Eastern Caribbean Telecommunications Authority

Recommendation to

National Telecommunications Regulatory Commissions

on

Cost Oriented Interconnection Rates in the ECTEL Member States

April 2018

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Recommendation on Cost Oriented Interconnection Rates

1. INTRODUCTION

On May 4, 2000, the Eastern Caribbean Telecommunications Authority (hereinafter referred to as 'ECTEL' or 'the Authority') was established. This Authority came into being by way of a treaty signed between the five (5) contracting Eastern Caribbean States - Dominica, Grenada, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines. ECTEL regulatory framework has a two-tiered arrangement:

- At the national level, there is the National Telecommunications Regulatory Commission (NTRC)
- At the regional level there is the ECTEL Directorate as an advisory body. Each Member State cedes some of its "sovereignty" to a regional body. The NTRC must liaise and consult with the ECTEL Directorate and the Commission must act independently on all regulatory matters placed before the Commission.

The Authority is able to determine the framework regarding regulatory matters that affect the five (5) Contracting States pertaining to interconnection and pricing. In particular **Article 4 (e) of the Treaty** provides that one of the major purposes of ECTEL is to promote fair pricing and the use of cost-based pricing methods by telecoms providers in the Contracting States. Also, **Article 5(m)** indicates that one of the functions of ECTEL is to recommend a regional cost-based pricing regime for implementation by each Contracting States. Each country has its separate 'National Telecommunications Regulatory Commission' in place that is responsible for regulation of the telecommunications sector in that country.

In 2009, the Council of Ministers that govern ECTEL approved the implementation of the Long Run Incremental Cost Models ('LRIC') for setting interconnection rates (hereinafter the 'Existing Models'). As it relates to the mobile termination rates, the implementation of the LRIC model was to result in an up to 40 per cent reduction in the wholesale rate for mobile termination in the first year and up to 60 percent reduction over the three-year period.

In 2009, the Interconnection Regulations were passed in Dominica, Saint Lucia and Grenada, meanwhile, St. Vincent and the Grenadines and St. Kitts and Nevis saw the passage of the legislation in 2008.

ECTEL issued a public consultation on the principles, methodologies and guidelines to be applied to determine the cost oriented rate for interconnection services. The consultation took place between July and September 2016.

After addressing feedback provided by stakeholders, ECTEL published the final *"Principles Methodologies Guidelines for the Determination of New Interconnection Rates*" (hereinafter the 'Methodology')[1].

Axon Partners Group Consulting S.L.U. (Axon Consulting) developed, on behalf of ECTEL, two Draft BULRIC Models (one for fixed and one mobile networks) aligned with the Methodology.

On May 29th, 2017, ECTEL launched a public consultation on Draft Cost Models[2] for Fixed and Mobile Interconnection Rates (the "Consultation"). Stakeholders were instructed to submit relevant arguments and also data, analysis, benchmarking studies and any relevant information based on the national situation, or on the experience of other countries, in support of their comments.

Digicel and its consultant (together considered here as "Digicel") and Cable & Wireless Limited (hereinafter "C&W"), delivered comments with their contributions to the Public Consultation on July 18th and July 19th, 2017 respectively.

Afterwards, C&W delivered comments on comments to the Public consultation on August 9th while Digicel and the National Telecommunications Regulatory Commission St. Vincent and the Grenadines (NTRC SVG) delivered comments on comments on August 10th.

All in all, ECTEL had a fruitful interaction with the industry which has allowed the Authority to fine tune and improve the costing models. Based on this interaction, ECTEL

[1] https://www.ectel.int/principles-methodologies-and-guidelines-for-the-determination-of-new-interconnection-rates/
[2] Due to confidentiality of part of the information considered in the models, some figures were anonymised in the models shared with the stakeholders.

is confident of the reasonability of the results to provide the industry with proper price signals and fair compensation for the provision of wholesale services.

This document summarises feedback received during the Consultation and details ECTEL's views on the responses and the comments on responses provided by industry players regarding the Draft Cost Models for Fixed and Mobile Interconnection Rates.

Finally, this determination recommends the interconnection rates that should be applied in ECTEL Member States.

This document is structured into 4 main chapters as set out below:

- Issues relevant to both BULRIC models
- Issues specific to the BULRIC model for mobile networks
- Issues specific to the BULRIC model for fixed networks
- Consideration of submissions
- Recommendation for interconnection rates

2. ISSUES RELEVANT TO BOTH BULRIC MODELS

This section presents comments on those aspects which are relevant for both models (for fixed and mobile networks). Additionally, respondents pointed out a number of aspects related to the methodology previously approved by ECTEL and used in the development of the models and other general aspects.

Comments received related to both models have been grouped according to their subject, as follows:

- Methodological issues
- Procedural Issues
- Transparency of the models
- WACC calculation and parameters
- Useful lives
- Overcapacity
- Documentation

2.1. **Methodological issues**

ECTEL observes that Digicel has provided a number of comments which referred to the Methodological aspects which guide the costing models, namely:

- The use of scorched-earth methodology
- The consideration of working capital
- Benchmark information used for defining methodological aspect

Regarding all these comments, we note that the Methodological aspects were already discussed in a separate consultation process and the final Methodology approved by ECTEL[3]. Therefore, Digicel's comments are completely out of due process and they are not considered acceptable by the Authority at this stage.

[3] https://www.ectel.int/principles-methodologies-and-guidelines-for-the-determination-of-new-interconnection-rates/

Despite the above, and with the objective of provide transparency to the industry, the following sections provide more details on Digicel's comments and responses provided by other stakeholders.

2.1.1. Scorched earth methodology

Digicel stated that "*ECTEL's decision to choose a scorched-earth approach in modelling the radio network goes against international best practice*" and affirmed that benchmark information included in the Methodology is not accurate since some of the countries considered to be using scorched-earth approach are in reality, according to Digicel, using the scorched-node approach by calibrating to operator site counts.

C&W did not find the criticisms of Digicel *"particularly constructive"* as "*the benchmarking tables were provided more for informational purposes*", and stated that "*ECTEL's consultants justified their approach to particular aspects on methodology by means other than benchmarking.*"

Regarding this comment, ECTEL would like to clarify that a scorched-node approach is typically considered by assuming that the nodes' locations and numbers are taken directly from operators' information and not calculated with bottom-up technical algorithms (as it is done in the supposed benchmark inaccuracies pointed out by Digicel). The application of calibration techniques is the international practice in all bottom-up models (scorched-earth and scorched-node) to ensure the accuracy of the results. In fact, ECTEL confirms that in the process of developing the models, their results have been calibrated.

2.1.2. Working capital

Digicel indicated that a working capital allowance should be included and it suggested to use an estimated working capital equivalent to 30 days of annual OpEx expenditure multiplied by the WACC.

C&W disagreed with Digicel and stated that ECTEL should disregard Digicel's arguments in this regard, "*as this topic was reviewed and debated in the previous consultation. The comments are therefore out of process*".

ECTEL highlights that the Methodology reads: *"if licensees justify that the working capital associated with network OpEx has been efficiently incurred and presents a certain level of materiality, it should be incorporated into the BULRIC Models"*. It is noted that

no justification has been provided and therefore network OpEx related working capital has been considered.

2.1.3. Benchmark

Digicel pointed out that there are inconsistences and outdated information in the benchmark of the Final Principles Methodologies and Guidelines. About this aspect, C&W stated that these *"Digicel here is exaggerating the significance of the errors. Furthermore, these benchmarks dealt with methodological issues and were the subject of an earlier consultation. If Digicel had a significant point to make with these errors, they missed their chance. Digicel is one consultation too late. ECTEL should reject these comments as out of process".*

ECTEL highlights that, as described in the Methodological Document approved by ECTEL, "*even though ECTEL has considered the international best practice, the methodology described in this determination has been carefully designed to reflect the reality and specificities of the market in ECTEL member states and to serve ECTEL's regulatory objectives.*"

2.2. **Procedural Issues**

Digicel believed that *"the failure of ECTEL and its consultant to properly validate the model outputs and operation, the reliance on factually inaccurate information provided by the consultant and the denial of an adequate period to respondents to properly analyse and assess such a complex and poorly annotated model combine to mean that the consultation process falls short of the minimum procedure required by well established administrative law."*

C&W stated that *"[t]his round of the proceeding was designed specifically for vetting and validating the model outputs and operation, so it is absurd to suggest that the consultation process be criticized for lack of validation in advance. The "factually inaccurate information" in the model is insignificant both in terms of the share of input information overall and its impact on the model results as we shall discuss in Part III below. Finally, we disagree that there was not adequate time to review the models. As Digicel itself notes, ECTEL gave more time for stakeholders to review and respond to the models. It gave three extra weeks. Digicel does not provide how much time it asked for*

nor how much time it would have required. C&W also requested additional time and was satisfied with the time given."

ECTEL agrees with C&W and notes that the objective of the public consultation was to allow the industry to review the models and validate hypothesis and results. The Authority highlights also that during the data gathering process, information was requested of operators. ECTEL was flexible with operators, by adapting data requests to the information available, holding meetings with operators to clarify aspects and questions about the data request and granting deadline extensions. Despite ECTEL's facilitating approach, and after Digicel's communications stating that the information was going to be provided, no information at all was provided by Digicel to the Authority. On the other hand, C&W was collaborative, providing very relevant information, an attitude which was appreciated by ECTEL. The Authority confirms that the models' output and operation were validated based on the information provided by C&W. It was not possible to validate against Digicel's information since requested information was not provided. Moreover, it is important to note that comments provided by Digicel regarding supposedly inaccurate information were not supported with evidences, even it was a requirement in the rules for this Consultation[4].

2.3. **Transparency of the models**

Digicel listed a number of aspects for which they believed that "transparency of the cost modelling (and getting stakeholder buy-in and understanding of the calculation) is not of importance to ECTEL". In particular they mentioned *"model size", "excessive run-time", "excessive detail", "redundant functionality", "lack of auditability", "worksheet layout", "use of custom"* and *"complicated formulae", "poor use of pane freezing" and "lack of row grouping"*.

C&W affirmed that *"[a] number of these criticisms have merit, but none singly or together undermine the nature of the model as being fit for purpose".* C&W also noted that "*these issues do not prevent the models from being adequately reviewed*".

[4] Consultation document, point 4, reads: "*comments provided to this consultation should be supported with the supporting rationale and **required evidences**" (bold format added).*

Additionally, C&W stated that some of the aspects "*are more annoyances than anything else*". Finally, C&W "strongly disagree" that the transparency is not of value to ECTEL, particularly noting that its "*long history with ECTEL suggests quite the opposite. ECTEL deeply values transparency. And, while the models are not as user-friendly as one might hope, they achieve the objectives for the proceeding.*"

ECTEL agrees that the models are complex, which is typically the case in telecommunication services costs models. Additionally, the Authority highlights that opportunities were given to the operators to ask for clarifications regarding models' functioning. In fact, both Digicel and C&W's asked questions which were clarified during the consultation process.

Finally, ECTEL considers that the thoroughly detailed comments provided by both Digicel and C&W show that they have been able to review the models.

2.4. **WACC calculation and parameters**

Both operators, C&W and Digicel, have agreed with the overall approach followed by ECTEL, focusing their comments on the parameters used and proposing a number of updates and adjustments. In particular, Digicel proposed updating a number of parameters and C&W *"believe[d] updating the parameters is justified"*. However, C&W believed that Digicel's criticism is skewed, "*citing only those flaws in the modelling that raise cost in the mobile network"*.

Operators' comments, and ECTEL's views, are grouped below by parameter.

Risk free rate

Digicel did not show opposition to the source used nor the period considered (10 years). On the other hand, they *"disagree[d] with the mixing of longer-term and medium-term bonds in the calculation and recommend that the 10-year bond only is used".*

C&W noted that Digicel *"does not update the figures, it only chooses a subset of the original data values (i.e., the 10-year bond) that would raise the rate."*

ECTEL notes that risk free rate has fallen since WACC was calculated for the draft models. The following table shows the changes in Risk free rate based on the

methodology shown in the consultation document[5] and the methodology proposed by Digicel[6].

Parameter	Methodology used in consultation document	Methodology proposed by Digicel
Information extracted on October 2016	2.71%	2.88%
Information extracted on August 2017	2.50%	2.68%

Table 2.1: Changes in Risk free rate values based on the methodology shown in the consultation document and the methodology proposed by Digicel [Source: Axon Consulting]

ECTEL observes that C&W has not presented any argument against using 10-year yields only to calculate risk-free rate. Moreover, this methodology is common in other jurisdictions. Therefore, ECTEL accepts Digicel's proposal to calculate Risk-free rate based on 10-year yields. Based on this, the updated value is 2.68%[7].

ECTEL agrees with Digicel that longer-term and medium-term bonds should not be mixed in relation to the calculation of the risk-free rate. So ECTEL proposes to calculate based only on the 10-year yield.

C&W disagreed with Digicel that the period considered for the calculation, and stated that Digicel only chose a subset of the original values (from 12 October 2006 to 11 October 2016). C&W affirmed that the period considered should be updated to consider the 10 years preceding 8/8/2017. Based on that, the value for the risk-free rate proposed by C&W is 2.68% for both models.

ECTEL agrees with C&W that the period considered should be updated (10 years preceding 8/8/2017) in order to have the most updated values for the model. Therefore, ECTEL considers using a risk-free rate of 2.68% for both models.

Country risk premium

Digicel has not proposed any changes.

[5] Average between 5-year, 7-year, 10-year and 20-year yields.
[6] Considering only 10-year yields.
[7] Average of US Daily treasury yield curve rates for last 10 years based on information from 8 August 2017.

C&W observed that this parameter has fallen since 2016, being currently 9.25%[8] (compared with 10.21% in 2016).

Based on the above, ECTEL has updated the country risk premium to 9.25%.

Debt premium

Digicel and C&W have not proposed any changes.

It is important to note that debt premium is related to the risk-free rate parameter in the following way:

$$Debt\ premium = Cost\ of\ debt_{Industry} - Risk\ free\ rate$$

Based on the overall approach to update WACC, ECTEL has updated Cost of debt based on the latest available information[9] (Cost of equity and capital from Damodaran website, updated on January of 2017).

Based on updated cost of debt and according to the update of the risk-free rate described above, ECTEL considers using an updated debt premium of 0.82% for mobile networks and 1.02% for fixed networks.

Cost of debt

The operators did not provide comments related to the cost of debt.

ECTEL reminds that as the Cost of debt (K_d) is obtained based on the following formula:

$$K_d = r_f + CRP + D_p$$

Where:

- r_f represents risk free rate
- CRP represents the country risk premium
- D_p represents the debt premium

[8] See http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html, updated on January 2017.
[9] Cost of equity and capital from http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html, updated on January of 2017

Based on updated parameters, ECTEL decided to update the cost of debt to 12.75% for mobile networks and 12.95% for fixed networks

Equity Beta

Digicel disagreed with the Equity Beta for mobile networks used in the consultation model, and affirmed that the beta for mobile should be 0.65 instead of 0.62 presented in the consultation document.

C&W disagreed with Digicel and affirms that Digicel *"seems to have identified the incorrect unlevered beta for wireless services"*. C&W also commented on updating the parameter based on new information available.

ECTEL confirms C&W's statement and notes that the figure presented in the consultation corresponds to unlevered beta. Moreover, ECTEL decided to update the equity beta based on the new information available[10], resulting in 0.5466 for mobile networks and 0.6636 for fixed networks.

Market risk premium

Digicel affirmed it was not able to identify the Market risk premium from the source data described.

ECTEL clarifies that the Market risk premium was obtained based on Implied Equity Risk Premiums[11], as clarified to Digicel during the consultation process.

ECTEL decided, consistent with the approach followed with other parameters, to update market risk premium based on the most recent information (average between 2012 and 2016) which resulted a Market risk premium of 5.67%.

Return on equity

The operators did not provide comments related to the return on equity.

[10] Latest value available corresponds to January 2017, http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html
[11] Based on http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/implpr.html

ECTEL reminds that as the Return on equity (K_e) is obtained through the following formula:

$$K_e = r_f + \beta \times (MRP + CRP)$$

Where:

- r_f represents risk free rate
- β represents the equity beta
- MRP represents market risk premium
- CRP represents country risk premium

Based on the updated parameters described above, return on equity should be updated to 10.83% for mobile networks and 12.57% for fixed networks

Gearing

Digicel did not provide any comment regarding gearing figures presented on the consultation document.

C&W reminded that *"gearing will differ from one business unit to another"*. They also stated that "*[i]t is not clear why ECTEL would have a uniform WACC when it differentiates so many other parameters for each Member State in the modelling".*

ECTEL agrees with C&W that gearing varies among Member States and decides to apply following gearing levels to each country, based on the information provided by the operators:

[CONFIDENTIAL]

Member States	Gearing
Dominica	XX%
Grenada	XX%
St. Kitts and Nevis	XX%
Saint Lucia	XX%
St. Vincent and the Grenadines	XX%

Table 2.2: Gearing for the Member States [Source: C&W]

[END CONFIDENTIAL]

Tax

Digicel identified and recommended an alternative source of tax levels which has been updated more recently (2017)[12].

C&W did not comment on Digicel's recommendation.

ECTEL does not see any argument against using the alternative source proposed by Digicel. Additionally, the Authority decides, consistent with the decision regarding gearing, to apply different tax values for each Member State, as shown below:

Member State	Corporate Tax Rates
Dominica	25.0%
Grenada	30.0%
St. Kitts and Nevis	33.0%
Saint Lucia	30.0%
St. Vincent and the Grenadines	33.0%

Table 2.3: Corporate Tax rates for the Member States [Source: Deloitte Corporate Tax Rates webpage]

Final WACC values

Based on the updated parameters described in this section, ECTEL decides to update WACC values as follows:

[12] https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-corporate-tax-rates.pdf

[CONFIDENTIAL]

Parameter	Public Consultation WACC for fixed networks	Updated WACC for fixed networks				
		Dominica	Grenada	St. Kitts and Nevis	Saint Lucia	St. Vincent and the Grenadines
Risk free rate	2.71%	xx%	xx%	xx%	xx%	xx%
Country risk premium	10.21%	xx%	xx%	xx%	xx%	xx%
Debt premium	1.75%	xx%	xx%	xx%	xx%	xx%
Cost of debt	14.66%	xx%	xx%	xx%	xx%	xx%
Equity Beta	56.00%	xx%	xx%	xx%	xx%	xx%
Market risk premium	5.55%	xx%	xx%	xx%	xx%	xx%
Return on equity	11.53%	xx%	xx%	xx%	xx%	xx%
Gearing	34.27%	xx%	xx%	xx%	xx%	xx%
Tax	27.62%	xx%	xx%	xx%	xx%	xx%
Nominal WACC	**15.50%**	**xx%**	**xx%**	**xx%**	**xx%**	**xx%**

Table 2.4: Original and updated WACC values for the fixed model [Source: Axon Consulting]

Parameter	Public Consultation WACC for mobile networks	Updated WACC for mobile networks				
		Dominica	Grenada	St. Kitts and Nevis	Saint Lucia	St. Vincent and the Grenadines
Risk free rate	2.71%	xx%	xx%	xx%	xx%	xx%
Country risk premium	10.21%	xx%	xx%	xx%	xx%	xx%
Debt premium	1.25%	xx%	xx%	xx%	xx%	xx%
Cost of debt	14.16%	xx%	xx%	xx%	xx%	xx%
Equity Beta	62.46%	xx%	xx%	xx%	xx%	xx%
Market risk premium	5.55%	xx%	xx%	xx%	xx%	xx%
Return on equity	12.55%	xx%	xx%	xx%	xx%	xx%
Gearing	34.27%	xx%	xx%	xx%	xx%	xx%
Tax	27.62%	xx%	xx%	xx%	xx%	xx%
Nominal WACC	**16.25%**	**xx%**	**xx%**	**xx%**	**xx%**	**xx%**

Table 2.5: Original and updated WACC values for the mobile model [Source: Axon Consulting]

[END CONFIDENTIAL]

2.5. **Useful lives**

C&W agreed in general with the useful lives employed in the models and considered it appropriate. C&W commented that "*there is additional 'access site' facilities, such as generators, that would have a lower life that the tower infrastructure itself*".

ECTEL notes that the useful lives listed in the consultation document were a sample of representative resources. ECTEL notes that a lower useful life has been considered for additional facilities in the access sites, such as generators, as can be identified in the model shared in the consultation period.

Digicel stated that *"lifetimes appear to be inconsistently implemented in the draft FLRIC model compared to the draft MLRIC model"* and presented the following comparison:

Asset type	FLRIC lifetime (years)	Proposed asset type from MLRIC model	MLRIC lifetime (years)
Network sites	40		
NGN chassis	5	Equipment hardware	8
Ethernet ports	5	Equipment hardware	8
Core equipment hardware	8		
Core equipment software	5		
Converters	8		
International exchange	5	Equipment hardware	8
MW hops	7	Transmission equipment	8
MW towers	11	Access sites	17
Fibre cable	20		
Transmission Ethernet chassis	5	Equipment hardware	8
Transmission Ethernet ports	5	Equipment hardware	8

Table 2.6: Comparison of lifetimes in ECTEL's BULRIC models [Source: Digicel]

Based on the table above, Digicel stated that "*There is no obvious reason or justification for very similar assets having different lifetimes in the core networks of fixed and mobile operators in the same countries*". And recommended that "*ECTEL consider that similar items have similar lifetimes, and align the assumptions used in the models.*"

C&W disagreed with Digicel and stated that the resources in the comparison are not equivalent. "*A 'network site', for example, in the fixed network is a building whereas an 'access site' for a mobile network is a tower or mast. The latter can indeed be expected to have a shorter life than a building. Similar distinctions must be made among the other assets in the models.*"

The following table presents ECTEL's views about each category highlighted by Digicel.

Table provided by Digicel				ECTEL's views
Asset type	FLRIC lifetimes (years)	Proposed asset type from MLRIC model	MLRIC lifetimes (years)	
Network sites	40		15	Digicel has not proposed any equivalent element. ECTEL considers that the Core Site in the mobile model is a proper equivalent element to fixed network sites. Then, ECTEL decides to use 40 years for both models.
NGN chassis	5	Equipment hardware	8	Ethernet switching equipment may apply a different useful life than the one proposed by Digicel, associated to mobile-specific equipment (e.g. BTS, BSC, MSC). No changes are deemed appropriate.
Ethernet ports	5	Equipment hardware	8	
Core equipment Hardware	8			Digicel has not proposed any equivalent element. These useful lives are equivalent to those used in the model for mobile networks, associated to core equipment.
Core equipment software	5			
Converters	8			There is no equivalent element in the model for mobile.
International exchange	5	Equipment hardware	8	Fixed international exchange is an ethernet switch. Please see comment above regarding ethernet switches.
MW Hops	7	Transmission equipment	8	ECTEL decides to use 8 years for both models.
MW Towers	11	Access sites	17	ECTEL decides to use 17 years for both models.
Fibre cable	20			No fibre cable is considered in the model for mobile networks.
Transmission ethernet chassis	5	Equipment hardware	8	No Ethernet transmission equipment is considered in the model for mobile. The comparison is not relevant.
Transmission ethernet ports	5	Equipment hardware	8	

Table 2.7: Comparison of lifetimes in ECTEL's BULRIC models and comments [Source: Digicel and ECTEL]

2.6. **Overcapacity**

Digicel did not agree with the overcapacity factors used for dimensioning assets in the mobile model. Digicel stated that the use of the proposed factors (10%) "*is a significantly lower allowance for spare network capacity than is assumed in other models*"; as a support Digicel listed the following benchmark of overcapacity factor for different elements:

Asset	Utilisation factor		Overcapacity factor	
	Average	Median	Average	Median
2G BTS	66%	70%	52%	43%
TRX	55%	50%	83%	100%
3G NodeB	67%	70%	50%	43%
CE	55%	52%	82%	92%
BSC	68%	70%	48%	43%
RNC	73%	75%	37%	33%
ATM last-mile backhaul	83%	80%	21%	25%
Ethernet last-mile backhaul	84%	80%	18%	25%
Hub-core transmission	62%	63%	60%	58%
Switches	68%	69%	47%	45%

Asset	Utilisation factor		Overcapacity factor	
	Average	Median	Average	Median
Servers	76%	80%	32%	25%
Switch port cards	69%	70%	44%	43%
Core-core transmission	62%	60%	62%	67%
SMSC	65%	70%	54%	43%

Table 2.8: Benchmark of overcapacity factors used in other cost models [Source: Digicel]

C&W agree with Digicel that a revision of overcapacity factors based on benchmarks could be done. However, C&W noted that the figures presented by Digicel appear excessively high compared to recent models conducted in the region. For instance, "*The recent Jamaica mobile LRIC model assumes an uplift in demand of 30%*".

C&W affirmed that, in general, it *"has no issues with a revision based on justified benchmarks, but believes that ECTEL should ensure that 1) such a revision would not lead to "double counting" overcapacity and thus increase underutilization unduly and 2) revisions be considered to both fixed and mobile models equally as necessary".*

ECTEL notes that the margin of overcapacity allowed by operators may vary significantly from one operator to another. This is confirmed when analysing the models which are public from those considered by Digicel, showing considerably different utilisation factors. For instance, for the case of TRX the utilisation factors vary between 33% (The Netherlands) and 96% (Antilles-Guyana).

This reality was well known when developing the model and, therefore, ECTEL requested information from the operators about the capacity installed in their networks in order to validate overcapacity factors used. Despite the extensions granted during the data gathering process, Digicel did not provide any information to ECTEL.

Additionally, ECTEL notes that most of the models considered by Digicel do not consider other factors which lead to overcapacity in telecom networks that are, in fact, considered in ECTEL's models, such as seasonality of the demand and mobility of the users. Therefore, direct comparison between the table above and the factors presented in the models subject to consultation is not possible.

Since both operators agree with a revision of overcapacity factors, ECTEL saw merit in revisiting these parameters. ECTEL has analysed those models included in Digicel's

comments, and other available models in the Caribbean region, to update the overcapacity factor but ensuring that:

- Double counting is avoided, i.e., avoiding the unreasonable use of other overcapacity factors, such as mobility factors or the planning horizon.
- Results are aligned with operators existing network, avoiding that the use of benchmarked overcapacities may overestimate Member States' operator's costs.

Overcapacity factors for fixed and mobile models are discussed in following sections:

- Mobile model overcapacity
- Fixed model overcapacity

2.6.1. Mobile model overcapacity

This section presents a summary of network overcapacities or elements' usage factors in the mobile model.

Access Capacity

The most important elements to measure access network capacity are TRXs and Cell Carriers. ECTEL also notes that the usage factor can be employed in models to cover several realities:

- Operators typically design the network to leave a security margin for bursts of calls and unexpected peaks. This means that operators consider site upgrade when traffic causes the frequent use of the security margin.
- Traffic is typically not distributed homogeneously within a geotype (due to the mobility nature of the subscribers) or within the year (due to the seasonality behaviour in different locations). If these factors are not considered separately, as in ECTEL draft model, they can be covered by the usage factor.

ECTEL notes that some models simplify the calculation of required capacity in GSM networks. For instance, most of the models mentioned as reference by Digicel calculate the number of TRXs based only on voice traffic, assuming a fixed allocation of capacity for GPRS and signalling. Based on this approach, usage factors may cover any underestimation of data and signalling traffic.

As described above, overcapacity and usage factors may differ significantly among operators and, thus, among regions. Therefore, ECTEL has reviewed not only the models indicated by Digicel (focused only in Europe) but also other models in the Caribbean, namely:

- Jamaica
- Cayman Island
- Mexico
- Antilles-Guyana

The following table presents usage factors employed in the models analysed:

Country	Region	2G	3G
Jamaica	Caribbean	65%	65%
Cayman Island	Caribbean	80%	-
Mexico	Caribbean	85%	85%
Antilles-Guyana	Caribbean	96%	81%
The Netherlands	Europe	33%	53%
UK	Europe	50%	50%
Norway	Europe	43%	50%
Sweden	Europe	40%	40%
France	Europe	59%	69%
Spain	Europe	80%	80%

Table 2.9: Access capacity usage factors used in the models analysed [Source: Axon Consulting based on public models]

Based on the above, ECTEL observes that countries in the Caribbean tend to include higher usage factors than those in Europe.

ECTEL has analysed different scenarios based on the usage factor levels observed in the previous table, comparing the results with the capacity provided by C&W (no information was provided by Digicel).

To avoid double counting, ECTEL has set the seasonality factor, mobility factor and planning horizon to 1 (i.e. no effect).

Based on the analyses performed, it was identified that using usage factors above 80% would tend to overestimate network capacity requirements. Therefore, ECTEL proposes to update overcapacity factors for access capacity consistently with a usage factor of 80% (compared to 91% used in consulted model).

Access Nodes

Regarding access nodes, BTSs and Nodes B, ECTEL notes that some models considered by Digicel apply a usage factor in addition to the one applied to TRXs and Cell Carriers. Such usage factor means that, according those models, not all card slots are used.

ECTEL notes that card slots are not typically left unused for security margin. Therefore, this factor is typically used to avoid inaccuracies associated with considering average capacity for each geotype (i.e. a percentage of sites would have more or less TRXs or Cell Carriers than the average, requiring additional nodes due to modularity issues).

This effect is considered in several models published by telecom operators by using a modularity factor, as is the case with ECTEL's models. The relation between both parameters is as follows:

$$Modularity\ factor = \frac{1}{Access\ node\ usage\ factor\ [BTS\ or\ Nodes\ B]}$$

The following table presents the equivalent modularity factors used in the analysed models:

Countries	Region	2G Modularity factor	3G Modularity factor
Mexico	Caribbean	1.18	1.18
Antilles-Guyana	Caribbean	1.50	1.50
The Netherlands	Europe	1.06	1.06
UK	Europe	1.50	1.50
Norway	Europe	1.35	1.67
Sweden	Europe	2.67	2.67
France	Europe	1.43	1.40
Spain	Europe	1.50	1.50

Table 2.10: Modularity factors used in the models analysed [Source: Axon Consulting based on public models]

As observed in previous table, most models consider a modularity factor of around 1.5, which is aligned with the figures used in the model for the BTS. ECTEL notes that 1.1 was used for Node B equipment, which is below typical values found in other models. ECTEL decided to use a factor of 1.5 for both BTS and Node B.

Transmission Network

In the case of transmission equipment, the following table presents the usage factors employed in other models:

Countries	Region	Backhaul	Backbone
Jamaica	Caribbean	N/A	73%
Antilles-Guyana	Caribbean	N/A	60%
The Netherlands	Europe	N/A	40%
UK	Europe	71%	60%
Norway	Europe	90%	90%
Sweden	Europe	N/A	40%
France	Europe	80-86%	50%
Spain	Europe	80%	70%

Table 2.11: Transmission network usage factor of the models analysed [Source: Axon Consulting based on public models]

ECTEL notes that the usage factors for backhaul equipment are mostly aligned between them at around 80%. ECTEL observes higher variation for backbone transmission, around 60%. These values are aligned with those proposed by Digicel and ECTEL does not have information which indicates that they are not reasonable.

Based on the above, ECTEL decided to set a usage factors of 80% for backhaul transmission and 60% for backbone transmission.

Core Network

In the case of core equipment, the following table presents the usage factors employed in other models:

Countries	Region	BSC	RNC	Switches	Servers	SMSC
Jamaica	Caribbean	65%	65%	-	70%	64%
Cayman Island	Caribbean	80%	-	-	-	-
Mexico	Caribbean	43%	73%	80%	75%	80%
Antilles-Guyana	Caribbean	77%	86%	73%	83%	68%
The Netherlands	Europe	50%	73%	60%	60%	80%
UK	Europe	80%	75%	74%	74%	80%
Norway	Europe	54%	90%	82%	-	70%
Sweden	Europe	80%	80%	60%	80%	40%
France	Europe	77%	44%	60%	67%	58%
Spain	Europe	70%	70%	70%	70%	70%

Table 2.12: Core equipment usage factor of the models analysed [Source: Axon Consulting based on public models]

ECTEL observes that, despite some variation among elements and countries, the values used are around 70%, aligned with values proposed by Digicel. ECTEL does not have information which indicates that these usage factor levels are not reasonable. ECTEL considers it appropriate to use a usage factor for core equipment of 70%.

2.6.2. Fixed model overcapacity

This section presents a summary of network overcapacities or elements' usage factors in the fixed model. As indicated in the case of the mobile model, ECTEL has analysed, apart from those considered by Digicel, a number of examples in the Caribbean regions, namely:

- Jamaica
- Cayman Island
- Mexico

The following table presents average usage factors used in the analysed models:

Country	Region	Access Network	Distribution Network	Core Network	Transmission Network
Jamaica	Caribbean	91%	91%	91%	91%
Cayman Island	Caribbean	N/A	N/A	N/A	59%
Mexico	Caribbean	N/A	40%	60%	40%
Denmark	Europe	91%	75%	N/A	75%
Italia	Europe	75%	N/A	N/A	N/A
Norway	Europe	95%	N/A	64%	N/A
Sweden	Europe	75%	N/A	60%	N/A
Portugal	Europe	77%	73%	69%	N/A
France	Europe	40%	N/A	57%	N/A
The Netherlands	Europe	N/A	N/A	52%	N/A

Table 2.13: Usage factors used in the fixed models analysed. [Source: Axon Consulting based on public models]

Based on the above figures, ECTEL considers using the following usage factors in the fixed BULRIC model:

Network layer	Usage factor
Access network	80%
Distribution network	70%
Core network	65%
Transmission network	65%

Table 2.14: Usage factors by network layer considered in the model. [Source: Axon Consulting]

2.7. **Documentation**

Digicel commented on several aspects related to the supporting documentation of the draft BULRIC models. The following table summarises Digicel's comments and ECTEL's views.

Aspects related to the supporting documentation	Digicel´s comments	ECTEL's views
Mobility factor	Digicel believes that the documentation related to the mobile model should describe how the mobility factor is derived and asked why Saint Lucia is the only island where the urban/suburban geotypes have a mobility factor of 1	As described in section 2.6.1, all mobility factors have been set to 1 to avoid double counting with updated overcapacity factors. Therefore, this comment is no longer relevant
Effective capacity approach	Digicel asked for further detail about how the effective capacity approach has been implemented in the mobile model in models' documentation.	Further detail on the implementation of effective capacity approach has been included in models' documentation.
Custom formula	Digicel asked about the rationale behind custom formula *"array2mat"*.	Further detail on the custom formula has been included in models' documentation
Transmission topologies	Digicel affirmed that the consultation document states *"Ring Topology for urban areas and rural areas and Minimum Distance Tree Topology for Suburban and Rural areas"* and proposed to describe more clearly.	Further detail on the implementation of the topologies has been included in models' documentation.
Unused data in the models	Digicel stated that there are references to municipalities, which are not relevant to modelling, and should be revised accordingly.	These references have been deleted from models and documentation.
Missing information	Digicel stated that the lifetime for backhaul assets (fibre or leased line) is missing from the table 2.7 from the consultation document, although a lifetime is included in worksheet 2G in the draft MLRIC model.	The consultation document presented a summarised list of assets, being the complete version in worksheet 2G, as indicated by the respondent.
Irrelevant references	Digicel affirmed that there is a reference to the "Sultanate" and "RAN sharing" in the mobile model documentation which are not relevant for ECTEL models.	These references have been removed from the models and documentation.
Wording	Digicel stated that the word "Coubicated" related to the worksheets 6A, 6B, 6C and 6D of the mobile model should be substituted by "co-located".	Wording has been amended accordingly.
Redacting process	Digicel stated that the table 3.5 from the consultation document, related to the fixed resources evolution makes no sense to present, since *"it appears to show that all five countries have identical numbers of network nodes. This is only due to the redaction process and is therefore highly misleading for stakeholders."* Digicel stated that the comments from the tables from the Worksheets 2A-2E related to the Fixed model should be amended, since the inputs are completely identical and the comment stated: *"the values shown are illustrative, which have been anonymised by + -30%"*	Due to the confidentiality of the information about fixed networks, it was not possible to share real inputs with the industry. Even if in some cases redacted inputs were equivalent for all Member States, the resulting number of elements were sufficient to determine each Member States costs, and comments could have been provided.

Table 2.15: Digicel comments related to the BULRIC models´ documentation [Source: Axon Consulting]

3. ISSUES SPECIFIC TO THE BULRIC MODEL FOR MOBILE NETWORKS

This chapter contains those comments received which are only applicable to the model for mobile networks. Comments are grouped based on the following topics:

- Market demand considered in the model
- Population coverage of the modelled operator
- Spectrum allocation per technology
- Modelled Backbone Network
- Resulting network elements
- Geotypes characterisation
- Market Share

Please note that operators agreed with the models with regards to Demand Statistics. Therefore, this aspect is not detailed in following sections.

3.1. Market demand considered in the model

ECTEL observes that overall, C&W *"believe that the demand presented in the Consultation Document reasonably depict the mobile market in the Member States"*. Digicel has not provided any comment regarding the overall historic demand considered in the model. This section discusses comments submitted by the operators concerning:

- Demand disaggregation per technology
- Traffic forecast

3.1.1. Demand disaggregation per technology

C&W stated that they provided the requested information for the year 2015 on 14 October 2016 in its Third Tranche of responses to the ECTEL Data Request. C&W requested that ECTEL considers these figures in subsequent revisions of inputs to the model.

ECTEL confirms that named information was provided by C&W and has updated demand disaggregation, based on information provided as follows:

[CONFIDENTIAL]

Technology for Voice, SMS and MMS services	Dominica	Grenada	St. Kitts and Nevis	Saint Lucia	St. Vincent and Grenadines
GSM	xx%	xx%	xx%	xx%	xx%
UMTS	xx %	xx %	xx %	xx %	xx %
LTE	xx %	xx %	xx %	xx %	xx %

Table 3.1: Demand Disaggregation per technology for voice, SMS and MMS services. [Source: Axon Consulting]

Technology for Data services	Dominica	Grenada	St. Kitts and Nevis	Saint Lucia	St. Vincent and Grenadines
GSM	xx%	xx%	xx%	xx%	xx%
UMTS	xx %	xx %	xx %	xx %	xx %
LTE	xx %	xx %	xx %	xx %	xx %

Table 3.2: Demand Disaggregation per technology for data services for the Member States. [Source: Axon Consulting]

[END CONFIDENTIAL]

Digicel pointed out that the model considers only 3G subscribers but Digicel continues to sell 2G handsets in the market. ECTEL acknowledges Digicel's comment, and notes that:

- Digicel did not provide any information about its customers disaggregation by technology.
- Customers disaggregation by technology has limited impact on MTRs results since both 2G and 3G customers are sharing the elements that are mostly dependent on subscribers (e.g. HLR, VMS).
- Subscribers' information included in the draft model was provided by other operators.

Despite the above, ECTEL agrees with the fact that 2G only devices are still used in the Member States. Since no information is available from the operators, ECTEL has updated the subscribers' disaggregation per technology based on the subscribers' trends per technology from Ericsson data trends[13]. The following table presents the updated subscribers growth rates considered in the final mobile model:

[13] Ericsson Traffic exploration – Subscriptions World total https://www.ericsson.com/TET/trafficView/loadBasicEditor.ericsson

Service Category	Technology	2015	2016	2017	2018	2019	2020
Subscribers	GSM	49.0%	41.4%	34.1%	27.6%	22.5%	19.8%
Subscribers	UMTS	51.0%	58.6%	65.9%	72.4%	77.5%	80.2%

Table 3.3: Subscribers growth rates. [Source: Axon Consulting based on Ericsson report]

3.1.2. Traffic forecast

Voice and data trends

C&W disagreed with the growth rates assumed for data traffic in the mobile model. C&W stated that 15% data growth considered in the models would not be consistent with the consideration in the model of steady voice traffic. Moreover, C&W mentions Ericsson's Mobility report which shows an annual growth rates of 45% for the period 2015–2021.

Digicel disagreed with C&W's comment *"on higher data growth rates. Axon's projection of declining growth is consistent with other industry forecasts made by respected analysts"*. Digicel also affirmed *"[t]he declining growth forecast adopted in ECTEL's model reflects the limitations of existing technology. It is recognised that the inexorable growth in mobile data traffic needs repeated releases of additional mobile spectrum in more and more capacity expansion bands, beyond the spectrum amounts deployed in ECTEL's model"*.

NTRC SVG considered that the approach taken by ECTEL was prudent and stated that "*while data increasing replacing voice, growing fixed wireless broadband (Wi-Fi) across the region is enabling consumers to connect to the internet*", which could slow the growth of data traffic overtime.

ECTEL acknowledges all the comments and notes that the data growth of 15% mentioned by C&W, only represents the growth rate of the last 2 years of modelling period, i.e., 2019 and 2020. ECTEL notes that the data combined CAGR (from 2015 to 2020) considered in the model is 26.47%.

In the case of voice services, C&W provided to ECTEL growth rates between **[CONFIDENTIAL]** xx% and xx% **[END CONFIDENTIAL]**. However, such estimation was considered misrepresentative of typical growth trends, as observed in historic traffic provided to ECTEL. Therefore, ECTEL considers that 0% growth rate for voice services is a prudent approach.

Moreover, ECTEL notes that the voice growth proposed by C&W would have an impact on data traffic growth below 0.3%, not being a solid argument for higher data growth rates.

Based on the above, ECTEL decided to keep the prudent trends shown in the draft models.

SMS trends

Digicel stated that "*SMS is declining in use as data messaging is increasing, hence SMS volumes should be forecast to decline in the future*".

ECTEL acknowledges Digicel's comment and notes:

- Digicel has not provide a SMS forecast estimation to support their argument.
- The SMS forecast implemented in the mobile model was considered based on other operators forecast demand.
- Based on historical information available to ECTEL, there is no clear trend for SMS demand.

Based on the above, ECTEL decided to consider a conservative 0% grow rate for SMS demand.

3.2. **Population coverage of the modelled operator**

C&W stated that "*considering the figures have been modified with a ± 10% range we cannot say for certain that the coverage accurately represents coverage in the Member States; we agree, however, that the coverage presented is reasonable*".

C&W agreed that 2015 coverage is representative for the period 2015-2020, in fact C&W stated that "*further network development is likely to focus on bringing increasing bandwidth to existing sites, rather than increasing the number of sites for coverage or capacity"*.

Digicel affirmed to have reported "*population coverage to the GSMA of 94-96-98% in Dominica, Saint Lucia and St. Vincent and the Grenadines*". Digicel stated that the model "*shows significantly less than 90% coverage for these countries*". Digicel expected much higher coverage for these countries and *"disagre[ed] with C&W that the coverage*

percentages are reasonable, and an understatement of the coverage is likely to lead to the understatement of required assets".

ECTEL acknowledges C&W's comments and observes that Digicel did not provide any information about coverage during the data gathering process. Moreover, in its comments Digicel only provided figures for 3 out of the 5 Member States and it did not provide any supporting information as requested in the Consultation Document.

ECTEL highlights that the population coverage considered is consistent with the information provided to ECTEL by other operators. Therefore, ECTEL decides to consider a modelled operator with coverage levels aligned with the information provided to ECTEL and not change the figures included in the draft model.

3.3. **Spectrum allocation per technology**

Digicel did not provide any comment regarding the spectrum allocation.

C&W asked if the exhibit represents the actual aggregate bandwidth available for allocation, or if the exhibit shows the bandwidth not yet allocated to market participants.

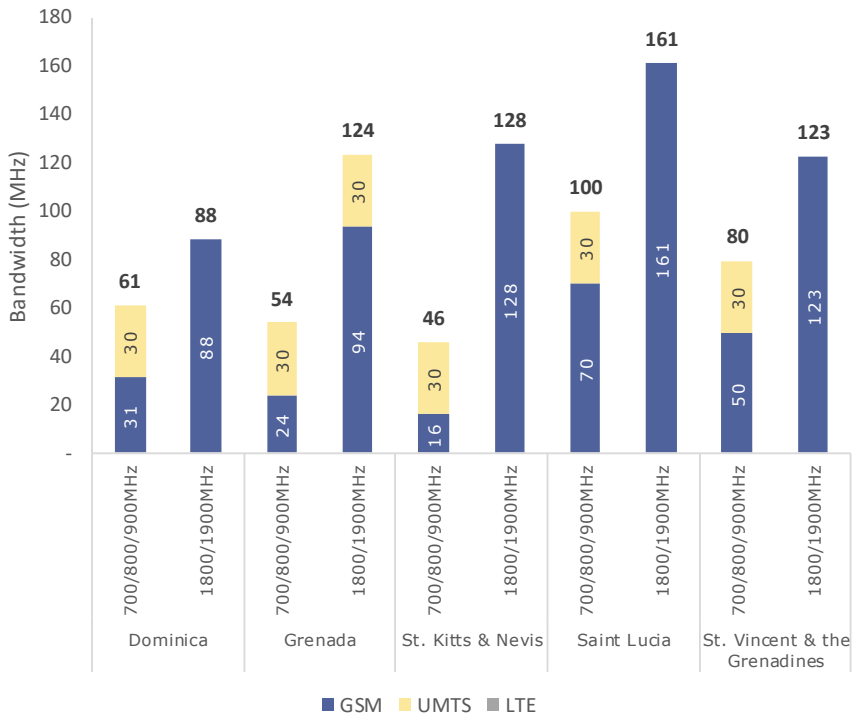

Exhibit 3.1: Bandwidth (uplink plus downlink) available for operators in each market and allocation to technologies. [Source: Axon Consulting]

ECTEL confirms that Exhibit 3.1 represents the actual aggregate bandwidth allocated to operators.

3.4. **Modelled Backbone Network**

C&W stated that "*the backbone network depicted […] are reasonable*".

Digicel stated that *"[t]he backbone networks shown for Grenada and St. Kitts and Nevis do not include resilient links: ring structures and resilient inter-island links would be reasonable to ensure the modelled network has a reasonable level of resilience to a single link point of failure between one of the islands. Digicel does not agree with C&W on this question, and recommends that additional microwave links will be needed to provide this resilience (as appears to have been done for the network linking St. Vincent and the Grenadines)"*.

ECTEL agrees with Digicel and notes that every island would be benefited by redundancy and, therefore, it should be considered in the model. Then, ECTEL accepts Digicel's proposal and included resilient links for Grenada and St. Kitts and Nevis, as shown below:

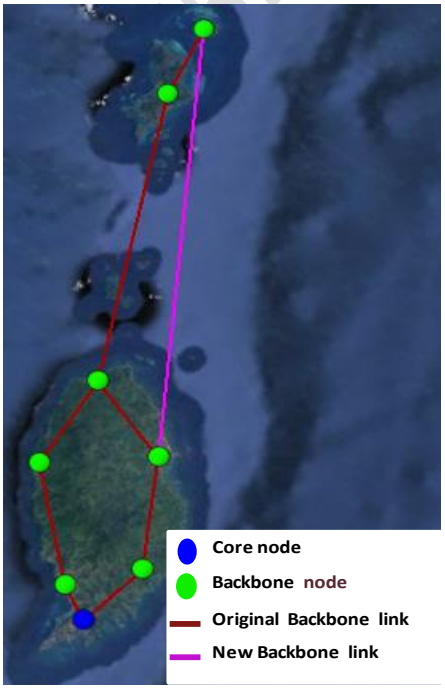

Exhibit 3.2: Topology of the mobile core network for Grenada. [Source: Axon Consulting]

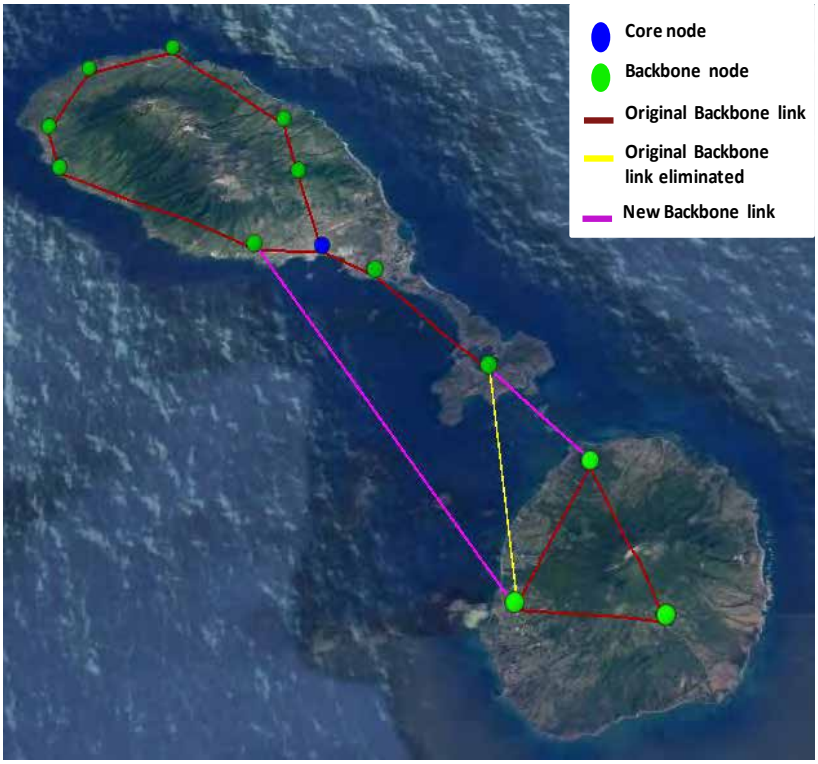

Exhibit 3.3: Topology of the mobile core network for St. Kitts and Nevis. [Source: Axon Consulting]

3.5. **Resulting network elements**

This section summarises the operators' comments related to the resulting network elements, particularly:

- Access sites estimation
- 2G TRX estimation
- Cell radii

3.5.1. Access sites estimation

Sites calculation

Digicel states that they *"reproduced the base station volumes for the whole archipelago […] with little difference between using a 33% market/spectrum share or 50% market/spectrum share)"*.

ECTEL understands Digicel's comment about the limited variation of 2G sites between 33% and 50% market/spectrum share. According to the information available, ECTEL

notes that 2G sites are mostly coverage-driven and, therefore, the impact associated with the demand (i.e. market share) is limited.

Digicel also pointed out that the number of sites for coverage was lower than the number of contiguous areas in each geotype. ECTEL agrees with Digicel and notes that two areas that are not contiguous are not expected to be covered by the same site.

C&W disagreed with Digicel and stated that there may be a problem with the colour coding in the documentation, rather than a flaw in the scorched earth algorithm.

ECTEL acknowledges C&W's comment and confirms that there are not issues in the colour coding of the Member States maps and that the current algorithms do not include safeguards to avoid the model from producing less coverage sites than contiguous areas. ECTEL, thanks Digicel for its comment and decided to include such safeguards in the model.

Sites evolution

C&W disagreed that *"the site evolution GSM and UMTS is reasonable*". C&W expected that "*given the spectrum available and the assumption on constant population coverage, that the number of sites would begin to plateau and the additional traffic would be addressed through increases in capacity on existing sites*"

Digicel stated that "*that there is strong evidence that the modelled network resources are not sufficient, based on our analysis of the overcapacity factors and coverage calculations*."

ECTEL acknowledges Digicel´s comments and affirms that the overcapacity factors and coverage calculations have been revised (see section 2.6.1 and 3.2 respectively).

ECTEL disagrees with C&W that 3G sites should not be affected by the data growth. It is true that site capacity can be increased, but ECTEL's estimations indicate that even considering the maximum capacity with the available spectrum, the current number of sites would not be enough to satisfy the forecast data traffic.

ECTEL considers that new technologies, e.g. 4G, may increase the sites' capacity, but notes that it has not been informed of any plans for migration to 4G in the modelled period.

Sites information

Digicel pointed out that "*the National Telecommunications Regulatory Commissions in each member state have access to the site information for Digicel*". Then, the NTRCs should have been able to cross-check the actual sites and the grid squares. Digicel stated that such checks should be undertaken during the model finalization.

C&W agreed with Digicel and stated that ECTEL should sense-check estimated locations against actual locations.

ECTEL notes that Digicel did not provide any information related to their site locations and the number of sites, in response to the ECTEL Data Request. When this information was requested from the NTRCs, ECTEL found that the detail available was very limited, and did not include the information requested from Digicel such as equipment and capacity installed, traffic, etc.

3.5.2. 2G TRX estimation

Digicel had "*compared the modelled TRX in 2017 (using a 50% market share) with actual TRX deployments in Digicel's current network*" and stated that "*the model is significantly under-dimensioning the requirement for these assets in all the islands and cannot therefore be relied upon to produce a realistic network design*".

ECTEL acknowledges Digicel's comment and notes that Digicel has provided alleged differences between the model's estimations and Digicel's values for only 4 out of 5 Member States without supporting documentation or supporting analysis as was requested in the consultation document.

ECTEL also notes that Digicel did not provide any information regarding access sites, installed capacity and traffic supported even when it was requested by ECTEL.

Without any detailed information or supporting evidences, ECTEL cannot validate that the model results are not aligned with the equipment needs of a generic reference operator with the existing demand, coverage, etc., as alleged by Digicel. Therefore, no changes were deemed appropriate in the model in this regard.

3.5.3. Cell radii

Digicel stated that based on the formulae used in the worksheet 6A of the mobile model, the phrase "cell radii" seems to mean "sector radii" instead of "base station radii".

Digicel affirmed that the cell radius input "*leads to a different sector size depending on whether the 2G base station is 2-sectored or 3-sectored*".

C&W disagreed with Digicel and stated that Digicel appears to confuse the terms "radius" with "area".

First of all, ECTEL confirms that cell radii is equivalent to base station radii or site radii, and not sector radii as Digicel believed. ECTEL agrees with C&W and notes that Digicel has not properly reviewed the formulas used in the shared model, misunderstanding the results. In order to clarify this, it is important to note the following points:

- As well represented by Digicel in its comments, 3-sectored sites are modelled assuming hexagonal sectors. When calculating the area covered by one site, the area of three hexagons must be calculated. The formula used for calculating the area of each hexagon is as follows:

$$HexagonArea = \frac{3 \times \sqrt{3}}{2} s^2$$

  Where "s" represents the length of the hexagon side. Then one must understand the relationship between each of the three hexagons' side with the radii of the site itself. Based on the geometry of regular hexagons and on the optimum location of the sites to minimise inter-cell interference such relationship is:

$$s = \frac{2}{3} r$$

  Where "r" represents site radii.

- In the case of 2-sectored sites, it is important to mention that they are used for covering roads and, therefore, coverage calculations are based on length covered (i.e. not area). In such a case, the length covered by one sector is equal to site radii.

Based on the above explanation, ECTEL concludes that the calculations are correct.

3.6. **Geotypes characterisation**

Digicel affirmed that the population centre information was obtained from Geonames' website. Digicel noted that the entry type "P" (city, village, etc) from Geonames' website that was used for characterising the geotypes of the model, was insufficient because there were other locations type "S" (spot, building, farm, etc) which included airports, hotels/resorts, hospitals and schools/universities, which are population centres "*in terms of frequent occupancy and therefore it is reasonable to expect that they need to be covered*".

C&W disagreed with Digicel and believed that any single characterization (e.g., "P" for city, village, "S" for spot, building farm, etc.) may lead to over or under estimation of the nature of the population in the area.

Digicel stated that locations found in the source used (Geonames) is relatively inaccurate and proposed the use of geoMinds.

C&W agreed with Digicel that ECTEL should review its geotyping in this regard and even consider geoMinds, but C&W also stated that similar distortion could be present in geoMinds as happened in Geonames.

ECTEL has analysed the source proposed by Digicel, i.e. geoMinds, and it has observed that it is mainly focused on roads. The information available for population centres is limited, including between 36% and 98% less population centres than the source used in the draft model, i.e. Geonames.

Despite the above, ECTEL acknowledges that geographical information used has some limitations and sees the merits of revisiting the geographical characterisation. In order to take advantage of both sources (Geonames and geoMinds) and to consider the maximum accuracy possible with the available information, ECTEL has proceeded with the following approach:

1. Starting point is the information of "p" locations (City, village, etc.) from Geonames. This information has been compared with satellite images in order to identify any deviated location and ensuring all the locations are accurate.
2. Analyse all "S" locations (hospitals, schools, university centres, etc.) in Geonames with satellite images to identify airports, hotels/resorts, hospitals and schools/universities not covered with step 1.

3. Review geoMinds population centres with satellite images to identify centres not covered with previous steps.
4. Review satellite images to include any population centre, airport, hotel/resort, hospital or school/university not covered with previous steps.

Finally, it has been verified that all the limitations identified by Digicel have been improved, without identifying any further limitation. The following exhibits present the improved geotypes used in the final model.

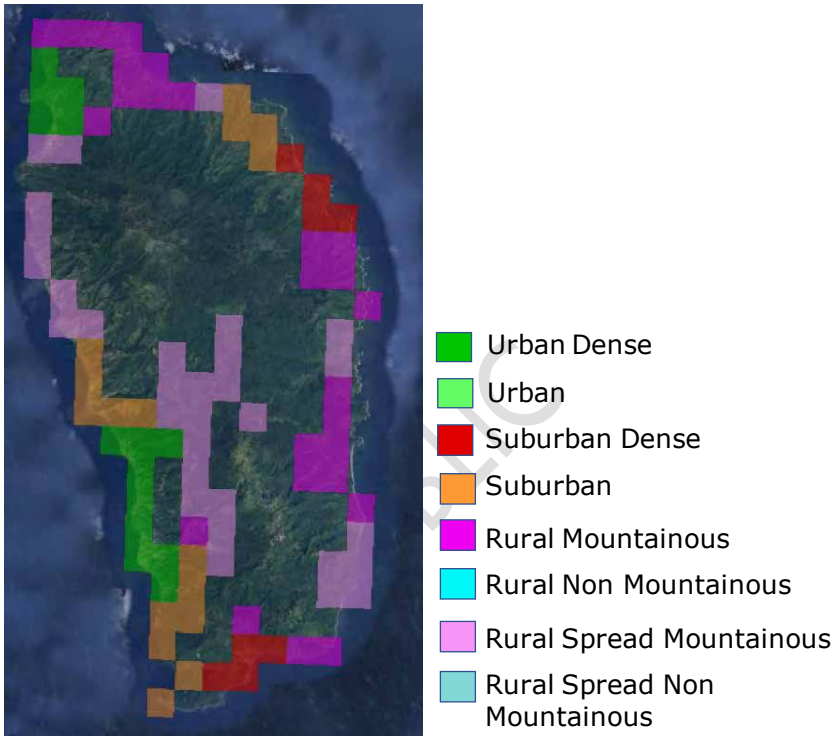

Exhibit 3.4: Updated geotypes for Dominica. [Source: Axon Consulting]

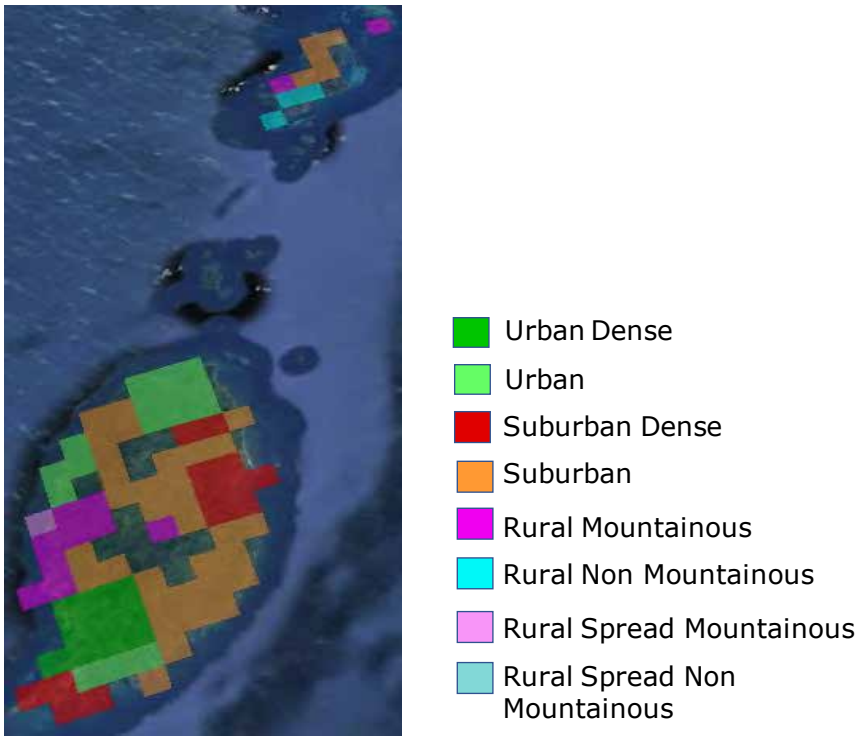

Exhibit 3.5: Updated geotypes for Grenada. [Source: Axon Consulting]

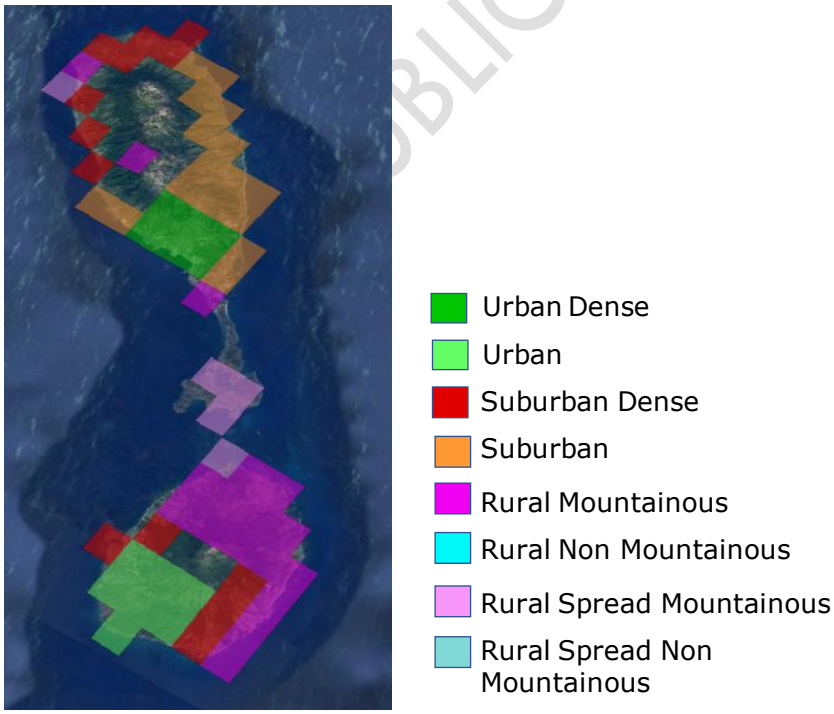

Exhibit 3.6: Updated geotypes for St. Kitts and Nevis. [Source: Axon Consulting]

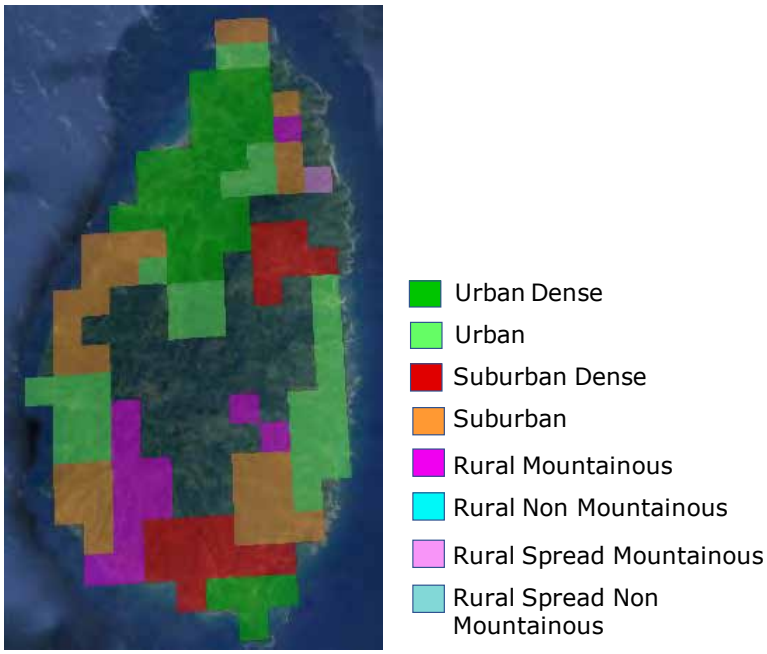

Exhibit 3.7: Updated geotypes for Saint Lucia. [Source: Axon Consulting]

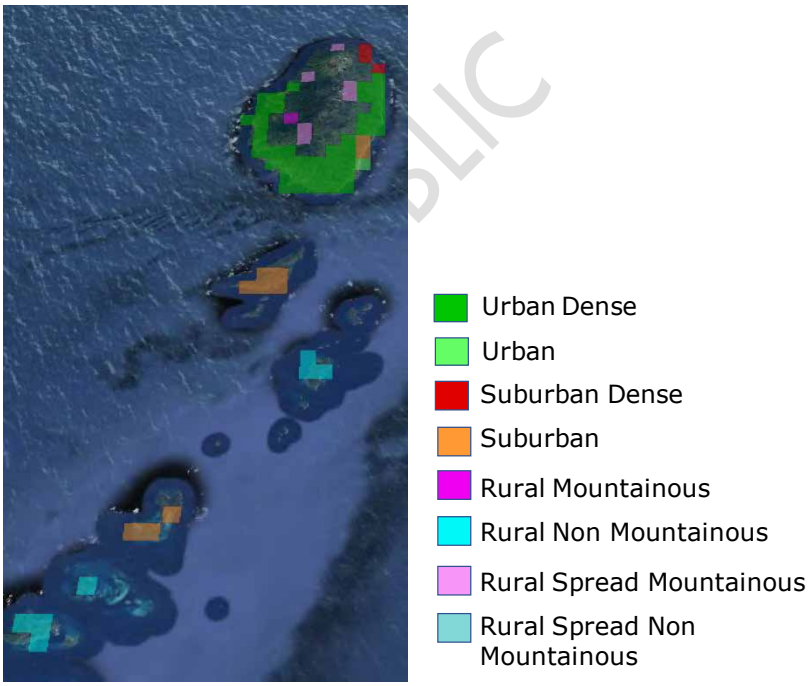

Exhibit 3.8: Updated geotypes for St. Vincent and the Grenadines. [Source: Axon Consulting]

Finally, Digicel stated that "*every grid square included in the modelling must have at least one population centre*". Digicel affirmed that in some geotypes of the Member States there appear to be fewer population centres than grid samples.

ECTEL agrees with Digicel that every grid square included in the modelling must have at least one population centre. ECTEL confirms that the improved geotypes above include

at least one population centre, airport, hotel/resort, hospital or school/university per each grid square.

3.7. **Market Share**

C&W did not believe "*the assumption of 33% market share for any of the islands is appropriate. It runs contrary to reality, as ECTEL has itself admitted three operator markets are a minority in ECTEL Member States; moreover, even in those Member States with three operators, it is not at all clear that the market is large enough for three operators in the long-term*".

Additionally, C&W stated that *"it is quite possible that the artificially high mobile termination rates, which a smaller market share assumption would generate, will lead to a MORE difficult business environment for new entrants, as they will be net senders of traffic during the first critical years of existence. Furthermore, more generally, ECTEL should not be in the business of raising costs in the mobile sector to favor certain operators over others"*.

Digicel disagreed with C&W *"that ECTEL should simply assume away one of the mobile operators, or assume that the markets should not support three players in the long-run. Stating that one of three players in the three-player markets is unsustainable is inconsistent with regulatory practice in most other countries, where the regulator applies the actual number of operators into the MTR costing model in some logical and justifiable way"*.

ECTEL agrees with C&W that the application of 33% Market Share in every country would not necessarily foster the entrance of third operators, since it is expected to lead to higher interconnection rates.

ECTEL agrees with Digicel and considers it reasonable to apply a mobile market share of 33% or 50% reflecting the actual situation in each market. In the following table, the Market Share considered in the model for each Member States is shown:

Member States	Number of mobile operators	Market Share
Dominica	2	50.0%
Grenada	3	33.3%
St. Kitts and Nevis	3	33.3%
Saint Lucia	2	50.0%
St. Vincent and Grenadines	2	50.0%

Table 3.4: Market Share and number of mobile operators of each of the Member States. [Source: Axon Consulting]

4. ISSUES SPECIFIC TO THE BULRIC MODEL FOR FIXED NETWORKS

This chapter contains those comments received which are only applicable to the model for fixed networks. Comments are grouped based on the following topics:

- Market demand considered in the model
- Domestic transit demand
- Data demand
- Resulting network elements

Please note that operators agreed with the models with regards to Demand Statistics, traffic forecast and access network links distance[14]. Therefore, these aspects are not detailed in following sections.

4.1. Market demand considered in the model

This chapter discusses the comments submitted by the operators concerning:

- Domestic transit demand
- Data demand

4.2. Domestic transit demand

C&W stated that *"domestic transit call volumes appear exaggerated. Domestic transit as we understand it should include interconnection transited traffic between the fixed and mobile networks and between the mobile networks".*

ECTEL understands C&W's comment that domestic transit call volumes appear exaggerated compared to what C&W provided. ECTEL notes that, apart from the traffic provided by C&W, the model is including the mobile network off-net traffic (incoming and outgoing). This approach was considered based on C&W's explanation that the mobile network is interconnecting through the fixed network.

[14] ECTEL confirms that these distances are based on methodology described.

Based on clarifications provided by C&W, ECTEL has updated transit demand, based on off-net mobile traffic and operators´ market share for each of the Member States.

4.3. **Data demand**

About broadband traffic, C&W stated that some of the Member States appear to have reasonable traffic levels whereas others do not seem reasonable.

C&W affirmed that the data provided was measured directly from the servers at each of C&W business units and that ECTEL did not indicate that there were problems with these particular data submissions.

ECTEL notes that the modelled operator should include the traffic for both copper and HFC networks, as defined in the Methodology: "*model an operator that will have similar characteristics to the national incumbent operator that combines existing copper and HFC networks. Therefore, the reference operator will be presumed to have the demand and coverage of both the copper and HFC incumbent's networks."*

Based on the above, ECTEL confirms that the demand (data and voice) is based on the information provided by the incumbent operator (which referred to C&W operations) plus HFC network demand based on the statistics available to ECTEL.

4.4. **Resulting network elements**

C&W agreed with the resulting network elements of the fixed model and stated that these resources seem reasonable to satisfy the relevant demand of the Member States.

C&W noted that ECTEL has pursued an approach that generates substantially fewer edge nodes than C&W would expect; however, C&W accepted this approach as reasonable, as "*so long as the capacity of those fewer edge nodes are appropriately larger and the average distances from access node to edge node are correspondingly longer*".

ECTEL acknowledges C&W's comments and notes that the number of node locations and the distances between them considered in the model are based on C&W's information, and the distribution of the number of the nodes' type (access, edge, distribution) was estimated based on the required capacities.

5. CONSIDERATION OF SUBMISSIONS

ECTEL appreciates every comment provided by the stakeholders and states that the Authority has carefully considered all the comments related to the BULRIC models for mobile and fixed networks. After analysing them in previous sections, ECTEL has decided to implement a number of improvements in the BULRIC models, as shown in the following tables.

Changes	Chapter	Section
WACC values has been be updated based on the stakeholders´ comments.	2.4	WACC calculation and parameters
Useful life of the mobile model core site has been changed to 40 years.	2.5	Useful lives
Overcapacity and modularity factors have been revisited.	2.6	Overcapacity
Demand disaggregation per technology has been amended based on C&W information.	3.1.1	Demand disaggregation per technology
Subscribers' disaggregation per technology has been updated based on Ericsson estimates.	3.1.1	Demand disaggregation per technology
SMS trends has been updated to 0% grow rate.	3.1.2	SMS trends
Redundancy links has been included in backbone network for Grenada and St. Kitts and Nevis.	3.4	Modelled Backbone Network
Access sites algorithms has been revisited and has been upgraded in order to consider the number of contiguous areas.	3.5.1	Access sites estimation
Geotypes characterisation has been revisited and updated based on proposed sources and with a thorough methodology.	3.6	Geotypes characterisation

Table 5.1: Summary of changes included in the mobile draft model [Source: Axon Consulting]

Changes	Chapter	Section
WACC values has been be updated based on the stakeholders ´comments.	2.4	WACC calculation and parameters
Useful lives for MW hops and MW have been made consistent with Mobile model.	2.5	Useful lives
Overcapacity factors have been revisited.	2.6	Overcapacity
Transit traffic has been updated.	4.2	Domestic transit demand

Table 5.2: Summary of changes included in the fixed draft model [Source: Axon Consulting]

After implementing these changes, the models produce the following final results.

5.1. Results from BULRIC Model for Mobile Networks

5.1.1. Dominica

Dominica Mobile Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PLMN Terminating Access Service	2.22	2.07	2.01	1.93	-92.5%
Incoming International Call Termination to PLMN Service	2.22	2.07	2.01	1.93	-92.5%
SMS Termination	0.12	0.12	0.13	0.13	-97.2%
PLMN Transit Service	0.16	0.15	0.14	0.14	-95.6%

Table 5.3: Cost of services of the mobile model for Dominica. [Source: ECTEL´s BULRIC Model for Mobile Networks]

5.1.2. Grenada

Grenada Mobile Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PLMN Terminating Access Service	2.10	2.01	1.92	1.83	-92.7%
Incoming International Call Termination to PLMN Service	2.10	2.01	1.92	1.83	-92.7%
SMS Termination	0.06	0.07	0.07	0.07	-98.2%
PLMN Transit Service	0.10	0.09	0.09	0.09	-95.7%

Table 5.4: Cost of services of the mobile model for Grenada. [Source: ECTEL´s BULRIC Model for Mobile Networks]

5.1.3. St. Kitts and Nevis

St. Kitts and Nevis Mobile Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PLMN Terminating Access Service	1.59	1.51	1.45	1.51	-94.6%
Incoming International Call Termination to PLMN Service	1.59	1.51	1.45	1.51	-94.6%
SMS Termination	0.05	0.05	0.06	0.06	-98.4%
PLMN Transit Service	0.10	0.10	0.10	0.09	-96.8%

Table 5.5: Cost of services of the mobile model for St. Kitts and Nevis. [Source: ECTEL´s BULRIC Model for Mobile Networks]

5.1.4. Saint Lucia

Saint Lucia Mobile Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PLMN Terminating Access Service	1.50	1.43	1.43	1.40	-93.8%
Incoming International Call Termination to PLMN Service	1.50	1.43	1.43	1.40	-93.8%
SMS Termination	0.06	0.06	0.06	0.06	-97.9%
PLMN Transit Service	0.09	0.09	0.08	0.08	-95.2%

Table 5.6: Cost of services of the mobile model for Saint Lucia. [Source: ECTEL´s BULRIC Model for Mobile Networks]

5.1.5. St. Vincent and the Grenadines

St Vincent and the Grenadines Mobile Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PLMN Terminating Access Service	2.68	2.58	2.53	2.36	-90.2%
Incoming International Call Termination to PLMN Service	2.68	2.58	2.53	2.36	-90.2%
SMS Termination	0.09	0.09	0.10	0.10	-97.1%
PLMN Transit Service	0.11	0.11	0.10	0.10	-94.3%

Table 5.7: Cost of services of the mobile model for St. Vincent and the Grenadines. [Source: ECTEL's BULRIC Model for Mobile Networks]

5.2. Results from BULRIC Model for Fixed Networks

5.2.1. Dominica

Dominica Fixed Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PSTN Terminating Access Service	0.87	0.83	0.79	0.77	-86.9%
Incoming International Call Termination to PSTN Service	1.06	1.05	1.04	1.04	-82.2%
PSTN Transit Service	0.18	0.17	0.17	0.16	-94.8%
Emergency Services Access Service	14.96	14.93	14.92	14.91	493.9%
National DQ Services	15.18	15.19	15.21	15.22	-84.3%
International DQ Services	15.18	15.19	15.21	15.22	-82.7%
International Call Origination Service	1.09	1.07	1.07	1.07	-82.5%

Table 5.8: Cost of services of the fixed model for Dominica. [Source: ECTEL´s BULRIC Model for Fixed Networks]

5.2.2. Grenada

Grenada Fixed Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PSTN Terminating Access Service	0.57	0.55	0.54	0.53	-87.0%
Incoming International Call Termination to PSTN Service	0.60	0.59	0.59	0.60	-85.4%
PSTN Transit Service	0.11	0.10	0.10	0.10	-95.3%
Emergency Services Access Service	14.71	14.70	14.70	14.69	378.5%
National DQ Services	14.77	14.77	14.78	14.79	-83.9%
International DQ Services	14.77	14.77	14.78	14.79	-84.4%
International Call Origination Service	0.62	0.61	0.61	0.62	-89.9%

Table 5.9: Cost of services of the fixed model for Grenada. [Source: ECTEL´s BULRIC Model for Fixed Networks]

5.2.3. St. Kitts and Nevis

St. Kitts and Nevis Fixed Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PSTN Terminating Access Service	0.63	0.61	0.60	0.59	-77.5%
Incoming International Call Termination to PSTN Service	0.74	0.75	0.75	0.77	-70.6%
PSTN Transit Service	0.11	0.11	0.11	0.11	-96.4%
Emergency Services Access Service	14.80	14.79	14.78	14.77	653.7%
National DQ Services	14.95	14.96	14.97	14.99	-83.0%
International DQ Services	14.95	14.96	14.97	14.99	-83.0%
International Call Origination Service	0.76	0.77	0.78	0.79	-72.7%

Table 5.10: Cost of services of the fixed model for St. Kitts and Nevis. [Source: ECTEL´s BULRIC Model for Fixed Networks]

5.2.4. Saint Lucia

Saint Lucia Fixed Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PSTN Terminating Access Service	0.56	0.54	0.53	0.53	-85.0%
Incoming International Call Termination to PSTN Service	0.52	0.52	0.51	0.52	-85.3%
PSTN Transit Service	0.09	0.09	0.09	0.09	-95.2%
Emergency Services Access Service	14.76	14.75	14.74	14.73	569.7%
National DQ Services	14.76	14.76	14.76	14.76	-84.3%
International DQ Services	14.76	14.76	14.76	14.76	-85.0%
International Call Origination Service	0.55	0.54	0.54	0.54	-85.8%

Table 5.11: Cost of services of the fixed model for Saint Lucia. [Source: ECTEL´s BULRIC Model for Fixed Networks]

5.2.5. St. Vincent and the Grenadines

St Vincent and the Grenadines Fixed Services (XCD cents/min)	2017	2018	2019	2020	Required reduction from current RIO to 2020
PSTN Terminating Access Service	0.70	0.68	0.67	0.66	-82.6%
Incoming International Call Termination to PSTN Service	0.80	0.81	0.82	0.83	-78.0%
PSTN Transit Service	0.13	0.13	0.13	0.12	-93.1%
Emergency Services Access Service	14.91	14.90	14.89	14.88	726.6%
National DQ Services	15.05	15.07	15.08	15.10	-82.8%
International DQ Services	15.05	15.07	15.08	15.10	-83.2%
International Call Origination Service	0.83	0.83	0.85	0.86	-77.4%

Table 5.12: Cost of services of the fixed model for St. Vincent and the Grenadines. [Source: ECTEL´s BULRIC Model for Fixed Networks]

6. RECOMMENDATION FOR INTERCONNECTION RATES

As can be extracted from previous chapters, ECTEL notes that since the currently applicable recommendation on wholesale interconnection rates was published (March 2009), the cost of service provision has decreased significantly. This is related to the relevant changes observed in Member States' markets in the last 8 years including deployment of 3G technologies, smartphone up take, and increased consumption of fixed and mobile broadband.

The significant differences found between the currently applicable wholesale rates and cost of providing interconnection services require that ECTEL takes a decision on how the models' results should be implemented in terms of the rates and the appropriate timing.

In fact, Digicel also highlights the need to take a decision regarding how and when new rates should be applied, stating in its comments that *"[i]n the event that the modelled price is significantly below the current price then an issue arises as to how to manage the transition between the two"*.

Digicel continued *"[w]here the change is large then it is a well recognised and widely adopted regulatory approach to use a so called "glide path" to move between the initial price and the final price with a number of interim step down prices spread out over time"*.

ECTEL acknowledges that glide-paths are commonly used by regulators to implement wholesale charges when rate adjustments are material. This approach is typically applied to avoid the so-called "waterbed effect", as described by C&W: *"the theory of the waterbed effect [...] suggests that under competitive conditions pressing down prices in one part of an operator's business (wholesale) causes another set of prices (retail) to rise"*.

This issue is related also with Digicel's concern about the *"disruption to the cash flow of the regulated companies which could have short term impacts on investment phasing. Positive working capital is required to ensure that a firm is able to continue its operations and that it has sufficient funds to satisfy both maturing short-term debt and upcoming operational expenses. Therefore step changes in wholesale pricing will also act to delay reductions in retail pricing as operators must protect their ability to meet their short term liabilities"*.

ECTEL agrees that the use of glide paths would minimise the risk of the waterbed effect and it would provide the operators with the transparency and predictability that are required to smoothly adapt their strategy to the new regulatory reality.

On the other hand, the application of very long glide paths will impact the net payments between operators, as indicated by C&W: *"Digicel is the net recipient of traffic charges, thus they unfairly benefit from above cost termination rates. Moreover, there may indeed be a distorted form of waterbed effect for Digicel: it would have to seek another source of income to replace its unfair subsidy. Happily for consumers this is not the circumstance for either C&W fixed or mobile business. Quite the opposite exists for C&W, the lower the MTR, the lower the outpayments, and the more it can pass along to consumers in the form of lower retail prices"*.

Even though operators seem to agree with benefits of applying a glide path in general, they disagree on the duration of such glide path. First of all, Digicel proposes to apply a differentiated approach for fixed and mobile interconnection rates (3-years glide path for mobile termination and 1-year glide path for fixed termination).

In particular, Digicel compared both markets as follows:

- *"The lack of competitive pressure in the retail fixed market means that reductions in MTR are unlikely to be promptly passed through to consumers and be retained as windfall profits by the fixed incumbent. Based on this Digicel believes that it would also be appropriate for ECTEL to adopt a multiyear glide path for MTRs spanning 3 years with equal step down increments between the current pricing and any modelled price."*
- *"By contrast because of more intense competitive pressure in the retail mobile market reductions in FTR are more likely to be passed through to consumers and a shorter steeper glide path of no longer than 1 year for Fixed Termination Rates would be justified. This is all the more appropriate as the structure of retail fixed pricing means that the high cost access element of the network is covered by separate retail access fees reducing the negative impacts of step changes in FTRs on fixed operators."*

C&W answers to the above arguments as follows: *"We disagree that "there is currently no effective retail competition in the fixed market" as mobile usage is highly substitutable for fixed and data calls are increasingly substituted for voice. But even if one believes that substitution inadequate, fixed-to-mobile retail call rates are directly regulated*

through the price cap plan. Unlike mobile rates, ECTEL has a direct mechanism to translate reductions in mobile termination rates into retail fixed pricing. The review of the current price cap begins nine months prior to the scheduled end of the PCP 2016, i.e., in June 2018, in less than a year's time. This will allow time both to assess the impact of the mobile termination rates on the retail price and to take necessary action to reduce fixed-to-mobile retail rates if necessary."

ECTEL agrees with C&W that fixed-mobile substitution is relevant in Member States and that price-caps on fixed retail tariffs would be useful to address any competition issue related to termination rates that may arise in the fixed market.

Based on the above, ECTEL do not see any argument that supports the application of different glide path durations between fixed and mobile interconnection rates.

When discussing the duration of the glide paths, operators seem to propose figures which are aligned with their individual interests, as follows:

- Digicel proposes a long glide path (3 years) for mobile termination which would reduce and postpone the loses in net interconnection payments received. Additionally, Digicel proposes a short glide path (1-year) for fixed termination, which would accelerate the reduction in interconnection payments.
- C&W believes that *"glidepath should be as short as possible to provide benefit to consumers and reduce the scale of the transfer as soon as possible"*. ECTEL notes that the shorter the glide-path is, the higher and faster is the reduction of C&W's interconnection net costs.

ECTEL believes that the implementation of the new interconnection rates with no glide path or period for adjustment may limit operators' ability to adapt their business plans. ECTEL is also of the view that a long glide path is not necessary as would only serve to delay potential benefits for the customers. Therefore, ECTEL recommends the application of a one-year adjustment period for the implementation of new interconnection rates.

1. Effective **May 15, 2018** the rate for all interconnection services, except the rate for emergency services, will not exceed 50 per cent of the current interconnection rates. For the purposes of this calculation the current interconnection rates are the applicable rates in ECTEL's ***Recommendation to NTRCs on Cost Oriented Interconnection Rates in the ECTEL Member States*** dated March 2009.

2. Using the new cost models, ECTEL proposes an increase in the interconnection rates for emergency services. Further, ECTEL recommends a one year adjustment period for the implementation of the new rates for emergency services. Effective **May 15, 2018** the rate for emergency interconnection services will not exceed 50 per cent of the proposed new cost oriented rates for emergency services.
3. Effective **May 15, 2019** the rates for all interconnection services will not exceed the cost-oriented rates as determined by the new cost models.

6.1. The recommendation approved by the Council of Ministers

6.1.1. Recommend rates for mobile interconnection services

The Council of Ministers approved a one-year phased reduction in the rates for mobile interconnection services. The recommended rates will result in an up to 50 per cent reduction in the wholesale rate for mobile termination in the first year and up to 95 per cent reduction over the three-year period. The impact of this recommendation is expected to be significant reductions in rates for fixed to mobile and mobile to mobile calls over the next three years. The recommended rates are presented in the following tables. The recommended rates are applicable for calls originating domestically and internationally.

Dominica

Dominica Mobile Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PLMN Terminating Access Service	12.90	2.01	1.93
Incoming International Call Termination to PLMN Service	12.90	2.01	1.93
SMS Termination	2.41	0.13	0.13
PLMN Transit Service	1.54	0.14	0.14

Table1.1: Cost of services of the mobile model for Dominica. [Source: ECTEL´s BULRIC Model for Mobile Networks]

Grenada

Grenada Mobile Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PLMN Terminating Access Service	12.55	1.92	1.83
Incoming International Call Termination to PLMN Service	12.55	1.92	1.83
SMS Termination	1.98	0.07	0.07
PLMN Transit Service	1.03	0.09	0.09

Table1.2: Cost of services of the mobile model for Grenada. [Source: ECTEL´s BULRIC Model for Mobile Networks]

St. Kitts and Nevis

St. Kitts and Nevis Mobile Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PLMN Terminating Access Service	14.09	1.45	1.51
Incoming International Call Termination to PLMN Service	14.09	1.45	1.51
SMS Termination	1.76	0.06	0.06
PLMN Transit Service	1.48	0.10	0.09

Table1.3: Cost of services of the mobile model for St. Kitts and Nevis. [Source: ECTEL´s BULRIC Model for Mobile Networks]

Saint Lucia

Saint Lucia Mobile Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PLMN Terminating Access Service	11.20	1.43	1.40
Incoming International Call Termination to PLMN Service	11.20	1.43	1.40
SMS Termination	1.50	0.06	0.06
PLMN Transit Service	0.93	0.08	0.08

Table1.4: Cost of services of the mobile model for Saint Lucia. [Source: ECTEL´s BULRIC Model for Mobile Networks]

St. Vincent and the Grenadines

St. Vincent and the Grenadines Mobile Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PLMN Terminating Access Service	12.07	2.53	2.36
Incoming International Call Termination to PLMN Service	12.07	2.53	2.36
SMS Termination	1.65	0.10	0.10
PLMN Transit Service	1.35	0.10	0.10

Table1.5: Cost of services of the mobile model for St. Vincent and the Grenadines. [Source: ECTEL´s BULRIC Model for Mobile Networks]

6.1.2. Recommended rates for fixed interconnection services

The Council of Ministers approved a one-year phased reduction in the rates for most fixed interconnection services. The maximum rates for fixed interconnection services in the ECTEL Member States are presented in the following tables.

Dominica

Dominica Fixed Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PSTN Terminating Access Service	2.93	1.04	1.04
Incoming International Call Termination to PSTN Service	2.93	1.04	1.04
PSTN Transit Service	1.54	0.17	0.16
Emergency Services Access Service	7.48	14.92	14.91
National DQ Services	48.50	15.21	15.22
International DQ Services	44.00	15.21	15.22
International Call Origination Service	3.64	1.07	1.07

Table 2.1: Cost of services of the fixed model for Dominica. [Source: ECTEL´s BULRIC Model for Fixed Networks]

Grenada

Grenada Fixed Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PSTN Terminating Access Service	2.04	0.59	0.60
Incoming International Call Termination to PSTN Service	2.04	0.59	0.60
PSTN Transit Service	1.03	0.10	0.10
Emergency Services Access Service	7.36	14.70	14.69
National DQ Services	46.00	14.78	14.79
International DQ Services	47.50	14.78	14.79
International Call Origination Service	3.05	0.61	0.62

Table 2.2: Cost of services of the fixed model for Grenada. [Source: ECTEL´s BULRIC Model for Fixed Networks]

St. Kitts and Nevis

St. Kitts and Nevis Fixed Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PSTN Terminating Access Service	1.31	0.75	0.77
Incoming International Call Termination to PSTN Service	1.31	0.75	0.77
PSTN Transit Service	1.48	0.11	0.11
Emergency Services Access Service	7.40	14.78	14.77
National DQ Services	44.00	14.97	14.99
International DQ Services	44.00	14.97	14.99
International Call Origination Service	1.45	0.78	0.79

Table 2.3: Cost of services of the fixed model for St. Kitts and Nevis. [Source: ECTEL´s BULRIC Model for Fixed Networks]

Saint Lucia

Saint Lucia Fixed Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PSTN Terminating Access Service	1.73	0.53	0.53
Incoming International Call Termination to PSTN Service	1.73	0.53	0.53
PSTN Transit Service	0.93	0.09	0.09
Emergency Services Access Service	7.38	14.74	14.73
National DQ Services	51.50	14.76	14.76
International DQ Services	74.00	14.76	14.76
International Call Origination Service	2.73	0.54	0.54

Table 2.4: Cost of services of the fixed model for Saint Lucia. [Source: ECTEL´s BULRIC Model for Fixed Networks]

St. Vincent and the Grenadines

St. Vincent and the Grenadines Fixed Services (XCD cents/min)	May 15 2018*	May 15 2019	May 15 2020
PSTN Terminating Access Service	2.67	0.82	0.83
Incoming International Call Termination to PSTN Service	2.67	0.82	0.83
PSTN Transit Service	1.35	0.13	0.12
Emergency Services Access Service	7.46	14.89	14.88
National DQ Services	44.00	15.08	15.10
International DQ Services	45.00	15.08	15.10
International Call Origination Service	3.35	0.85	0.86

Table 2.5: Cost of services of the fixed model for St. Vincent and the Grenadines. [Source: ECTEL´s BULRIC Model for Fixed Networks]

* This denotes the date proposed by ECTEL for implementation of the new interconnection rates. However, the National Telecommunication Regulatory Commission (NTRC) will determine the specific commencement date in each Member State.

6.1.3. Notes

(i) All rates are per minute and denominated in Eastern Caribbean Dollars;

(ii) The composite interconnection charge (i.e. call duration plus interconnect-specific charges) for telecommunications providers should not exceed the recommended rates; and

(iii) Telecommunications providers may negotiate lower interconnection rates and may adopt a pricing structure that include peak and off-peak rates.