. In any estimation of CCTL's efficiency, these endogenous factors would have to be accounted for CCTL suggests taking the following factors which are specific to its operating environment into account within the cable efficiency analysis: ▪ The impact of illegal operators on our plant Inability or delays in gaining access to new housing and commercial	Endogenous factors which are specific to this operating environment should be taken account of in any analysis to measure efficiency.	The two operational characteristics presented by CCTL will be difficult to quantify in order to include them in the efficiency analysis. Furthermore, the Authority is of the view that these factors are not only relevant to operators in Trinidad and Tobago and as such, they will not necessarily impact on concessionaires' efficiency performance, relative to other operators within the benchmarking sample.

Document Sub-Section	Submission Made By: Stakeholder Category ⁴¹	Comments Received	Recommendations Made	TATT's Decisions
		developments		

