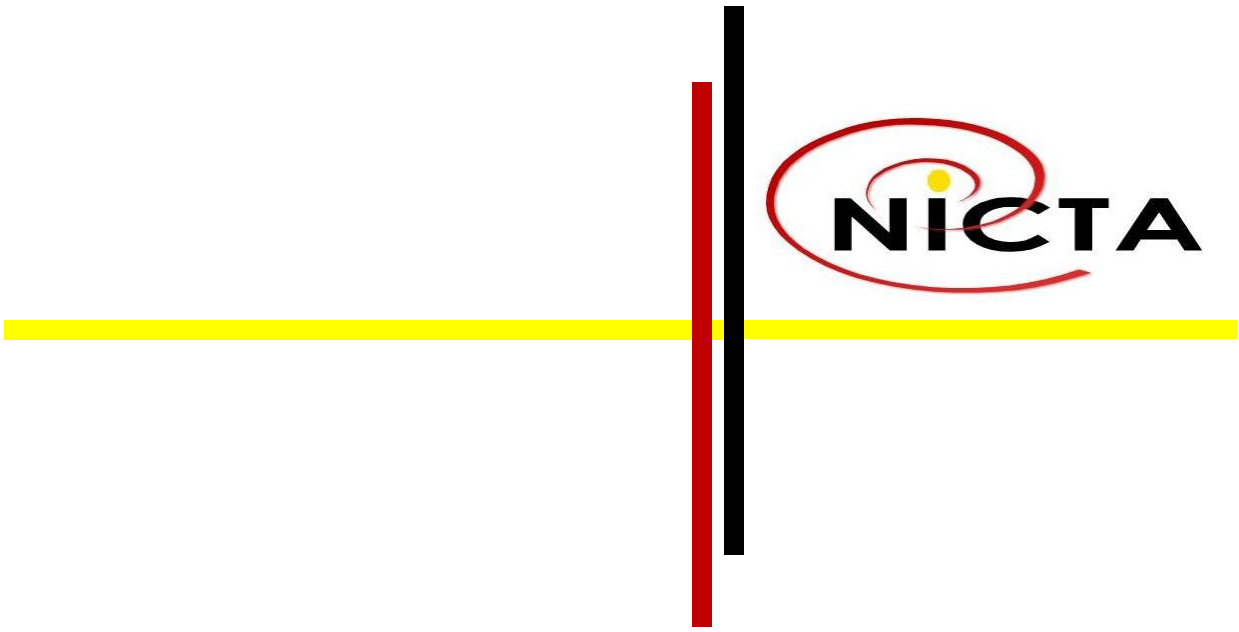

Domestic Mobile Terminating Access Services and Domestic Fixed Terminating Access Services

Public Inquiry into the Service-Specific Pricing Principles for Domestic Mobile and Fixed Terminating Access Services – Methodology and Principles

DISCUSSION PAPER

Issued on 5 June 2024

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1. BACKGROUND

1. Section 129 of the National Information and Communications Technology Act 2009 (the "Act") gives power to the National Information and Communications Technology Authority ("NICTA") to issue a recommendation to the Minister that certain wholesale services should be declared services.
2. Following a Public Inquiry under Section 127 of the Act, NICTA issued a "Recommendation Report. A Report to the Minister recommending the declaration of domestic Mobile and Fixed Terminating Access Services under Division 3, Part VI of the NICTA Act 2009", issued on 3 November, 2023 (the "Recommendation Report").
3. Pursuant to Section 130 of the Act, and after careful review of the Recommendation Report, the Minister accepted the recommendation and declared the domestic Mobile Terminating Access Service (DMTAS) and the domestic Fixed Terminating Access Service (DFTAS). The DMTAS and DFTAS declaration was published on the Gazette on 7 December 2023.
4. Pursuant to Section 135 (3) of the Act, NICTA shall make service-specific pricing principles within six months after the Minister declares a wholesale service to be a declared service.
5. Pursuant to Section 230 of the Act NICTA is initiating a public inquiry into the service-specific pricing principles for the DMTAS and DFTAS declared services[1], and is issuing this "Discussion Paper. Public Inquiry into the Service-Specific Pricing Principles for Domestic Mobile and Fixed Terminating Access Services – Methodology and Principles" (the "Discussion Paper").
6. In this initial phase into our public inquiry NICTA is not ready to issue a draft service-specific pricing principles for comments. Instead, we are issuing this Discussion Paper to elicit comments from interested parties on the proposed methodology and principles to be used for setting prices for the DMTAS and DFTAS (the "Declared Services").
7. NICTA invites interested parties to provide comments and answers to the set of questions posed in this Discussion Paper. Written submissions should be send by email to consultation.submission@nicta.gov.pg and must be received by 5 p.m. on 26th June, 2024. For further inquiries contact Mr. Polume Lume, Director, Economic, Consumer and International Affairs on telephone 3033272 during business hours or by email to plume@nicta.gov.pg

[1] See Public Notice in Annex A.

2. OBJECTIVE

8. The purpose of this Discussion Paper is first, to inform interested parties about NICTA's proposed methodology and principles to be used as the service-specific pricing principles for determining the cost-based prices of the Declared Services.
9. Second, it is to gather the views and comments from interested parties about the proposed methodology and principles, and in this way ensure that NICTA's proposal results in a well thought out service-specific pricing principles for the declared services in accordance with Sections 134 and 135 of the Act.
10. NICTA intends to use the methodology and principles (i.e., the service-specific pricing principles) resulting from this public inquiry to determine the maximum allowable prices for the Declared Services in accordance with Section 135 of the Act.

3. LEGAL AND REGULATORY FRAMEWORK

11. Pursuant to Section 135 (3) of the Act, NICTA shall make service-specific pricing principles within six months after the Minister has declared a wholesale service.
12. Pursuant to Section 134 (3) of the Act, the service-specific pricing principles shall be consistent with the general pricing principles in Section 134 of the Act (the "General Pricing Principles"). The General Pricing Principles constrains NICTA on what it can mandate in the service-specific pricing principles with respect to the price of the Declared Services and related terms and conditions, or with respect to the method for ascertaining the prices of the Declared Services.
13. It is important to identify clearly the limits imposed by the General Pricing Principles:

"(1) The "general pricing principles" are that the price of access to a declared service should promote the achievement of the objective of this Part as set out in Section 124 and, in particular, that the price of access to –

(a) that declared service should –

(i) be set so as to generate expected revenue from that declared service that is sufficient to meet the efficient costs of providing access to that declared service; and

(ii) include a reasonable return on investment, over the economic life of the assets employed, commensurate with the regulatory and commercial risks involved, this principle is known as the "cost recovery principle"; and

(b) a declared service that is a resale service should be set by –

(i) RMAC, where this results in pricing that is consistent with the cost recovery principle; or

(ii) cost-based pricing, if RMAC would result in pricing that is insufficient to meet the cost recovery principle; and

(c) a declared service that is not a resale service should be subject to cost-based pricing; and

(d) a declared service, where the access provider is required to extend or enhance to the capability of a facility in order to supply the declared service, should –

(i) be set so as to generate expected revenue in respect of that extension or enhancement that is sufficient to meet the reasonably anticipated costs of that extension or enhancement in the circumstances; and

(ii) include a reasonable return on investment, commensurate with the regulatory and commercial risks involved; and

to avoid doubt, this may require the access seeker to bear up to 100% of the actual cost of any such extension or enhancement.

(2) For the purposes of Subsection (1), the following words have the following meanings –

"cost-based pricing" means pricing based on the cost recovery principle in which NICTA has regard to the following factors –

(a) the application of the cost recovery principle; and

(b) the need for the pricing to make a fair and reasonable contribution to the access provider's common costs; and

(c) the need for the recovery of the reasonable costs, incurred in the provision of access and interconnection by the access provider, that would not have been otherwise incurred but for the requirement to provide such access or interconnection; and

(d) the availability and capacity of the facilities operated by the access provider and the timeframe reasonably required to provide access to additional capacity; and

(e) any other factors that NICTA considers relevant, to the extent that such factors are consistent with the cost-recovery principle and Subsections (a) to (d) of this definition.

"efficient costs" include the direct and indirectly attributable capital, operating and maintenance costs actually incurred by the access provider in providing the declared service to itself and access seekers (including a reasonable contribution to any common costs), unless NICTA determines that such costs are inefficient having regard to the efficiency objective and any evidence before it.

"RMAC" means a "retail minus avoidable cost" pricing methodology in which NICTA has regard to the following factors –

(a) where the access provider offers the benchmark retail service at more than one price point, the starting retail price should be calculated as the weighted average of the retail price points for that benchmark retail service, where the weights are based on the number of units sold by the access provider; and

(b) the avoided costs deducted from that starting retail price should reflect the costs that the access provider would reasonably avoid by not retailing that benchmark retail service; and

(c) any other factors that NICTA considers relevant, to the extent that such factors are consistent with the cost-recovery principle, the efficiency objective, and Subsections (a) and (b) of this definition.

(3) Any provision of the following instruments has no effect to the extent it is inconsistent with the general pricing principles –

(a) any service-specific pricing principles; and

(b) any model terms; and

(c) any access exemption; and

(d) any RIO."

14. Terminology used in the Act may be subject to interpretation; depending on that interpretation, terms may have different meanings. For example, the Act defines "efficient costs" in broad terms, and not in the context of ascertaining the costs of a particular service or services. The General Pricing Principles are intended to be applicable to a large array of possible wholesale declared services. However, international best practices often use terminology that is more precise and within the context of regulating a particular service. Therefore, it is important to recognize that the broad language used in the Act may need to be interpreted in more specific terms applicable to the Declared Services.

4. INTRODUCTION

15. Having the Minister declared the DMTAS and DFTAS as wholesale declared services, NICTA is required to adopt pricing principles that are specific to the Declared Services. To that end, NICTA must interpret the terminology in the General Pricing Principles within the context of the Declared Services. The proposed pricing principles must be specific to the Declared Services while at the same time, consistent with the interpretation of the General Pricing Principles.
16. The Act provides general guidance on interpreting the meaning of the General Pricing Principles. Where more specific guidance is required, NICTA will seek such guidance from NICTA's prior regulatory proceedings and from reputable sources that provide guidance on international best practices for the regulation of the Declared Services.
17. The prior paragraph should not be construed as meaning that NICTA would follow its prior regulatory decisions or opinions without critically assessing the appropriateness of applying such decisions or opinions to the current case. New information on specific regulatory matters may cause NICTA to change prior views on the matter.
18. In seeking to develop the service-specific pricing principles for the Declared Services, this Discussion Paper focuses on ten issues that in NICTA's view, are fundamental to delineate a methodology and pricing principles applicable to the Declared Services. This methodology and principles need to be specific enough to be used to assess the cost of providing the Declared Services and to set the prices for those services.
19. With the aim of increasing transparency about the proposed methodology and principles to use for setting cost-based prices for the Declared Services, this Discussion Paper addresses the following issues:

(a) Appropriate approach to determine cost-based prices for the Declared Services: international benchmarking or cost modelling?

(b) If cost modelling is appropriate, what modelling approach should NICTA use? Top-down, bottom-up, or another?

(c) What approach should NICTA use for allocating costs?

(d) How should NICTA treat capital related costs?

(e) What network topology should NICTA use for the cost model?

(f) Definition of the reference operator for modelling purposes.

(g) The appropriate service increment to consider in the cost model.

(h) What method should NICTA use to allocate common costs to services?

(i) What depreciation method should NICTA use in the cost model?

(j) What approach should NICTA follow to determine a reasonable rate of return?

5. APPROACH TO DETERMINE THE PRICE OF THE DECLARED SERVICES: COST MODELLING v. INTERNATIONAL BENCHMARK

20. International best practice on the regulation of mobile and fixed termination[2] access services generally recognize cost-modelling as the standard best practice approach to set those prices. For example, the European Commission, in its recommendations for regulating fixed and mobile termination rates states:

> *"Taking account of the particular characteristics of call termination markets, the costs of termination services should be calculated on the basis of forward-looking long-run incremental costs (LRIC). In a LRIC model, all costs become variable, and since it is assumed that all assets are replaced in the long run, setting charges based on LRIC allows efficient recovery of costs".*[3]

21. Similarly, the GSM Association (GSMA) considers cost modelling as a superior method to international benchmarking to set termination rates:

> *"It is our view that relying on international benchmarking for setting MTRs [mobile termination rates] is fraught with difficulties, and as such should be used only as a last-choice and then preferably only as an interim solution,*

[2] Throughout the document we use the term termination or terminating interchangeably. The declared services use the term "terminating services" to refer to what is commonly known in other jurisdictions as "termination services".

[3] The Commission of the European Communities. Recommendations. Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2009|396|EC). Official Journal of the European Union. L 124/67, 20.5.2009. Para. 13.

when the difficulties of performing a properly specified cost-modelling exercise prove too challenging."[4]

22. Nevertheless, it is still common, especially, but not exclusively, among regulators in less developed countries to use an international benchmarking approach, particularly, when National Regulatory Authorities (NRAs) perceive that developing a cost model would be onerous or when there is urgency to set the rates as an interim measure until a cost model is developed.[5]

23. Although cost modelling is regarded as international best practice, the fact that international benchmarking is still widely used,[6] gave us pause and made us consider it as a possible approach to use.

5.1 Consistency with the General Pricing Principles

24. If international benchmarking were to be accepted as an appropriate method to set the price of the Declared Services, it would need to be consistent with the General Pricing Principles.

25. Section 134 (1) (c) states that: *"(c) a declared service that is not a resale service should be subject to cost-based pricing*". Therefore, NICTA needs to determine whether an international benchmarking approach would result on prices for the declared services that are cost-based.

26. NICTA's view is that a cost modelling approach would result in cost-based prices as long as the cost model is consistent with the General Pricing Principles. However, the case for using an international benchmark approach appears less clear. For it to be used, it would need to be consistent with the definition of cost-based pricing in Section 134 (2) of the General Pricing Principles:

""cost-based pricing" means pricing based on the cost recovery principle in which NICTA has regard to the following factors –

(a) *the application of the cost recovery principle; and*

(b) *the need for the pricing to make a fair and reasonable contribution to the access provider's common costs; and*

(c) *the need for the recovery of the reasonable costs, incurred in the provision of access and interconnection by the access provider, that would not have been otherwise incurred but for the requirement to*

[4] GSMA. "The setting of mobile termination rates: Best practice in cost modelling." GSMA. 16 October 2008. pp. 6. https://www.gsma.com/mobilefordevelopment/resources/the-setting-of-mobile-termination-rates-best-practice-in-cost-modelling/

[5] For example, see: The World Bank-ITU-InfoDev. "Telecommunications Regulations Handbook". Tenth Anniversary Edition, 2011, pp. 58. See also, ITU, "A Practical Guide on Benchmarking Telecommunication Prices." ITU, August 2014. pp. 1. Se also, GSMA. "The setting of mobile termination rates: Best practice in cost modelling." GSMA. 16 October 2008. pp. 6. https://www.gsma.com/mobilefordevelopment/resources/the-setting-of-mobile-termination-rates-best-practice-in-cost-modelling/

[6] For example, NRAs in Fiji and New Zealand set mobile termination rates based on international benchmarks.

provide such access or interconnection; and

(d) *the availability and capacity of the facilities operated by the access provider and the timeframe reasonably required to provide access to additional capacity; and*

(e) *any other factors that NICTA considers relevant, to the extent that such factors are consistent with the cost-recovery principle and Subsections (a) to (d) of this definition."*

27. Jurisdictions that use an international benchmark approach to set cost-based termination rates claim that their results are consistent with cost-based pricing principles because their benchmarks are from jurisdictions that have developed cost models to set those termination rates.

28. In this view, if the jurisdictions used cost models that incorporate principles consistent with the General Pricing Principles in Section 134 of the Act, the associated international benchmark results would be acceptable. For this reason, NICTA is not ready to rule out the use of an international benchmark approach to set the price of the Declared Services. However, to account for differences in scale, topography, and technology, to name a few, an international benchmark approach would need to develop appropriate selection criteria to discard jurisdictions that are too different from PNG.

5.2 Preliminary views

29. NICTA is of the view that a cost modelling approach would be consistent with the General Pricing Principles and preferable to an international benchmark approach.

30. Nevertheless, NICTA is not ready to rule out the use of an international benchmark approach based on comparable jurisdictions that have developed cost models if those cost models could be regarded as being consistent with the General Pricing Principles. We seek comments on our preliminary view from interested parties.

Question 1: Do you think an international benchmark approach to determine the price of the declared services would be consistent with the general pricing principles in Section 134 of the Act? If you do, please explain your rationale. Question 2: In case you think that both approaches (the cost modelling and an international benchmark) are consistent with Section 134 of the Act, which approach do you think would be preferable for NICTA to implement and why?

6. COST MODELLING APPROACH

31. Given NICTA's preliminary view that a cost modelling approach would be preferable over an international benchmark approach, we want to probe deeper on the appropriate principles and methodology to use for implementing a cost modelling approach.

32. Generally speaking, NRAs use three different kinds of approaches to model the costs of services: Top-down, bottom-up, and a hybrid approach.

6.1 Top-down cost models

33. Top-down cost models use data from an access provider's accounts and allocation rules, to distribute the costs across main categories of services. This approach does not involve detailed network modelling. Top-down models ensure reconciliation with the access provider's historic or accounting costs.[7]

34. Top-down models have often been criticised for incorporating the access provider's inefficiencies. As such they would not reflect the costs of and efficient operator, as is often mandated in the laws or regulations following international best practices.

35. This criticism prompted NRAs to introduce changes on how top-down modelling is performed. Some of these changes involve adjusting the top-down models to reflect more closely current (efficient) costs. Attempts to reflect the efficient cost of an operator often require adjustments to the network configuration and costs. This introduces an element of discretion making the top-down cost models less transparent than bottom-up models.

36. Another downside of the top-down approach is that they are more dependent than bottom-up model on the access provider's cost data. The common reticence of operators to provide data that is sufficiently detailed and disaggregated creates a problem for NRAs as they often found themselves unable to develop their own top-down models. This reliance on the access provider's data creates a problem for NRAs where there is considerable information asymmetry between them and the access provider. In consequence, it is common for NRAs using this approach to rely on the operator's own top-down cost model to set the price of the services. The problem with that is that NRAs have very little information, and in consequence, are unable to conduct a proper audit of those models to determine whether the operators' assumptions, costing data, cost allocation rules, and results are reasonable.

6.2 Bottom-up cost models

37. These models use data on demand, network coverage, geographic and technical information to dimension the required network to serve the geographic coverage area

[7] See for example, The World Bank-ITU-InfoDev. "Telecommunications Regulations Handbook". Tenth Anniversary Edition, 2011, pp. 136. ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 2.

with the required capacity and technology. The underlying technical engineering model of a network is used to develop unit costs of various network components. These costs are then allocated to various services based on certain criteria.

38. One advantage of bottom-up models is that they need less information from the operators than the top-down models. As such, NRAs can develop their bottom-up models. In addition, these models tend to be more transparent and allow to perform scenario analysis and test the sensitivity of assumptions to a much larger degree than top-down models.

39. Bottom-up models are regarded as better equipped to calculate the cost of termination access services by an efficient operator. For example, the European Commission in its recommendations for setting the prices of termination rates states:

> *"NRAs should set termination rates based on the costs incurred by an efficient operator…(…)…It is recommended that the evaluation of efficient costs is based on current cost and the use of a bottom-up modelling approach using long-run incremental costs (LRIC) as the relevant cost methodology."*[8]

6.3 Hybrid approach

40. Frequently, a hybrid approach is implemented where a bottom-up cost model is used as the primary model to calculate the costs, and then a top-down model[9] is used only to fine-tune some of the assumptions and in consequence, the results of the bottom-up model.

41. The aim of this approach is not to find a middle ground (or average value) between the results of the two models. The actual model results would come from a bottom-up cost model. The top-down model results are commonly used to first make sure the results of the bottom-up model are not too different from a top-down model using comparable cost standards for capital costs, network topology, and other relevant assumptions. Second, it is to use the results of a top-down cost model to fine tune the assumptions in the bottom-up model to improve the reasonableness of its results.[10]

6.4 Consistency with the General Pricing Principles

42. Whether top-down cost models are consistent with the General Pricing Principles would depend on how a top-down cost model is implemented. Therefore, it cannot be discarded *a priori* as a viable approach for cost modelling as long as it is implemented in accordance with Section 134 of the Act. In particular, that the cost

[8] The Commission of the European Communities. RECOMMENDATION. COMMISSION. "Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU." 2009|396|EC. Para. 23 (1-2). Official Journal of the European Union L124.

[9] It may not be a complete top-down model but the modelling of certain costs using data from an access provider's accounts to fine-tune some of the assumptions in the bottom up model.

[10] See GSMA, "The setting of mobile termination rates: Best practice in cost modelling." GSMA. 16 October 2008. pp. 9. https://www.gsma.com/mobilefordevelopment/resources/the-setting-of-mobile-termination-rates-best-practice-in-cost-modelling/

modelling is based on the "efficient costs" of providing the Declared Services and that prices are "cost-based" in accordance with Section 134 (2) of the Act.

43. As with the top-down approach, whether the bottom-up approach (or the hybrid approach) is consistent with the General Pricing Principles would depend on how it is implemented. Nevertheless, bottom-up cost models seem by design better positioned to reflect the efficient cost of providing the Declared Services because of their flexibility in modelling an efficient operator's network.

6.5 Preliminary views

44. NICTA is of the view that in principle, either the top-down, bottom-up, or the hybrid approaches could be used in the calculation of cost-based prices for the Declared Services.

45. Nevertheless, NICTA is of the view that the implementation of a bottom-up approach with its associated techno-engineering model, would ensure to a much higher degree that the costs reflect efficient costs and that the prices are cost-based in accordance with the General Pricing Principles.

46. As mentioned earlier, the shortcomings of the top-down approach are several and non-trivial, including being heavily dependent on operator's data and in extreme cases, even on the modelling itself. This could lead to a situation where NICTA could be unable to model the cost of service; find itself reliant on an access provider's own cost model, and unable to conduct a proper audit to assess whether those costs are reasonable and in accordance with the General Pricing Principles.

47. For the abovementioned reasons, NICTA is of the view that a top-down approach should be discarded in favour of a bottom-up approach. This would not only represent a better alignment with international best practices but would also follow the observed trend amongst NRAs of an increased use of bottom-up cost models.

48. However, if sufficient data is available from the operators, NICTA would be inclined to use a hybrid approach as well. The hybrid approach would rely primarily on a bottom-up cost model, but also would use a partial top-down model to fine tune some of the assumptions in the bottom-up model. We seek comments on our preliminary view from interested parties.

Question 3: Do you agree that NICTA should use a top down (if data is available) or a bottom-up approach to cost modelling to calculate cost-based prices for the Declared Services in accordance with Section 134 of the Act? Please explain your reasons for why one approach would be preferable over the other.

Question 4: Do you agree that NICTA could also use a hybrid approach should enough data becomes available from the operators? Explain your reasons for agreeing or disagreeing.

7. APPROACH TO COST ALLOCATION

49. Modelling the costs of providing a service requires a method to allocate four different kinds of costs to the services modelled. These costs are often referred as: (a) direct variable costs, (b) direct fixed costs, (c) joint costs, and (d) common costs. [11]

50. Direct variable costs are directly attributable costs for the provision of a service that vary when the output of a service varies.

51. Direct fixed costs are directly attributable costs for the provision of a service that are not sensitive to variations in the volume of the service. These costs include asset related costs and operating costs that do not vary with the volume of service.

52. Joint costs are the costs of an input that is used in the supply of two or more services.

53. Common costs are the costs of certain inputs that are necessary for the supply of two or more services but that cannot be directly assigned to specific services.[12] Common costs can be subdivided, as we do later, into network common costs and corporate overhead costs.

54. International best practice shows that NRAs generally use two methods for the allocation of the abovementioned costs. The first one is often referred as the fully allocated cost (FAC) approach, also known as fully distributed costs or FDC.

55. The second approach is often referred as the forward-looking long-run incremental cost (LRIC) approach, also known as long-run average incremental cost (LRAIC).[13] Different jurisdictions use different terminology according to the kinds of costs included or based on convention. For example, the LRIC approach is sometimes subdivided into pure LRIC (without joint and common costs) and LRIC+ which includes joint and common costs.[14] Other terms used are total service long-run incremental cost (TSLRIC) and TSLRIC+. It has been common in the past ten years to add a plus ("+") symbol to denote that a cost model includes joint and common costs in addition to the direct variable and fixed costs. Whatever the terminology, the important thing to stress now is that these are all forms of LRIC cost modelling.

56. A third approach, which is less used nowadays, is the stand-alone costs or SAC. The SAC has fallen out of favour due to its unrealistic assumption of attributing all the identified joint and common cost to the service cost being modelled, instead of apportioning these costs among the various services supplied by the modelled

[11] See for example, ITU, "Regulatory Accounting Guide", Telecommunications Development Bureau, March 2009, pp. 19-20.
[12] *Id*., pp. 19-20.
[13] *Id.*, pp. 20-23, 26.
[14] See ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp.3. See also, CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016, pp. 13-14.

operator. As one would expect, the SAC approach results on inflated costs estimates relative to the FAC or the LRIC approaches.[15]

7.1 Fully allocated costs (FAC)

57. In this approach all four categories of costs; direct variable costs, direct fixed costs, and a portion of the joint and common costs are allocated to the services being modelled. In its traditional form, the FAC approach was implemented with top-down models and using historical cost accounting (more on this later).

58. An advantage usually attributed to the FAC approach is that all costs in an operator's accounts are accounted for in the cost model.[16] This ensures that costs would be consistent with an operator's accounting costs (in a traditional historical cost accounting method). However, the downside is that the calculated cost of service would include the inefficiencies of the operator. To remedy this, NRAs sought to adjust the cost basis to reflect efficient costs, also referred as current cost accounting or CCA (more on this later).

59. Regardless of whether a FAC approach uses historical cost accounting or CCA, the rules for allocating joint and common costs under this approach (using a top-down model), are less transparent than under the LRIC approach.

7.2 Long-run incremental cost approach (LRIC)

60. The long-run incremental cost (LRIC) approach is based on the notion that the costs of the declared services should consider the forward-looking long-run incremental costs of those services.

61. This approach is normally implemented in conjunction with the development of a techno-economic bottom-up cost model which includes various cost-volume relationships between network components associated with inputs needed for the supply of certain volume of services (outputs). These cost-volume relationships for cost allocation makes the allocation of costs more transparent and less arbitrary than under a top-down FAC approach.

62. The implicit assumption in this approach is that when producing a certain service jointly with other services, a licensed operator incurs economies of scope (in addition to economies of scale) of joint production. To incorporate those economies, this approach only allocates costs to the incremental cost of providing the service being modelled.

[15] ITU, "Regulatory Accounting Guide", Telecommunications Development Bureau, March 2009, pp. 20-23.
[16] For example, using Activity-based Costing (ABC), This accounting method of costing recognizes the relationship between costs, overhead activities, and services or products supplied, assigning indirect costs to products less arbitrarily than traditional costing methods used with the FAC approach.

7.2.1 Pure LRIC or LRIC+?

63. This long-run incremental approach is often implemented in two ways, both of which can be considered international best practices.[17] The pure LRIC excludes common and joint costs, while the LRIC+ adds the joint and common costs.[18] See Figure 1 for an illustration of this difference. The European Commission recommends the use of a pure LRIC model to set termination rates,[19] but many countries prefer to use the LRIC+ approach.

64. The pure LRIC approach has been criticised for not including a share of common and joint costs, and risking having an efficient operator under recover its true costs. To address this criticism, many NRAs have preferred to use an LRIC+ approach by adding a reasonable proportion of the joint and common costs. Setting prices using LRIC+ might reduce market distortions. If prices were based on pure LRIC costs, the operator would have to recover some joint/common costs from its other (non-regulated) services, which might distort prices in those markets.

65. By adding a reasonable proportion of the joint and common costs to the pure long-run incremental costs, the LRIC+ approach in effect moves the cost model a step closer to the FAC approach. The difference with the FAC approach (implemented with a top-down model) is that the LRIC+ allocates the service costs within the framework of a sophisticated techno-economic bottom-up cost model that uses cost-volume relationships for the allocation of costs.

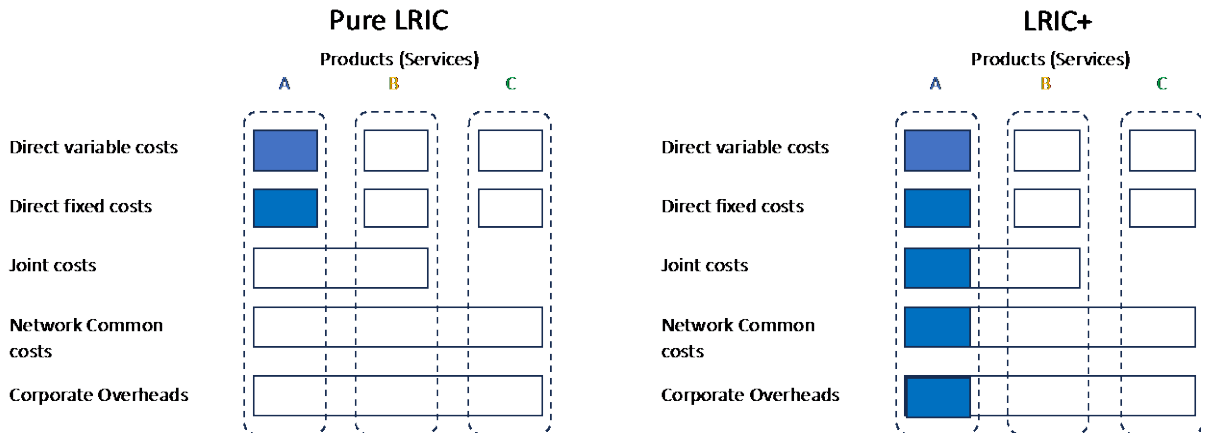

Figure 1: Pure LRIC vs LRIC+

[17] See Independent Regulators Group (IRG). "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp: 6

[18] This is also referred as TSLRIC+.

[19] See, The Commission of the European Communities. RECOMMENDATION. COMMISSION. "Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU." 2009|396|EC. Para. 23 (6). Official Journal of the European Union L124. See also ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 3.

7.3 Consistency with the General Pricing Principles

66. Whether the FAC or the long-run incremental cost approaches (pure LRIC or LRIC+) are consistent with the General Pricing Principles would depend on how each approach is implemented. In particular, as we will discuss later, it would depend on whether historical accounting costs or current costs are used for capital related costs.

67. On the other hand, the pure LRIC modelling approach seems not consistent with the General Pricing Principles. From Section 134 (2) under the definition of "cost-based pricing", the Act states that NICTA shall consider a "*fair and reasonable contribution to the access provider's common costs*", which seems to rule out the pure LRIC approach because it does not include common and joint costs.

7.4 Preliminary views

68. NICTA is of the view that the exclusion of joint and common costs in the pure LRIC approach renders it not consistent with the General Pricing Principles.

69. With regards to the use of the FCA and the LRIC+ approaches, whether they are consistent with the General Pricing Principles would depend on how they are implemented. As discussed in the next section, as long as costs reflect current (efficient) costs, then either approach would be in accordance with the General Pricing Principles and the efficiency objective in Section 124 (1) of the Act.

70. Nevertheless, NICTA is of the view that it should strive to implement international best practices as long as they are consistent with the General Pricing Principles. Although the FAC approach (implemented with a top-down model) was common many years ago, it has become less so. NRAs strongly favour the use of long-run incremental cost models because of their flexibility and greater transparency in the allocation of costs to services. Therefore, NICTA is of the view that an LRIC+ approach should be used. We seek comments on our preliminary views from interested parties.

Question 5: With respect to the inclusion or exclusion of common costs; do you agree that Section 134 (2) of the Act rules out the use of a pure LRIC cost allocation approach because the Act requires the inclusion of "fair and reasonable common costs" in the calculation of the costs of the Declared Services? If you disagree, please explain why.

Question 6: Do you agree that NICTA should use a LRIC+ approach for allocating cost in the cost model? Please explain why you agree or disagree.

8.TREATMENT OF CAPITAL RELATED COSTS

8.1 Historical costs v. Current cost accounting

71. Cost models need to impute the cost of the assets used in the supply of the services being modelled. Two approaches have been followed by NRAs. The traditional approach was to use information from the access provider's accounting books and impute those values as the costs of assets. This is often referred as historical cost accounting.

72. The second approach is to use the cost of replacing a given asset with a modern equivalent that provides similar level of functionality or use. This is often referred as current cost accounting (CCA) or forward-looking costs.

73. NRAs view historical cost accounting as not reflecting the efficient cost of an operator. Over the past decade or more, NRAs had largely switched from historical cost accounting to using a CCA approach. For example, the European Commission's recommendation on fixed and mobile termination rates states that:

> *"In a competitive environment, operators would compete on the basis of current costs and would not be compensated for costs which have been incurred through inefficiencies. Historic cost figures therefore need to be adjusted into current cost figures to reflect the cost of an efficient operator employing modern technology."*[20]

74. For similar reasons NRAs in other regions have adopted the use of CCA and abandoned the use of historical cost accounting. For example, the Eastern Caribbean Telecommunications Authority (ECTEL) uses a CCA approach for its bottom-up model and not historical costs for capital related costs. In ECTEL's own words:

> *"ECTEL, therefore considers the static CCA approach as the more appropriate choice, since it sends accurate price signals in the market."*[21]

75. Similarly, the regulatory authorities in Bahrain (TRA) and Peru (OSIPTEL) adopted the use of CCA instead of historical cost accounting.[22]

8.2 Consistency with the General Pricing Principles

76. The General Pricing Principles specify that the prices of the declared services need to be set to generate revenue "*sufficient to meet the efficient costs of providing access*."[23]

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[20] The Commission of the European Communities. RECOMMENDATIONS. COMMISSION. "Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU." 2009|396|EC. Para. 9. Official Journal of the European Union L124.

[21] CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016, pp.9.

[22] TRA. "Development, Implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain". Position Paper. 19 October 2011. Ref. MCD/10/11/144, pp. 17-18. See also, OSIPTEL, Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022, pp. 63.

[23] Section 134 (1) (a) (i) of the Act.

77. This on itself seems to imply that only the use of CCA, as opposed to historical accounting costs, would be appropriate to use for capital related costs. Section 134 (2) provides further clarification on the matter of efficient costs:

> *"include the direct and indirectly attributable capital, operating and maintenance costs actually incurred by the access provider in providing the declared service to itself and access seekers (including a reasonable contribution to any common costs), unless NICTA determines that such costs are inefficient having regard to the efficiency objective and any evidence before it."*

78. Unfortunately, this does not clarify what "*costs actually incurred*" means. One view could be that it means the costs incurred based on historical accounting costs of the access provider. However, a plausible interpretation could be that it means the economic costs actually incurred by the access provider. The later interpretation (i.e., economic costs) seems to be supported by the references to efficient costs and the efficiency objective quoted above. With regards to the efficiency objective in Part VI of the Act, Section 124 (1) (b) states that:

> *"promoting the economically efficient use of, and the economically efficient investment in, the facilities by which ICT services may be supplied, to be known as the "efficiency objective""*

79. It is clear from the quoted paragraph above that the "efficiency objective" in the Act is concerned specifically with economic efficiency. Therefore, the references to costs and efficient costs in the General Pricing Principles must represent economic costs or efficient economic costs and not historical accounting costs.

80. As NICTA demonstrates below, it is our view that the use of historical accounting costs would not reflect costs that are economically efficient, and therefore would be inconsistent with the General Pricing Principles and the efficiency objective in Section 124 (1) of Part VI of the Act. There are few reasons for this.

81. First, historical accounting costs, do not reflect the actual economic value of an asset, it only reflects the book value or accounting value. As such, it is heavily influenced by the accounting policies of the access provider. In particular, the corporate accounting policies and practices used for depreciation, or accounting policies or actions to revaluate old assets that are still in use. If NICTA were to use those values as the costs of the assets, the resulting costs would not represent the economic costs of those assets.

82. To illustrate the discrepancy between accounting (book) value and economic value, we quote a well-regarded accounting textbook:

> "*depreciation does not measure a decline in the market value of a fixed asset. Instead, depreciation is an allocation of a fixed asset's cost to expense over the asset's useful life. Thus, the book value of a fixed asset (cost less accumulated depreciation) usually does not agree with the asset's market value*."[24]

[24] Carl Warren, James Reeve, and Jonathan Duchac. "Accounting", 27th Edition. Cengage Learning (2018), pp. 492.

83. In consequence, the use of historical accounting costs would amount to using costs that are likely to be materially different than economic costs and result in prices that would not be "*promoting the economically efficient use of, and the economically efficient investment in, the facilities by which ICT services may be supplied",* and therefore, inconsistent with the efficiency objective in Section 124 (1) of the Act.

84. In NICTA's view, to keep consistency with the efficiency objective, one must use the economic value of an asset, which amounts to using the CCA approach and not historic accounting costs.

85. Second, as mentioned earlier, over the past decade, NRAs have shifted from using historic accounting costs into using CCA[25] in their cost models. NRA's do not regard historic accounting costs as representing an efficient operator's actual economic costs. It is clear from the efficiency objective, that Section 124(1)(b) of the Act is concerned with economic efficiency, which implies the use of economic costs and not historical accounting costs. This becomes clear once we recognize that an operator sets its own compensation (i.e., its own price) not based on its historical accounting costs but based on market demand and its own economic costs.

86. It is important to highlight what the EU Independent Regulators Group (IRG) says about this:

> *"In a competitive environment operators may not be able to set the price for every product in order to fully recover its incurred or historic costs, since they have to respond to market prices, which can often lie well below historic costs. They cannot therefore work according to historic costs since reversing investments is, for the main part, either not possible or only possible at a loss. An operator should therefore only be able to recover necessary for maintaining future real-asset values in a competitive market. This implies that the basis for asset valuation is the replacement cost of an asset as derived from the application of current cost accounting (CA) methodologies."*[26]

87. Perhaps a simple example taken from a microeconomics textbook can help illustrate why historical accounting costs is not the right cost standard to use.[27] Let's assume that a producer of a certain product uses an old production line which annual depreciation cost is $10 Million. Assume further that there is not alternative value for that production line and its scrap value is zero. Other annual costs amount to $25 Million for a total annual accounting cost of $35 Million. Assume the expected annual revenue from sales of this product is only $30 Million, for an accounting loss of $5 Million. Should the firm continue to use the old production line or shut down? Notice that the annual depreciation cost is $10 Million, but that is based on a sunk cost that was incurred when the production line was installed years ago. Since the market value of the production line is zero, its economic cost is zero.[28] By continuing to operate and

[25] Current costs are often referred as forward-looking costs.

[26] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp: 6.

[27] This example is based on: "Microeconomics. Private and Public Choice." Gwartney, James; Richard Stroup; Russell Sobel; and David Macpherson. 10th Edition, Thomson South-Western (2003): pp 205-206.

[28] Economic costs are opportunity costs, represented by the value of the next best alternative use.

sell the product, the firm can earn annually $5 Million ($30 Million - $25 Million). Again, the relevant costs are the economic costs and not the historical accounting costs.

88. Third, the use of historic cost accounting would not provide operators with appropriate incentives to promote the efficiency objective under Part VI of the Act. If access providers are compensated for their actual historical costs stemming from investments in legacy technology that has become obsolete due to newer more efficient technology, they would not have an incentive to increase efficiency as their inefficiency would be paid by their competitors.[29]

8.3 Preliminary views

89. For the aforementioned reasons, NICTA is of the view that historical accounting costs would not reflect the efficient economic costs of supplying the Declared Services. Moreover, the use of historical accounting costs to value the access provider's assets would not promote the achievement of the efficiency objective under Section 124 (1) of the Act.

90. In consequence, NICTA is of the view that the use of current cost accounting for costing capital related assets would be consistent with the General Pricing Principles and would promote the achievement of the efficiency objectives in Section 124 (1) of the Act.

Question 7: Are you in agreement with NICTA's view that the use of current cost accounting (CCA) to value the capital assets used for the supply of the Declared Services would reflect the efficient costs of those assets, and that historical accounting costs wouldn't?

8.4 Modern equivalent asset (MEA)

91. In practice, the implementation of CCA requires NRAs to calculate the economic (i.e., market) value of an equivalent modern asset. That is, to assess the value as if the access provider needed to replace it with a modern equivalent asset.

92. For example, the EU Independent Regulators Group states, that the implementation of current cost accounting, also referred as forward-looking costs, requires that:

> *"assets are valued using the cost of replacement with the modern equivalent asset (MEA). The MEA is the lowest cost asset, providing at least equivalent functionality and output as the asset being valued."*[30]

93. Likewise, the ITU states that:

[29] See for example, COMMISSION OF THE EUROPEAN COMMUNITIES. COMISSION STAFF WORKING DOCUMENT accompanying the COMISSION RECOMMENDATION on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU. EXPLANATORY NOTE. Brussels, 7.5.2009 SEC (2009) 600. Sec. 2.2.

[30] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp: 6.

"*Modern Equivalent Asset (MEA) should be used whenever it is possible, as it is the most accurate valuation criterion to reflect the cost of an efficient operator".*[31]

94. The MEA is a common approach followed by many NRAs around the world. For example, the Eastern Caribbean Telecommunications Authority recommended its application for the determination of mobile termination rates.[32] Similarly, in Peru, the national regulatory authority implemented the MEA approach in its cost model to determine mobile termination rates.[33]

8.5 Preliminary view

95. NICTA is of the view that the cost model should use the modern equivalent asset approach to value the assets used in the supply of the Declared Services.

Question 8: Do you agree with the approach of valuing assets using the cost of a modern equivalent asset (MEA)?

9. NETWORK TOPOLOGY

96. International best practice on cost modelling of termination rates is based on a bottom-up cost model of a hypothetical efficient operator. For example, The Commission of European Communities states that:

"The implementation of a bottom-up model is consistent with the concept of developing a network for an efficient operator whereby an economic/engineering model of an efficient network is constructed using current costs. It reflects the equipment quantity needed rather than that actually provided and it ignores legacy costs."[34]

97. The concept of a hypothetical efficient operator is necessary if we are to base the pricing of the Declared Services on the efficient costs of providing those services as required by the General Pricing Principles and the efficiency objective in Section 124(1) of the Act.

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[31] ITU. "Regulatory Accounting Guide", Telecommunications Development Bureau, March 2009, pp. 18.
[32] CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016, pp. 9-10.
[33] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022, pp. 63.
[34] The Commission of the European Communities. RECOMMENDATIONS. COMMISSION. "Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU." 2009|396|EC. Para. 10. Official Journal of the European Union L124.

98. It also implies that only one cost model is to be developed for mobile termination and a separate for fixed termination. Furthermore, it also implies that DMTAS (and DFTAS) would be symmetrical between all operators supplying the same Declared Service.

99. Usually a bottom-up cost model uses a reference operator's network as guidance to build up the cost model of an efficient network. To that end, a network topology for the cost model needs to be defined in order to calculate the cost of the different network components. It is a common practice among NRAs to use any of the following three approaches to build up the cost model of an hypothetical efficient network: (a) scorched node, (b) scorched earth, or (c) modified scorched node.[35]

100. In the scorched node approach, the existing location of the reference operator's nodes are used to design the hypothetical network. There is room for optimizing the hypothetical network in the cost model, but it is constrained by the predetermined location of the network nodes. The resulting optimized network would have a similar footprint as the reference network. It is important to note that, while this approach permits some network optimization in the cost model, it does to a lesser degree than the other approaches.

101. Using the scorched earth approach allows the hypothetical network to be optimized to the fullest extent by having no constrains on the location of the nodes. With this approach the cost model could place optimally the nodes to serve the required demand with an optimized network.

102. The modified scorched node approach is a combination of the prior two. With this method, the location of the nodes is based on the location of the reference operator's nodes but are not strictly fixed at that location. Locations may be modified or calibrated to optimize the real network.

103. Depending on the quality of the network information received from the operators (i.e., topology, services, demand, coverage, assets, etc.), the modified scorched node model may reflect a network optimization ranging from an optimized real network to a totally optimal hypothetical network as shown in Figure 2.

[35] ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 13. See also Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp:3.

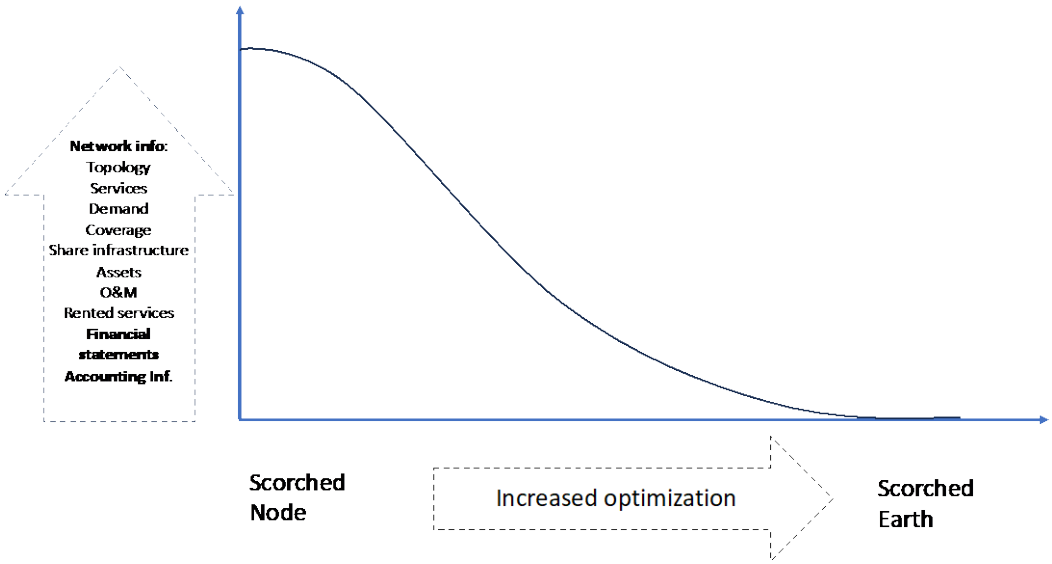

Figure 2: Bottom-up approaches and network optimization.

104. One version of the modified scorched node approach was recommended by the Eastern Caribbean Telecommunications Authority. The authority recommended the use of a scorched earth approach to model the mobile access network and a modified scorched node approach for the core network.[36]

105. The three approaches are widely used by NRAs, including a combination of these, as in the eastern Caribbean countries. For example, the regulatory authority in Peru implemented a scorched earth approach to determine mobile termination rates[37], while the regulator in Jamaica implemented a scorched node approach.[38] On the other hand, the regulator in Bahrain adopted the scorched node approach with the option of using a modified scorched node approach if inefficiencies were detected in the reference operator's network topology.[39]

9.1 Consistency with the General Pricing Principles

106. NICTA understands that all three approaches for modelling the network topology allow for various degrees of network optimization. This in turn would result in costs that could reasonably be regarded as pertaining to an efficient hypothetical

[36] CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016, pp. 27.

[37] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022, pp. 33.

[38] Office of Utilities Regulation, "Cost Model for Mobile Termination Rates." Consultation Document. Feb. 21, 2012, pp. 27-28.

[39] Telecommunications Regulatory Authority. "Development, Implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain". Position Paper. 19 October 2011. Ref. MCD/10/11/144, pp. 28-29.

operator, in accordance with the General Pricing Principles and the efficiency objective in Section 124(1) of the Act.

107. Furthermore, all three approaches seem to be consistent with the use of cost-based pricing in accordance with the General Pricing Principles.

9.2 Preliminary views

108. NICTA is of the view that any of the three approaches or a combination of these, would be consistent with international best practices. Furthermore, as discussed earlier, any of the three approaches would be consistent with the General Pricing Principles and the efficiency objectives in Section 124 (1) of the Act.

109. NICTA is mindful that there are benefits and downsides of using one approach over another. While the scorched earth approach results in a more optimized (efficient) hypothetical network, it also leads to a hypothetical network with a footprint that could be appreciably different from that of the reference operator. At the opposite end is the scorched node approach which results in a hypothetical network that is less optimized but where the footprint is much closer to that of the reference operator.

110. To strike a balance between these two approaches, NICTA is inclined to favour the implementation of a modified scorched node approach. However, NICTA is mindful that the implementation of the modified scorched node approach would require detailed information from the reference operators. If for any reason this information does not become available, or the information received is incomplete, NICTA may not be able to implement the modified scorched node approach and would need to implement the scorched earth approach.

111. NICTA's view is that it would be appropriate to model the network topology using a modified scorched node approach but if incomplete information prevents us from implementing this approach, a scorched earth approach may be implemented. We seek comments from interested parties.

Question 9: Do you agree that NICTA should implement a modified scorched node approach, but if not enough information is available from the reference operators, NICTA may use a scorched earth approach? Please explain why or why not.

10. REFERENCE OPERATOR

112. One important decision to model the costs of the Declared Services is whether the cost model should be based on an actual operator or a hypothetical operator.

113. Over the past 20 years, NRAs have moved away from using asymmetric rates between operators to using symmetric rates, meaning one single price for DMTAS and

another price for DFTAS.[40] In consequence, international best practice on cost modelling has moved away from modelling each operator's costs (and having different rates for each access provider), towards using one single model of a so-called reference operator or generic (hypothetical) operator, to calculate the termination costs.

10.1 Demand/Scale

114. NRAs have followed different approaches to define the reference or generic efficient operator. A common approach is to define the reference operator as having a market share equal to 1/N, where N is the total number of operators.[41] Therefore, in a market such as PNG, the reference mobile operator would be modelled with a 33.33% market share of the traffic volume.

115. NICTA is not convinced that a 1/N approach for the market share of the reference operator would be appropriate for PNG because of the large discrepancy between Digicel's market share and that of the other mobile operators. An alternative approach would be to model the reference operator for DMTAS based on a market share comparable to that of Digicel, which has by far the largest market share. This would imply an estimated market share of 97% of the domestic mobile traffic volume. NICTA seeks comments from interested parties on this matter.

116. On the other hand, NICTA is of the view that the reference operator for modelling the DFTAS should be based on a market share comparable to that of Telikom's fixed voice market. For that reason, NICTA proposes to model a reference operator with a market share of 100%of the domestic fixed terminating traffic volume.

10.2 Network coverage

117. It is common for NRAs to model the reference operator as having a network coverage equivalent to the average of all the operators. For the DMTAS, an alternative approach is to assume a network coverage for the reference operator to be equivalent to that of Digicel's which carries the highest traffic volume. NICTA seeks comments from interested parties on this matter.

118. On the other hand, for DFTAS, NICTA is of the view that the reference operator should be modelled with a network coverage equivalent to that of Telikom's fixed network.

10.3 Consistency with the General Pricing Principles

119. The General Pricing Principles does not provide clear guidance on what approach to follow with respect to the reference operator. However, NICTA's view is that either approach regarding the market share and network coverage of the

[40] European Regulatory Group (ERG), "ERG's Common Position on symmetry of fixed call termination rates and symmetry of mobile call termination rates". ERG (07) 83 final 080312, 28 February 2008, pp.78-79.
[41] ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 11.

reference operator for the DMTAS (and the proposed for the DFTAS) would be consistent with the use of cost-based pricing in accordance with the General Pricing Principles.

10.4 Preliminary views

120. In NICTA's view, the price of DMTAS should be symmetrical and equal for all operators. Similar for the price of DFTAS. This implies that two separate cost models shall be developed.

121. For the DMTAS, NICTA is of the view that the reference (generic) operator could be modelled based on a market share equivalent to that of Digicel or using the 1/N approach. Similarly, with respect to network coverage, the reference (generic) operator could be modelled based on a network coverage equivalent to that of Digicel or using the average network coverage of all the operators.

122. On the other hand, for the DFTAS NICTA is of the view that the reference operator should be modelled based on a market share and network coverage equivalent to that of Telikom. NICTA seeks comments from interested parties.

Question 10: Do you agree that NICTA should use one single model for the determination of the price of DMTAS and a separate model for the DFTAS? Please explain your reasons for why or why not.

Question 11: For the DMTAS model; do you agree that the reference operator should be modelled based on a market share and network coverage equivalent to that of Digicel's mobile network, or should NICTA use a market share of 1/N and the average network coverage of the operators? Please explain your reasons for preferring one over the other.

Question 12: For the DFTAS model; do you agree that the reference operator should be modelled based on a market share and network coverage equivalent to that of Telikom's fixed network? Please explain your reasons for why or why not.

11. RELEVANT INCREMENT

123. A common approach to cost modelling using the LRIC approach is to group the cost of the services provided into groups of incremental services also known as increments. One common way of computing the incremental cost of a service is to compute the costs that can be saved when the defined incremental service is no longer provided.

124. The incremental service for which the cost model is built shall not be too narrow as to make the cost modelling overly complex and intractable. On the other hand, the relevant incremental service shall not be too aggregated as to preventing

the use of the cost model to demonstrate that the resulting price of the declared service is cost-based.[42]

125. For instance, in the context of the cost models to set termination rates, the European Commission recommends that:

> *"Within the LRIC model, the relevant increment should be defined as the wholesale voice call termination service provided to third parties. This implies that in evaluating the incremental costs NRAs should establish the difference between the total long-run cost of an operator providing its full range of services and the total long-run cost of this operator in the absence of the wholesale call termination service being provided to third parties…(…)…This implies that only those costs which would be avoided if a wholesale voice call termination service were no longer provided to third parties should be allocated to the regulated voice call termination service".*[43]

126. There are three common ways to define the incremental services: (1) based on technology, (b) based on service type, and (c) based on wholesale/retail distinction.[44] When defining the incremental services based on technology, services are grouped for example into GSM services, LTE/4G services, etc. A more common approach is to define incremental services based on types of services. For example, for mobile networks one group could be voice/SMS, while a second groups could be mobile data services. This approach facilitates the identification of costs that are directly attributable to a service type. A third approach is based on distinguishing the wholesale services from the retail services.

127. NRAs often combine elements of these three approaches to define the groups of incremental services in broad categories, but to define more narrowly the relevant services for which the cost model is being developed.

128. NICTA's view is that the cost model for the DFTAS should model the following services and technologies:

i. Modelled Technology: Next Generation Network (NGN)
    1. Copper Access Network (ADSL)
    2. Fibre Access Network (PON)

ii. Modelled Services:
    1. Voice: On-Net, Incoming, Outgoing, International calls
    2. Data: Fixed internet service

[42] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp. 3-4.

[43] The Commission of the European Communities. RECOMMENDATION. COMMISSION. "Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU." 2009|396|EC. Para. 23 (6). Official Journal of the European Union L124.

[44] ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 13.

3. Video[45]: Cable TV

iii. Modelled service increment: Wholesale domestic fixed voice call termination provided to third parties.

129. NICTA is of the view that the cost model for the DMTAS should model the following services and technologies:

i. Modelled Technologies:

1. GSM (2G): voice, data, SMS
2. UMTS/HSPA (3G): voice, data, SMS
3. LTE (4G): voice (VoLTE)[46], data

ii. Modelled Services:

1. Voice: On-Net, Incoming, Outgoing, International calls
2. Data

iii. Modelled service increment: Wholesale domestic mobile voice call termination provided to third parties.

130. The incremental cost can also be calculated as the avoidable costs of not providing the relevant increment, which in this case would be the wholesale DMTAS or the DFTAS.

11.1 Consistency with the General Pricing Principles

131. The General Pricing Principles does not provide clear guidance on what approach to follow on this matter. However, in the context of defining the relevant incremental services in the cost models, the wholesale DMTAS and DFTAS provided to third parties should be the relevant increments. Moreover, it is consistent with the use of cost-based pricing in accordance with the General Pricing Principles.

132. For the avoidance of doubt, and per the definition of DMTAS and DFTAS, the relevant incremental service would only include the terminating traffic that originated in the national territory of PNG.

11.2 Preliminary views

133. NICTA is of the view that the relevant service increment to be used in the cost models shall be defined as wholesale DMTAS (or DFTAS) provided to third parties. NICTA seeks comments from interested parties.

[45] Only if shares infrastructure with the other services

[46] Only if is available by the operator.

Question 13: In the context of the cost model to set the price for DMTAS, do you agree that NICTA should define the relevant incremental service as the DMTAS provided to third parties? Please explain your reasons for why or why not.

Question 14: In the context of the cost model to set the price for DFTAS, do you agree that NICTA should define the relevant incremental service as the DFTAS provided to third parties? Please explain your reasons for why or why not.

134. NICTA also seek comments from interested parties on the technologies and services to be modelled. NICTA is of the view that the following technologies and services should be modelled in the DMTAS cost model:

i. Technologies:
   1. GSM (2G): voice, data, SMS
   2. UMTS/HSPA (3G): voice, data, SMS
   3. LTE (4G): voice (VoLTE)[47], data

ii. Modelled Services:
   1. Voice: On-Net, Incoming, Outgoing, International calls
   2. Data

iii. Modelled service increment: Wholesale domestic mobile voice call termination provided to third parties.

Question 15: In reference to the DMTAS cost model; do you agree with the proposed technologies and services to model? Explain why or why not.

i. Technologies:
   a. GSM (2G): voice, data, SMS
   b. UMTS/HSPA (3G): voice, data, SMS
   c. LTE (4G): voice (VoLTE), data

ii. Modelled Services:
   a. Voice: On-Net, Incoming, Outgoing, International calls
   b. Data

iii. Modelled service increment: Wholesale domestic mobile voice call termination provided to third parties.

[47] Only if is available by the operator.

135. NICTA is of the view that the DFTAS cost model should model the following technologies and services:

i. Technology: Next Generation Network (NGN)
    1. Copper Access Network (ADSL)
    2. Fibre Access Network (PON)
ii. Modelled Services:
    1. Voice: On-Net, Incoming, Outgoing, International calls
    2. Data: Fixed internet service
    3. Video: Cable TV
iii. Modelled service increment: Wholesale domestic fixed voice call termination provided to third parties.

Question 16. In reference to the DFTAS cost model; do you agree with the proposed technologies and services to model? Explain why or why not.

i. Technology: Next Generation Network (NGN)
    a. Copper Access Network (ADSL)
    b. Fibre Access Network (PON)
ii. Modelled Services:
    a. Voice: On-Net, Incoming, Outgoing, International calls
    b. Data: Fixed internet service
    c. Video: Cable TV
iii. Modelled service increment: Wholesale domestic fixed voice call termination provided to third parties.

12. ALLOCATION OF JOINT AND COMMON COSTS

136. NICTA's view is that to be consistent with the General Pricing Principles, the cost model of a Declared Service must include joint and common costs. The broad definition of common costs (which include common costs) is provided by the European Independent Regulators Group, as:

"the costs that are incurred in the supply of all or a group of products or services provided by the company and that are not incremental to any one product or service."[48]

137. As indicated earlier, the term joint costs is used to differentiate those costs that are common only to a subset of incremental services, while the term common costs is used for costs that cannot be assigned to any incremental services or subset of services. See Figure 1 in Section 7.2.

138. The allocation of joint and common costs to incremental services presents a challenge as they are not a direct cost that can be easily attributed to an incremental service.

139. In theory, these costs are best allocated using Ramsey price rules. This allocates common costs of a service based on the marginal cost and the price elasticity of demand for the services. The theory is sound, but its implementation is not practical due to the difficulty on estimating the price elasticity of demand for the different incremental services.

140. As we mentioned earlier, the LRIC+ approach adds a proportion of the joint and common costs to each of the services modelled. For the allocation of the network related joint and common costs, regulatory authorities generally recommend the use of the capacity-based allocation rules (technical allocation) or the Shapley-Shubik rule (economic allocation).

141. The capacity-based allocation rule allocates common and joint costs to the services based on the network capacity required by each service at the busiest hour. This rule is used by many NRAs as it follows the cost drivers (networks are dimensioned to support the peak traffic). This rule tends to allocate a larger share of indirect costs to services that require a larger capacity in the network (data, Internet or VoD), but leads to lower cost allocations to services that require less capacity in the network (voice services). NICTA's view is that the capacity-based allocation rule should be implemented in the model.

142. The Shapley-Shubik[49] allocation rule consists of setting the cost of a service equal to the average of the incremental costs of the service after reviewing every possible order of arrival of the increment. Such a rule may be worth considering because it gives different insights as compared to the traditional capacity-based allocation rule.

143. A different method is often used by NRAs for the allocation of overhead (common) costs, where overhead costs are allocated in proportion to the cost of each service modelled. This is often referred as the equal proportionate mark-up (EPMU) rule.

144. The Eastern Caribbean Telecommunications Authority combined the use of the capacity-based allocation and the EPMU[50] approaches to allocate network-related

[48] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp. 4.
[49] An Introduction to Allocations Rules (2009) Jens Leth Hougaard pp 104
[50] Equi-Proportional Mark-Up (EPMU)

and non-network common costs in its recommendation for its proposed bottom-up LRIC+ cost model for mobile termination rates:

> *"ECTEL considers the efficient [effective] capacity approach, which also belongs to the 'proportional rules' family, to be the option that more accurately represents how network-related common costs should be shared among services…(…)…Unlike network-related common and joint costs, those common costs related to G&A are normally not relevant only to a particular set of services. The Authority thus considers to employ an EPMU to allocate G&A common cost to services."*[51]

145. The distinction between common costs that are network related, and common costs that are not, such as General and Administration (G&A)[52], is a sound approach. Other NRAs implemented a similar approach to that recommended by the ECTEL. For example, the Telecommunications Regulatory Authority of Bahrain used the EPMU approach to allocate non-network common costs, while it used the EPMU and the Shapley-Shubik methods to allocate network related common costs.[53]

12.1 Consistency with the General Pricing Principles

146. The General Pricing Principles does not provide clear guidance on what approach to follow. However, it is NICTA's view that any of the approaches described above would be consistent with the use of cost-based pricing in accordance with the General Pricing Principles.

12.2 Preliminary views

147. While all the approaches described above to allocate joint and common costs seem consistent with the General Pricing Principles, the Ramsey Price approach, which in theory is economically sound, is unfortunately impractical to implement. On the other hand, NICTA is of the view that for the allocation of network-related joint and common costs, the capacity-based allocation or the Shapley-Shubik approaches would be appropriate. Moreover, it is possible that for some network elements the use of the capacity-based allocation method would be appropriate, while for others the use of the Shapley-Shubik method would be preferred.

148. For the allocation of overhead (non-network related) common costs, NICTA is of the view that the EPMU approach would be appropriate. We seek comments from interested parties.

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[51] CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016. Section 2.1.4, pp. 16-17.

[52] These are commonly referred as overhead costs.

[53] Telecommunications Regulatory Authority. "Development, Implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain". Position Paper. 19 October 2011. Ref. MCD/10/11/144, pp. 25-27.

Question 17: Do you agree that for the allocation of network related joint and common costs, NICTA should use the capacity-based allocation and the Shapley-Shubik approaches depending on the network element analyzed? Please explain your reasons for why or why not.

Question 18: Do you agree that for the allocation of overhead common costs, NICTA should use the equal proportionate mark-up (EPMU) approach? Please explain your reasons for why or why not.

13. DEPRECIATION

149. The cost model must include an annualized cost of depreciation of the capital assets used in the Declared Services. In theory, the economic depreciation (i.e., economic cost) should be used. However, while conceptually economic depreciation provides a useful framework, its implementation is difficult.[54] Instead, the following depreciation methods have been commonly used by NRAs: (a) straight-line depreciation, (b) standard annuity, (c) tilted annuity, and (d) adjusted tilted annuity.

150. Straight-line depreciation is the most common method used in financial accounting but unless adjustments are made, it is not suitable for regulatory purposes.[55] A common adjustment is to use a straight-line depreciation based on CCA values instead of historical accounting costs. A second adjustment is to add the cost of capital employed to the annual depreciation to calculate the annual cost recovery of the assets used. While this method was often used in the past it is seldom used now.

151. The standard annuity method spreads evenly the annual cost of an asset over its economic life. It also uses CCA values to reflect the efficient or market value of an asset and takes into account the cost of capital.

152. Although the standard annuity approach is an improvement over the prior method, its constant depreciation profile has been criticised for not reflecting the real economic depreciation profile of assets in real life. In a formulaic way, this approach can be represented as:[56]

$$Annual\ Cost = GRC\ x\ \frac{WACC}{1-(1+WACC)^{-UL}}, \quad (1)$$

where,

GRC: Gross replacement cost of an asset,

UL: useful life of an asset, and

WACC: weighted average cost of capital.

[54] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp. 7.
[55] ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 9.
[56] *Id.*, pp.9.

153. The tilted annuity method incorporates the notion that the price of the network assets tends to decline over time. This leads to higher depreciation costs in the early years.

154. The tilted annuity formula can be represented by the following:[57]

$$Annual\ Cost_t = GRC\ x\ \frac{(WACC-PT)x\ (1+PT)^t}{1-\left(\frac{1+PT}{1+WACC}\right)^{UL}}, \quad (2)$$

where,

GRC: Gross replacement cost of an asset,

PT: the price trend, or the rate of price change of an asset,

UL: useful life of an asset, and

WACC: weighted average cost of capital.

155. Finally, the adjusted tilted annuity method is a variant of the prior method and is an attempt to mimic more closely what could be the true economic depreciation. This method adjusts the annual cost recovery of the tilted annuity method by forecasting the changes on output produced by the assets and adjusting the annual value of the assets to reflect these changes. A drawback of this method is that it introduces more discretion in the calculation of the annual costs of the assets which can produce annual costs that are significantly different from the other annuity methods.

156. In recent years, NRAs have been using the various CCA annuity approaches described above. For example, ECTEL recommended the use of a tilted annuity approach for depreciating assets in the cost models for mobile and fixed termination.[58] Similarly, the Telecommunications Regulatory Authority of Bahrain adopted either the tilted annuity or the adjusted tilted annuity approach in their bottom-up cost model for fixed and mobile termination.[59] On the other hand, the regulatory authority in Peru (OSIPTEL) used the standard annuity approach to set mobile termination rates.[60]

[57] Telecommunications Regulatory Authority. "Development, Implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain". Position Paper. 19 October 2011. Ref. MCD/10/11/144, pp. 101.

[58] ECTEL, CONSULTATION DOCUMENT. Recommendation of the Eastern Caribbean Telecommunications Authority ("ECTEL") To the National Telecommunications Regulatory Commission to consult on Principles, methodologies and guidelines for the determination of interconnection rates. Consultation Document No. 3 of 2016. 28th July, 2016. Section 2.1.3, pp. 12.

[59] Telecommunications Regulatory Authority. "Development, Implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain". Position Paper. 19 October 2011. Ref. MCD/10/11/144, pp. 49.

[60] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022. pp. 33.

13.1 Consistency with the General Pricing Principles

157. No clear guidance is provided by the General Pricing Principles on this issue. However, it is NICTA's view that the straight-line depreciation method using historical accounting costs would not reflect cost-based prices or efficient costs, for reasons exposed earlier in this Discussion Paper.

158. Aside from that, in NICTA's view, the use of CCA in combination with any of the approaches described would in principle, reflect the economic depreciation profile of the assets, and as such, would be consistent with the use of cost-based prices for the declared services.

13.2 Preliminary views

159. NICTA is of the view that in principle, the use of CCA with any of the annuity approaches could be regarded as international best practices and consistent with the General Pricing Principles and the efficiency objective in Section 124 (1) of the Act. However, this does not mean that NICTA views each of the three annuity approaches as equally appropriate. The tilted annuity approach seems to follow more closely what could be regarded as the economic depreciation profile of assets than the standard annuity approach.

160. On the other hand, NICTA is not convinced that the added discretion with the adjusted tilted annuity approach would represent an improvement over the tilted annuity. On the contrary, the added discretion may result in annual costs significantly different than those calculated with the tilted annuity approach. For these reasons, NICTA is of the view that the tilted annuity approach should be implemented.

Question 19: Do you agree that NICTA should use the tilted annuity approach to calculate the depreciation of assets? Please explain your reasons for why or why not.

14. REASONABLE RATE OF RETURN

14.1 WACC formula and gearing

161. The use of the weighted average cost of capital (WACC) is a widely accepted method to calculate the reasonable rate of return on capital for the modelled efficient access provider.[61] The WACC is defined as the weighted cost of debt and equity, with the weights being the share of equity and debt on the modelled operator's total capital. The (after-tax) WACC formula can be represented as:

[61] Independent Regulators Group. "Principles of implementation and best practices regarding FL-LRIC cost modelling" as decided by the Independent Regulators Group, 24 November 2000, pp. 8. See also ITU, "Guidelines on cost modelling. Economic policies and methods of determining the costs of services related to national telecommunication/ICT networks." ITU, Geneva, Switzerland (2021), pp. 6-7.

$$WACC = \left(\frac{E}{E+D}\right) x\, r_e + \left(\frac{D}{E+D}\right) x\, (1-t)\, x\, r_d\,, \quad (3)$$

where,

r_e: cost of equity capital or shareholder's expected return on equity,

r_d: cost of debt,

E: Equity of the operator's capital structure,

D: Debt of the operator's capital structure, and

t: corporate tax rate.

162. To calculate the pre-tax WACC, one needs to gross-up the after-tax WACC as follows:

$$Pre - tax\ WACC = \frac{After{-}tax\ WACC}{(1-t)}, \quad (4)$$

163. NRAs usually calculate a different WACC for the DMTAS and DFTAS cost models. This seems justified as long as the WACC faced by the respective modelled operators are different. Absent that difference, there does not appear to be a reasonable justification for having two different WACCs.

14.1.1 Gearing

164. It is common to refer to the ratio of debt to the total capital of a company (debt plus equity) as the gearing of a company. In a formulaic way it is represented as:

$$Gearing = \frac{D}{(D+E)}. \quad (5)$$

165. One approach to select an appropriate gearing for each cost model is to benchmark it using the main domestic operators' financial statements. The benefit of this is transparency and relative ease of obtaining such information. However, there are several potential pitfalls. For example, domestic operators' financial statements may not reflect the true market value of liabilities if there is no market for a company's debt,[62] or when credit risk is rapidly deteriorating. A second problem is that it would be based on historical data and not on current or forward-looking data as best practice requires. A third problem would be that the historical gearing of a company may reflect past inefficient decisions of a company's management and therefore should not be used without proper adjustments to calculate the WACC.

166. For those reasons, NRAs often use international benchmarks from telecommunications operators that can be regarded as having an efficient capital structure, meaning an optimal balance between equity and debt to finance their

[62] For example, the company may not issue corporate bonds, or in the case of state-owned enterprises (SOEs), government borrowing for capital expenses of the SOE may not appear in the SOE's balance sheet.

capital investments. For example, in Jamaica the regulator used the gearing value from international benchmarks from regulatory decisions in various countries,[63] while in Peru the regulator (OSIPTEL) used data from the financial statements of the main domestic operators to calculate the average gearing for the latest year and used that as the notional gearing of the hypothetical efficient operator.[64]

14.2 Consistency with the General Pricing Principles

167. As indicated elsewhere, the General Pricing Principles are broad and do not provide detailed guidance. However, Section 134 (1)(a) says that the Declared Services should,

> *"(ii) include a reasonable return on investment, over the economic life of the assets employed, commensurate with the regulatory and commercial risks involved".*

168. NICTA's proposal to use the WACC of the modelled access provider is consistent with the General Pricing Principles, and in particular, with the clause quoted above. As we will see later in more detail, the proposed WACC formula specifically considers various kinds of risks "*commensurate with the regulatory and commercial risks involved*". In particular, it incorporates various risk premiums such as country risk, debt risk, market risk, and the modelled operator's investment risk.[65]

14.3 Preliminary views

169. NICTA is of the view that the use of the after-tax and pre-tax WACC formulas presented is the appropriate approach to calculating the cost of capital of the modelled access provider.

170. To the extent that the modelled providers of DMTAS and DFTAS are different and have different costs of capital, NICTA is of the view that two separate WACCs should be calculated.

171. To the extent that the gearing data in the financial statements of the main domestic operators of DMTAS and DFTAS may not reflect the capital structure of an hypothetical efficient access provider or the true market value of debt, NICTA will use appropriate international benchmarks to calculate a value of a notional gearing for the modelled operator. The international benchmarks shall be from telecommunications companies providing comparable services and that can be regarded as having an efficient capital structure.

[63] Office of Utilities Regulation. "Estimate of the Weighted Average Cost of Capital for Telecommunications Carriers". Consultation Document, 24 June 2020, pp. 16-19.
[64] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022. pp. 102.
[65] This is commonly referred as the beta.

Question 20: Do you agree that NICTA should use the after-tax and pre-tax WACC formulas presented earlier to calculate two separate costs of capital; one for the DMTAS modelled access provider and a different for the DFTAS modelled access provider? Please explain your reasons for why or why not.

Question 21: Do you agree that NICTA should not use the gearing values from the financial statements of the domestic operators, and that instead, should calculate notional gearing values based on international benchmarks from telecom companies that can be regarded as having an efficient capital structure? Please explain your reasons for why or why not.

14.4 Cost of Debt

172. In theory, if an operator issues corporate bonds to finance all of its capital investments one could use the observed yield on the bonds as the cost of debt. However, reality is more complicated. It is common for operators to have multiple sources of finance; for example, they could issue bonds but also have vendors financing part of their capital investment and also have short or medium-term financing from banks. The multiple interest rates and maturities make the analysis more complicated. Moreover, for regulatory purposes NRAs want to have a notional cost of debt (r_d) for the hypothetical efficient operator. To make the analysis tractable, NRAs often subdivide the cost of debt in three components using the following formula:

$$r_d = r_f + CRP + D_p, \quad (6)$$

where,

r_d: cost of debt,

r_f: risk-free rate of return

CRP: country risk premium, and

D_p: Debt-risk premium.

173. It is common for NRAs to use the interest rate of the 10-year U.S. treasury bonds or similar debt instruments[66] as the risk-free rate of return (r_f).

174. The country risk premium (CRP) is often calculated as the difference (spread) between a country government bonds and the risk-free rate. This is the risk premium required by investors for specifically investing in PNG. Therefore, if a 10-year U.S. treasury bond is used as the risk -free rate, the spread should be measured against a government of PNG U.S. dollar denominated bond of comparable maturity.

175. The debt-risk premium is the operator's specific debt premium over the government sovereign bonds. If an operator doesn't issue bonds, then NRAs often

[66] An alternative could be the 10-year Australian government bond.

benchmark the operator's debt premium by observing comparable debt premiums in other jurisdictions.

176. NRAs have followed various approaches to calculate the debt-risk premium and more broadly the notional cost of debt (r_d) for the modelled operator. For example, the Eastern Caribbean Telecommunications Authority used a benchmark approach to estimate the cost of debt based on data from Prof. Damodaran.[67] Prof. Damodaran is a world renown authority on the valuation of financial assets and companies. He is a professor of finance at the Stern School of Business at New York University (NYU).

177. On the other hand, the Jamaican regulator (OUR) used a benchmark approach to estimate the debt-risk premium (D_P) based on data used by other NRAs in similar regulatory proceedings.[68] In Peru, a different approach was followed by the regulatory authority which calculated the cost of debt using all sources of debt financing in the operators' financial statements.[69]

14.5 Preliminary views

178. NICTA is of the view that the appropriate way to calculate the cost of debt is by using formula No. 6 presented above along with the use of the 10-year U.S. bond rate or comparable sovereign bond interest rate as the risk-free rate of return.

179. NICTA considers appropriate to use as the CRP the difference (spread) between the interest rate of the PNG government bonds and the risk-free interest rate of comparable maturity. Alternatively, NICTA could use the calculated CRP by Prof. Damodaran[70] which has been used extensively as a reliable source by many NRAs and researchers.

180. In addition, NICTA's view is that the debt-risk premium (D_p), could be measured by the spread (difference) between the interest rate of comparable corporate bonds and government bonds in other jurisdictions, as long as the corporate bonds are from operators that can be regarded as efficient operators and that provide comparable services as the modelled operator.

[67] Eastern Caribbean Telecommunications Authority. "Recommendation to National Telecommunications Regulatory Commissions on Cost Oriented Interconnection Rates in the ECTEL Member States." April 2018, pp. 9-10.

[68] Office of Utilities Regulation. "Estimate of the Weighted Average Cost of Capital for Telecommunications Carriers". Consultation Document, 24 June 2020, pp. 25-26.

[69] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022. pp. 102.

[70] See: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html

Question 22: Do you agree that NICTA should use formula No. 6 to calculate the cost of debt of the modelled access provider of DFTAS and DMTAS? Please explain your reasons for why or why not.

Question 23: Do you agree that NICTA should use the interest rate on a 10-year U.S. bond or comparable sovereign bond interest rate, as the risk-free rate of return? Please explain your reasons for why or why not.

Question 24: Do you agree that to calculate the country risk premium (CRP) NICTA should use either the difference between the interest rate of the PNG government bonds and the risk-free interest rate of comparable maturity, or the widely used CRP calculated by Prof. Damodaran from NYU? Please explain your reasons for why or why not.

Question 25: To calculate the debt-risk premium, do you agree that NICTA should use the spread between the interest rate of comparable corporate bonds and government bonds in other jurisdictions, as long as the corporate bonds are from efficient operators that provide comparable services as the modelled operator? Please explain your reasons for why or why not.

14.6 Cost of Equity

181. In keeping with international best practices, the capital asset pricing model (CAPM) remains the preferred method for calculating the cost of equity capital.

182. The basic CAPM equation states that the rate of return on equity (r_e) demanded by shareholders is equal to the rate of return on a risk-free instrument (r_f) plus the company's equity beta (β) multiplied by the market risk premium:[71]

$$r_e = r_f + \beta \, x \, (r_m - r_f), \qquad (7)$$

where the term ($r_m - r_f$) denotes the market risk premium.

183. While this equation has broad applicability, its use to calculate the cost of equity capital outside the U.S. and other advanced economies, creates several challenges. For example, the direct calculation of the cost of equity of an operator in PNG would require that operator to have its shares listed and traded in the PNG stock exchange. Moreover, even if it were listed in the PNG stock exchange, the lack of liquidity in the exchange compared with large markets such as the New York Stock Exchange or the NASDAQ, would result in a company beta which may significantly under or over-estimate the true company beta, leading to errors in the calculation of the cost of equity.[72]

[71] Stephen Ross, Randolph W. Westerfield, and Jeffrey F. Jaffe. "Corporate Finance". Third Edition, Richard D. Irwin, Inc. 1993, pp. 340.

[72] For a good discussion on these issues see: Aswath Damodaran. "Investment Valuation. Tools and Techniques for Determining the Value of Any Asset." University Edition. John Wiley & Sons, Inc. 2012, pp. 159-168.

184. For those reasons it is common to implement the formula above using U.S. stock market index data as the market risk premium and add a country risk premium (CRP), resulting in the following equation:

$$r_e = r_f + \beta\, x\, (MRP + CRP), \quad (8)$$

185. The market risk premium (MRP) is commonly calculated by the difference between the rate of return on a stock market index such as the Standard and Poor's 500 and the risk-free rate of return on a U.S. 10-year bond. The CRP is the country risk premium, which as mentioned before, could be calculated by the spread (difference) between the 10-year (or similar maturity) sovereign bond interest rate from PNG and that of the U.S.

186. The approach above was followed by the Eastern Caribbean Regulatory Authority and the regulatory authority in Jamaica in their regulatory proceedings to set termination rates.[73] Other regulatory authorities such as the ones in Peru and Bahrain used a slight variation of the approach described to calculate the cost of equity capital.[74]

14.7 Preliminary views

187. NICTA is of the view that the cost of equity capital should be calculated based on the CAPM model and in particular, by using formula No. 8.

188. NICTA also views that a proper calculation of the MRP is by the difference between the rate of return on the U.S. Standard & Poor's 500 Index and the risk-free rate of return. This could be calculated directly by using data from the S&P500 market index and the risk-free rate of return, or by using Prof. Damodaran's own calculation of the U.S. MRP.[75]

[73] See Eastern Caribbean Telecommunications Authority. "Recommendation to National Telecommunications Regulatory Commissions on Cost Oriented Interconnection Rates in the ECTEL Member States." April 2018, pp. 11-12. See also Office of Utilities Regulation. "Estimate of the Weighted Average Cost of Capital for Telecommunications Carriers". Consultation Document, 24 June 2020, pp. 27-35.

[74] See OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022. pp. 102. See also Telecommunications Regulatory Authority. "2013 Cost of Capital: Final Determination", 20 February 2013. Ref: MCD 02/13/018, pp. 54-63.

[75] See https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histimpl.html

Question 26: Do you agree that NICTA should use formula No. 8 to calculate the cost of equity capital for the modelled access provider of DFTAS and DMTAS? Please explain your reasons for why or why not.

Question 27: Do you agree that to calculate the market-risk premium (MRP), NICTA should use the difference between the rate of return on the U.S. Standard & Poor's 500 Index and the risk-free rate of return? Please explain your reasons for why or why not.

14.8 Equity beta

189. The equity beta of a company or an investment is the risk that the investment adds to a market portfolio. Intuitively, it measures the sensitivity of a company's rate of return on equity (r_e) to change on the market rate of return.[76]

190. The value of the equity beta can be calculated directly if the operator is a publicly traded company. However, that is not always the case or may not even be desirable for reason exposed earlier. NRAs often use benchmarks of equity betas from publicly traded companies or from estimated values for the U.S. telecommunications sector such as those from Prof. Damodaran.[77]

191. For example, in Peru, the regulatory authority (OSIPTEL) used Prof. Damodaran telecommunications sector equity beta to calculate the cost of equity (r_e) used in their cost model to calculate mobile termination rates.[78] A similar approach was recommended by the Eastern Caribbean Telecommunications Authority;[79] and a slight variation was implemented by the Jamaican regulatory authority which used the average betas applied by a sample of regulatory authorities in similar regulatory proceedings.[80]

14.9 Preliminary views

192. NICTA is of the view that to calculate the equity beta of the modelled access provider it should either use benchmarks of equity betas from publicly traded companies in the U.S. stock market or use the estimates from the U.S. telecommunications sector from Prof. Damodaran.

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[76] See for example, Aswath Damodaran. "Investment Valuation. Tools and Techniques for Determining the Value of Any Asset." University Edition. John Wiley & Sons, Inc. 2012, pp. 183. See also, Stephen Ross, Randolph W. Westerfield, and Jeffrey F. Jaffe. "Corporate Finance". Third Edition, Richard D. Irwin, Inc. 1993, pp. 301.

[77] Prof. A. Damodaran, New Your University, Stern School of Business. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html

[78] OSIPTEL. Informe No. 00076-DPRC/2022, "PROCEDIMIENTO DE REVISION DE LOS CARGOS DE INTERCONEXION TOPE POR TERMINACION DE LLAMADAS EN LAS REDES DE LOS SERVICIOS PUBLICOS DE TELECOMUNICACIONES MOVILES – APROBACION", 28 April 2022. pp. 101.

[79] Eastern Caribbean Telecommunications Regulatory Authority. "Recommendation to National Telecommunications Regulatory Commissions on Cost Oriented Interconnection Rates in the ECTEL Member States". April 2018, pp. 11.

[80] Office of Utilities Regulation. "Estimate of the Weighted Average Cost of Capital for Telecommunications Carriers". Consultation Document, 24 June 2020, pp. 30-32.

Question 28: Do you agree that to calculate the equity beta of the modelled access provider NICTA should either use benchmarks of equity betas from comparable publicly traded companies in the U.S or use the widely cited estimates from the U.S. telecommunications sector from Prof. Damodaran? Please explain your reasons for why or why not.

Annex A. Public Notice

Annex B. List of Questions

Question 1: Do you think an international benchmark approach to determine the price of the declared services would be consistent with the general pricing principles in Section 134 of the Act? If you do, please explain your rationale.

Question 2: In case you think that both approaches (the cost modelling and an international benchmark) are consistent with Section 134 of the Act, which approach do you think would be preferable for NICTA to implement and why?

Question 3: Do you agree that NICTA should use a top down (if data is available) or a bottom-up approach to cost modelling to calculate cost-based prices for the Declared Services in accordance with Section 134 of the Act? Please explain your reasons for why one approach would be preferable over the other.

Question 4: Do you agree that NICTA could also use a hybrid approach should enough data becomes available from the operators? Explain your reasons for agreeing or disagreeing.

Question 5: With respect to the inclusion or exclusion of common costs; do you agree that Section 134 (2) of the Act rules out the use of a pure LRIC cost allocation approach because the Act requires the inclusion of "fair and reasonable common costs" in the calculation of the costs of the Declared Services? If you disagree, please explain why.

Question 6: Do you agree that NICTA should use a LRIC+ approach for allocating cost in the cost model? Please explain why you agree or disagree.

Question 7: Are you in agreement with NICTA's view that the use of
current cost accounting (CCA) to value the capital assets used for the supply of the Declared Services would reflect the efficient costs of those assets, and that historical accounting costs wouldn't?

Question 8: Do you agree with the approach of valuing assets using the cost of a modern equivalent asset (MEA)?

Question 9: Do you agree that NICTA should implement a modified scorched node approach, but if not enough information is available from the reference operators, NICTA may use a scorched earth approach? Please explain why or why not.

Question 10: Do you agree that NICTA should use one single model for the determination of the price of DMTAS and a separate model for the DFTAS? Please explain your reasons for why or why not.

Question 11: For the DMTAS model; do you agree that the reference operator should be modelled based on a market share and network coverage equivalent to that of Digicel's mobile network, or should NICTA use a market share of 1/N and the average network coverage of the operators? Please explain your reasons for preferring one over the other.

Question 12: For the DFTAS model; do you agree that the reference operator should be modelled based on a market share and network coverage equivalent to that of Telikom's fixed network? Please explain your reasons for why or why not.

Question 13: In the context of the cost model to set the price for DMTAS, do you agree that NICTA should define the relevant incremental service as the DMTAS provided to third parties? Please explain your reasons for why or why not.

Question 14: In the context of the cost model to set the price for DFTAS, do you agree that NICTA should define the relevant incremental service as the DFTAS provided to third parties? Please explain your reasons for why or why not.

Question 15: In reference to the DMTAS cost model; do you agree with the proposed technologies and services to model? Explain why or why not.

i. Technologies:
    a. GSM (2G): voice, data, SMS
    b. UMTS/HSPA (3G): voice, data, SMS
    c. LTE (4G): voice (VoLTE), data

ii. Modelled Services:
    a. Voice: On-Net, Incoming, Outgoing, International calls
    b. Data

Modelled service increment: Wholesale domestic mobile voice call termination provided to third parties.

Question 16. In reference to the DFTAS cost model; do you agree with the proposed technologies and services to model? Explain why or why not.

i. Technology: Next Generation Network (NGN)
    a. Copper Access Network (ADSL)
    b. Fibre Access Network (PON)

ii. Modelled Services:
    a. Voice: On-Net, Incoming, Outgoing, International calls
    b. Data: Fixed internet service
    c. Video: Cable TV

Modelled service increment: Wholesale domestic fixed voice call termination provided to third parties.

Question 17: Do you agree that for the allocation of network related joint and common costs, NICTA should use the capacity-based allocation and the Shapley-Shubik approaches depending on the network element analyzed? Please explain your reasons for why or why not.

Question 18: Do you agree that for the allocation of overhead common costs, NICTA should use the equal proportionate mark-up (EPMU) approach? Please explain your reasons for why or why not.

Question 19: Do you agree that NICTA should use the tilted annuity approach to calculate the depreciation of assets? Please explain your reasons for why or why not.

Question 20: Do you agree that NICTA should use the after-tax and pre-tax WACC formulas presented earlier to calculate two separate costs of capital; one for the DMTAS modelled access provider and a different for the DFTAS modelled access provider? Please explain your reasons for why or why not.

Question 21: Do you agree that NICTA should not use the gearing values from the financial statements of the domestic operators, and that instead, should calculate notional gearing values based on international benchmarks from telecom companies that can be regarded as having an efficient capital structure? Please explain your reasons for why or why not.

Question 22: Do you agree that NICTA should use formula No. 6 to calculate the cost of debt of the modelled access provider of DFTAS and DMTAS? Please explain your reasons for why or why not.

Question 23: Do you agree that NICTA should use the interest rate on a 10-year U.S. bond or comparable sovereign bond interest rate, as the risk-free rate of return? Please explain your reasons for why or why not.

Question 24: Do you agree that to calculate the country risk premium (CRP) NICTA should use either the difference between the interest rate of the PNG government bonds and the risk-free interest rate of comparable maturity, or the widely used CRP calculated by Prof. Damodaran from NYU? Please explain your reasons for why or why not.

Question 25: To calculate the debt-risk premium, do you agree that NICTA should use the spread between the interest rate of comparable corporate bonds and government bonds in other jurisdictions, as long as the corporate bonds are from efficient operators that provide comparable services as the modelled operator? Please explain your reasons for why or why not.

Question 26: Do you agree that NICTA should use formula No. 8 to calculate the cost of equity capital for the modelled access provider of DFTAS and DMTAS? Please explain your reasons for why or why not.

Question 27: Do you agree that to calculate the market-risk premium (MRP), NICTA should use the difference between the rate of return on the U.S. Standard & Poor's 500 Index and the risk-free rate of return? Please explain your reasons for why or why not.

Question 28: Do you agree that to calculate the equity beta of the modelled access provider NICTA should either use benchmarks of equity betas from comparable publicly traded companies in the U.S or use the widely cited estimates from the U.S. telecommunications sector from Prof. Damodaran? Please explain your reasons for why or why not.