Malaysian Communications and Multimedia Commission

Review of Access Pricing

Public Inquiry Paper

5 October 2022

This Public Inquiry Paper was prepared in fulfilment of sections 55(2), 55(4), 58 and 61 of the Communications and Multimedia Act 1998

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ABBREVIATIONS AND GLOSSARY

2G	Second generation wireless technology
3G	Third generation wireless technology
4G	Fourth generation wireless technology
5G	Fifth generation wireless technology
AA	Apparatus Assignment
ADSL	Asymmetric Digital Subscriber Line
BEREC	Body of European Regulators for Electronic Communications
CAPEX	Capital Expenditure
CAPM	Capital Asset Pricing Model
CCA	Current Cost Accounting
CEO	Chief Executive Officer
CIIP	Common Integrated Infrastructure Provider
CMA	Communications and Multimedia Act 1998
CVR	Cost Volume Relationship
DCIS	Domestic Connectivity to International Service
DNB	Digital Nasional Berhad
DTTB	Digital Terrestrial Television Broadcasting
DWDM	Dense Wave Division Multiplexer
EC	European Commission
ED	Economic Depreciation
EPMU	Equi-Proportional Mark Up
EPC	Evolved Packet Core
ERP	Equity Risk Premium
EU	European Union
FAC	Fully Allocated Cost
FFLAS	Fixed Fibre Local Access Services
FTTH	Fibre to the Home
FTR	Fixed Termination Rate
Gbps	Giga bits per second
GPON	Gigabit Passive Optical Network
GSM	Global System for Mobile Communications
GSMA	GSM Association
HD	High Definition
HSBB	High Speed Broadband
IBCA	In-Building Common Antenna Systems
ILS	Interconnect Link Service

IMS	IP Multimedia Services
IP	Internet Protocol
LRIC	Long Run Incremental Cost
LTBE	Long Term Benefit of End-users
LTE	Long Term Evolution wireless technology
M&A	Mergers and Acquisitions
Mbps	Mega bits per second
MCMC	Malaysian Communications and Multimedia Commission
MEA	Modern Equivalent Asset
MMS	Multimedia Message Service
MNO	Mobile Network Operator
MOCN	Multi-operator core network
MSAN	Multi-Service Access Node
MTR	Mobile Termination Rate
MVNO	Mobile Virtual Network Operator
MYTV	MYTV Broadcasting Sdn Bhd
NPO	National Policy Objective
NRA	National Regulatory Authority
NSA	Non Stand Alone
ODF	Optical Distribution Frame
OLT	Optical Line Termination
ONU	Optical Line Unit
OPEX	Operating Expenditure
OTT	Over The Top
PI Paper	Public Inquiry Paper
POI	Point of Interconnection
POP	Point of Presence
QoS	Quality of Service
RAB	Regulatory Asset Base
RAN	Radio Access Network
RFR	Risk-free Rate
RM	Ringgit Malaysia
SA	Stand Alone
SAC	Stand Alone Costs
SAO	Standard Access Obligation
SD	Standard Definition
SBC	State Backed Company
SIM	Subscriber Identity Module

SMP	Significant Market Power
SMS	Short Message Service
SUBB	Sub-Urban Broadband
TM	Telekom Malaysia Berhad
TSLRIC	Total Service Long Run Incremental Cost
UHD	Ultra High Definition
UPE	User Provider Edge
USP	Universal Service Provision
VDSL	Very-high-bit-rate Digital Subscriber Line
WACC	Weighted Average Cost of Capital

PREFACE

The Malaysian Communication and Multimedia Commission (**MCMC**) invites submissions from industry participants, other interested parties and members of the public on the questions and issues raised in this Public Inquiry Paper (**PI Paper**) concerning the **Review of Access Pricing**. In this PI Paper, the MCMC sets out a number of preliminary views. Submissions are welcome on the preliminary views where comment is specifically sought. Submissions are also welcome on the rationale and analysis in this PI Paper where no specific questions have been raised. All submissions should be substantiated with reasons and, where appropriate, evidence or source references. Written submissions, in both hard copy and electronic form, should be provided to the MCMC in full by **12 noon, 21 November 2022.**

Submissions should be addressed to:

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In the interest of fostering an informed and robust consultative process, the MCMC proposes to make submissions received available to interested parties upon request. The MCMC also reserves the right to publish extracts or entire submissions received. Any commercially sensitive information should be provided under a separate cover clearly marked **'CONFIDENTIAL'**. However, for any party who wishes to make a confidential submission, a "public" version of the submission should also be provided.

The cost models developed for this Public Inquiry are available, upon written request, to interested licensees for their own examination. Any confidential data has been removed.

The MCMC thanks interested parties for their participation in this consultative process and looks forward to receiving written submissions.

EXECUTIVE SUMMARY

The MCMC is conducting this Public Inquiry to determine cost-based prices for the facilities and services in the Access List for the period 2023-2025 and to use these prices to set regulated rates for some of these facilities and services. The previous revision to cost-based prices occurred in 2017.

This PI Paper sets out the MCMC's preliminary views on which facilities and services in the Access List should be subject to price regulation and, where relevant, provides tables of proposed regulated prices for the period 2023-2025. The Public Inquiry seeks feedback from interested parties on a number of specific issues including the MCMC's approach to developing economic cost models for specific services, particularly on use of the Long-Run Incremental Cost methodology.

The fundamental guiding principles for price regulation are also described in this PI Paper. The MCMC considers price regulation to be important for some facilities and services in order to promote the long-term benefit of end users of communications services and to support continuing competition in the industry.

The MCMC has been working with licensees since April 2022 to collect relevant data and to develop economic cost models that were used to calculate appropriate cost-based prices. For this Public Inquiry, the Access List facilities and services have been classified into five major categories:

(a) Fixed Services;
(b) 4G Mobile Services;
(c) 5G Mobile Services;
(d) Infrastructure Sharing; and
(e) Digital Terrestrial Broadcasting Multiplexing Service.

Fixed Services covers Fixed Origination and Termination Services, HSBB Services, Transmission-related services, Network Co-location Service and access to Duct and Manhole services. For Fixed Origination and Termination, the proposed regulated prices have been calculated based on a bottom-up Long-Run Incremental Cost model of the core network. They are, in general, lower than the current rates. HSBB Services combine the costs of the access network and the core network. The core network costs were calculated using the same model as the Fixed Origination and Termination Services whilst the access network costs have been calculated based on a bottom-up Long-Run Incremental Cost model of a copper and fibre access network, with asset prices adjusted to reflect the presence of fully depreciated assets. These prices are also generally lower than the rates set previously.

4G Mobile Services covers the Mobile Origination and Termination, Mobile Virtual Network Operator (**MVNO**) Access and Domestic Inter-Operator Roaming services. The MCMC proposes to continue price regulation for Mobile Origination and Termination voice services and the average rates are lower than the previously regulated rates. The MCMC proposes to introduce price regulation for the MVNO Access and Domestic Inter-Operator Roaming services. The prices have been calculated based on a bottom-up Long-Run Incremental Cost model of a 4G mobile network.

5G Mobile Services covers 5G Standalone Access (**SA**) and 4G Evolved Packet Core (**EPC**) with 5G Radio Access Network (**RAN**) Access (**NSA**). The MCMC proposes to introduce price regulation for these services which are new to the Access List. The prices have been calculated based on a bottom-up Long-Run Incremental Cost model of a 5G mobile network.

Infrastructure Sharing services which include mobile towers and base station site costs have been calculated based on current asset cost provided primarily by the tower and state-backed companies.

The Digital Terrestrial Broadcasting Multiplexing Service has been costed using bottom-up current asset costs which have been provided by the licensee.

The issues on which the MCMC particularly seeks comment are summarised at the beginning of this PI Paper. Written feedback on these and other relevant issues are welcome prior to the end of the Public Inquiry period. At the conclusion of this Public Inquiry, the MCMC will issue a PI Report and may regulate prices for some facilities and services in the Access List for the period 2023-2025.

SUMMARY OF ISSUES FOR COMMENT

The MCMC welcomes comment particularly on the following questions and issues raised in this PI Paper:

Table 1: Summary of questions and issues for comment

Number	Section	Question/Issue
1	5.2.1	Do you think that the criteria for ex-ante determination of access prices presented remain appropriate?
2	5.2.2.2	Do you think that the approach to pricing which has been adopted is appropriate? Are there any other criteria that should be considered?
3	5.2.3	Do you have any comments on the appropriateness of setting regulated prices for the period up to and including 2025?
4	6.9	Do you have any comments on the proposed costing methodologies?
5	7.5	Do you have any comments on the proposed approach for allocating costs to services?
6	7.8	Do you have any comments on the choice of costing methodology adopted?
7	7.9	Do you have any comments on the model calibration and reconciliation?
8	7.10	Do you have any comments on the appropriateness of using glide paths and the method by which the glide paths have been calculated?
9	7.11	Do you have any comments on the appropriateness of using the cost model results in arbitrating disputes over access pricing?
10	7.14	Do you have any comments on the approach to setting prices for installation charges?
11	Part C Introduction	Do you have any comments on the approach to calculating the appropriate levels of WACC?
12	8.3	Do you have any comments on the proposed common parameters to be included in the WACC calculations?
13	9.1	Do you have any comments on the approach used for determining the asset beta and gearing assumptions for fixed services?

Number	Section	Question/Issue
14	9.2	Do you have any comment on the approach used for determining the estimate for the debt premium for fixed services?
15	9.3	Do you have any comments on the proposed WACC for the fixed sector?
16	10.1	Do you have any comments on the approach used for estimating the beta and gearing for the mobile sector?
17	10.3	Do you have any comments on the proposed WACC for mobile services?
18	11.1	Do you have any comments on the approach used for estimating beta and gearing parameters for 5G?
19	11.3	Do you have any comment on the WACC estimate for 5G?
20	12.1	Do you have any comments on the proposed approach for estimating betas and gearing for the infrastructure sharing sector?
21	12.2	Do you have any comments on the proposed approach for estimating the debt premium for the infrastructure sharing sector?
22	12.3	Do you have any comment on the WACC estimate for infrastructure sharing?
23	13.3	Do you have any comments on the WACC estimate for DTTB Multiplexing Service?
24	16.7	Do you have any comments on the approach adopted for the fixed model?
25	17.12	Do you have any comments on the proposed prices for the fixed services in the Access List?
26	18.2	Do you have any comments on the proposed market share assumption for the Notional Operator?
27	18.2	Do you have any comments on the proposed assumptions for the Notional Operator's services and volumes?
28	18.3	Do you have any comments on the proposed approach to the radio spectrum and coverage assumptions?
29	18.4	Do you have any comments on the busy hour traffic assumptions?
30	18.8	Do you have any comments on the design and cost assumptions for the 4G mobile model?

Number	Section	Question/Issue
31	18.9	Do you have any comments on the service costs calculated by the mobile model?
32	18.16	Do you have any comments on the proposed regulated prices for mobile services?
33	19.2	Do you have any comments on the proposed modelling approach for 5G?
34	19.3	Do you have any comments on the MCMC's proposed use of data in the 5G model?
35	19.4	Do you have any comments on the proposed demand forecast?
36	19.5	Do you have any comments on the assumptions for spectrum allocation and coverage?
37	19.6	Do you have any comments on any of the other proposed assumptions applied in the 5G model?
38	19.7	Do you have any comments on the proposed cost mark-ups?
39	19.8	Do you have any comments on the service costs calculated by the 5G model?
40	19.9	Do you have any comments on the 5G sensitivity analysis?
41	19.10	Do you have any comments on the proposed regulated prices for 5G?
42	20.3	Do you have any comments on the approach to the modelling of tower costs?
43	20.4	Do you have any comments on the sensitivities and outputs from the towers cost model?
44	20.6	Do you have any comments on the proposed indicative prices for infrastructure sharing?
45	20.7	Do you have any comments on the approach to modelling in-building common antenna system?
46	21.3	Do you have any comments on the approach to the modelling of the DTTB multiplex costs?
47	21.6	Do you have any comments on the proposed DTTB regulated services and prices?

SUMMARY OF MCMC VIEWS ON REGULATED ACCESS PRICES

The following Table 2 summarises the MCMC's preliminary views on which facilities and services in the Access List should be subject to price regulation.

The MCMC stresses that this PI Paper provides only the MCMC's preliminary views. The MCMC invites comments in response to those preliminary views and the questions raised in this PI Paper in order to finalise an appropriate list of Access Prices. A more detailed explanation of the MCMC's reasons for reaching the preliminary views is set out in the discussions below.

Table 2: Summary of MCMC's preliminary views

Service	MCMC's preliminary view
Fixed Network Origination Service	Price regulation
Fixed Network Termination Service	Price regulation
Interconnect Link Service	Price regulation
Domestic Connectivity to International Services	Price regulation
Wholesale Local Leased Circuit Service	Price regulation
Trunk Transmission Service	Price regulation
End-to-End Transmission Service	Price regulation
IP Transit Service	Price regulation
Layer 2 HSBB Network Service with QoS	Price regulation
Layer 3 HSBB Network Service	Price regulation
Network Co-Location Service	No price regulation
Duct and Manhole Access	Price regulation
Mobile Network Origination Service	Price regulation
Mobile Network Termination Service	Price regulation
MVNO Access	Price regulation
Domestic Inter-Operator Roaming Service	Price regulation
4G EPC with 5G RAN Access	Price regulation
5G SA Access	Price regulation

Service	MCMC's preliminary view
Infrastructure Sharing	No price regulation
Digital Terrestrial Broadcasting Multiplexing Service	Price regulation

PART A: BACKGROUND

1. Introduction

The MCMC has developed new economic cost models in order to determine cost-based prices for the facilities and services in the Access List for the period 2023-2025. The previous revision to cost-based prices occurred in 2017.

In March 2022, the MCMC informed industry and key stakeholders that it was about to embark on a new cost modelling process. The MCMC issued information requests to a wide range of licensees to seek data on communications networks and the costs of providing services.

During the period from May to August 2022, the MCMC analysed network and cost data from local and international sources. Substantial and detailed responses to the information requests were received from all major licensees. Further interaction with network operators occurred in order to clarify data provided and in some cases to request for further data. Some subsequent discussions took place with network operators for further clarification and collection of additional data.

This PI Paper provides the preliminary results of the MCMC's deliberations and seeks further comment from interested parties.

1.1. Legislative Context

The Communications and Multimedia Act 1998 (**CMA**) governs the communications and multimedia industry in Malaysia and establishes the regulatory and licensing framework applicable to the industry. The relevant provisions of the CMA for the purposes of this Review of Access Pricing are as follows:

(a) section 55 – the general processes for the MCMC to follow in making a determination under the CMA, including the requirement for the MCMC to hold an inquiry;
(b) section 58 – the discretion of the MCMC to hold a public inquiry on any matter which relates to the administration of the CMA, either in response to a written request from a person or on its own initiative if the MCMC is satisfied that the matter is of significant interest to the public or to the industry;
(c) section 60 – the discretion for the MCMC to conduct an inquiry as and when the MCMC thinks fit and to exercise any or all of its investigation and information gathering powers in Chapters 4 and 5 of Part V under the CMA;

(d) section 61 – the requirement for the inquiry to be public and for the MCMC to invite and consider submissions from members of the public relating to the inquiry;

(e) sections 62 and 63 – the discretion of the MCMC to conduct an inquiry (or parts of an inquiry) in private in certain cases, to direct that confidential material presented to the inquiry or lodged in submissions not be disclosed or that its disclosure be restricted; and

(f) section 65 – the requirement to publish a report into any inquiry undertaken under the previous sections of the CMA within 30 days of the conclusion of the inquiry.

In accordance with section 58(2), a Public Inquiry will be held as part of this Review of Access Pricing, as the review is of significant interest to the public or industry. This process accords with international regulatory best practice.

1.2. Structure of this PI Paper

This PI Paper is structured into eight (8) parts, as follows:

Part A: Background

Sections 1 to 4 are an introduction to this review, encompassing the processes and context in which the review is conducted.

Part B: General Regulatory Pricing Principles

Sections 5 to 7 describe the underlying regulatory principles that have guided the MCMC's development of cost models and the associated decisions regarding which prices should be directly regulated.

Part C: Weighted Average Cost of Capital

Sections 8 to 15 describe the MCMC's approach to determining the appropriate weighted average cost of capital (**WACC**) with details of the parameters, calculations and range of values which it determines as appropriate for the various services.

Part D: Fixed Services

Sections 16 and 17 describe the MCMC's preliminary conclusions on the regulated prices to be set for fixed network services. These include Fixed Origination and Termination services, Transmission-related services, Fixed Access services, HSBB network services, Network Co-location Service and access to duct and manholes. The conclusions are based on a cost model for fixed services, together with analysis of data received from licensees. The fixed services cost model and its results are presented in this chapter.

Part E: Mobile Services

Section 18 describes the MCMC's preliminary conclusions on the regulated prices to be set for Mobile Origination and Termination, MVNO Access and Domestic Inter-Operator Roaming services. The conclusions are based on a cost model for 4G Mobile services and analysis of the data received from licensees. The 4G cost model and its results are presented in this chapter.

Part F: 5G Services

Section 19 describes the MCMC's preliminary conclusions on the regulated prices to be set for the 5G wholesale services of Digital Nasional Berhad (**DNB**). The conclusions are based on a cost model for 5G services and analysis of the data received from licensees. The 5G cost model and its results are presented in this chapter.

Part G: Infrastructure Sharing

Section 20 describes the MCMC's preliminary conclusions on the regulated prices to be set for tower and other shared infrastructure. The conclusions are based on a cost model together with analysis of the data received from tower and mobile licensees.

Part H: Digital Terrestrial Broadcasting Multiplexing Service

Section 21 describes the MCMC's preliminary conclusions on the regulated prices to be set for the Digital Terrestrial Broadcasting Multiplexing Service. The conclusions are based on a cost model for the Digital Terrestrial Broadcasting Multiplexing Service and analysis of the data received from the licensee.

2. Purpose of this Public Inquiry

This PI Paper has been issued by the MCMC to solicit views from industry participants, other interested parties and members of the public to assist the MCMC to determine:

(a) which facilities and services in the Access List should be subject to price regulation through the setting of access prices; and
(b) the level of access prices to be set each year for the relevant facilities and services in the Access List.

After considering the results of this Public Inquiry, the MCMC may make one or more Determinations on the regulated access prices for some or all of the facilities and services in the Access List.

3. Matters outside scope

Matters that are outside the scope of this review include:

(a) determinations on which facilities and services should be included in the Access List;
(b) determinations on non-pricing terms and conditions; and
(c) consideration of exemptions from the standard access obligations (**SAO**s), which are subject to be determined by the Minister.

4. Issues for comment

Throughout this PI Paper, the MCMC has identified specific questions and issues particularly relevant to its final determinations. While the MCMC encourages comments on these questions in particular, comments are welcome on any other related issues that stakeholders believe are relevant.

It should be noted that where the MCMC has provided a "preliminary view" on any matter relevant to this Public Inquiry, this view is provided in the following context:

(a) it is a proposition only that invites views from parties on whether they agree or disagree, and why; and
(b) it should not be taken as a final view of the MCMC.

PART B: GENERAL REGULATORY PRICING PRINCIPLES

5. Introduction

An economic cost modelling exercise will determine costs for facilities and services in the Access List and facilitate derivation of access prices for facilities and services in the Access List. The MCMC will determine regulated access prices for those facilities and services potentially requiring price regulation, including fixed and mobile voice services, data and broadband services as well as facility sharing and Infrastructure Sharing services. The proposed regulated prices and the method by which they are to be determined are the subject of this Public Inquiry.

As it is well established in previous studies of access prices, the MCMC applies three criteria when assessing the need for intervention and access pricing regulation.

The criteria are:

(a) the presence of non-transitory high barriers to entry;
(b) the continuing absence of a trend towards effective competition; and
(c) the likelihood that ex-post regulatory controls will be insufficient to address concerns regarding access to fair and reasonable access prices.

These criteria and related matters are further discussed below.

5.1. Legislative Objectives

In performing its statutory functions under the CMA, the MCMC is guided by the National Policy Objectives (**NPO**) as set out in subsection 3(2) of the CMA and, in particular, objective 3(2)(d) which is to regulate for the long-term benefit of the end user (**LTBE**). The LTBE is promoted by achieving the following objectives:

(a) promoting competition in relevant markets;
(b) achieving any-to-any connectivity in relation to communications services; and
(c) encouraging the economically efficient use of and investment in communications infrastructure.

The LTBE is therefore promoted by sustainable lower prices, higher quality of service and greater choice of products and services. In its Public Inquiry on Access Pricing in 2017, the MCMC stated that the use of a system where access prices are either determined in a competitive market or are set on the basis of efficiently incurred costs supports most, if not all, of the NPOs. In particular, appropriate pricing of access services will:

(a) benefit the Malaysian communications industry by providing the appropriate signals for investment and opportunities for new entry into the marketplace;
(b) lead to a more efficient allocation of resources; and
(c) promote sustainable long-term competition rather than short-term competition based on arbitrage opportunities.

Part VI of the CMA contains provisions on economic regulation including access to services. Section 149 within Part VI requires Access Providers to offer access to facilities and services on reasonable terms and conditions, which, in the MCMC's view, includes the prices set by Access Providers.

In addition to Part VI, Part VIII of the CMA contains provisions on consumer protection including the following principles on rate setting:

(a) rates must be fair and, for similarly situated persons, not unreasonably discriminatory;
(b) rates should be oriented toward costs and, in general, cross-subsidies should be eliminated;
(c) rates should not contain discounts that unreasonably prejudice the competitive opportunities of other providers;
(d) rates should be structured and levels set to attract investment into the communications and multimedia industry; and
(e) rates should take account of the regulations and recommendations of the international organisations of which Malaysia is a member.

As stated in previous Public Inquiries, the conclusion is that the CMA provides adequate provisions to allow the MCMC to address the pricing of facilities and services in the Access List and prices should be oriented towards cost.

5.2. Principles in Setting Access Prices

5.2.1. Ex-ante Determination of Access Prices

The MCMC has also recognised the risk associated with an Access Provider, in control of essential facilities, deliberately prolonging commercial negotiations to gain or protect an unfair first-mover advantage. Given the rapid pace of change in the communications industry, a first-mover advantage may be difficult for a potentially competitive Access Seeker to overcome and ex-post intervention by the MCMC may not provide a sufficient remedy to this type of abuse of dominance. Intervention by the MCMC in access pricing matters cannot therefore be conditional only on the failure of commercial negotiations and consequently a role exists for ex-ante regulation of prices.

In addition, there are circumstances in which Access Seekers may be denied recourse to fair and reasonable access prices. These circumstances are:

(a) presence of high barriers to entry: high barriers to entry potentially allow an Access Provider to delay competition by setting unreasonably high wholesale prices and thus gaining a first-mover advantage in downstream markets; and
(b) absence of a trend towards effective competition: lack of sufficient competition in the provision of access facilities can lead to bottleneck conditions for the supply of wholesale services.

In these cases, the setting of maximum regulated prices for the facilities or services in the Access List should help provide commercial certainty in the market and assist with commercial negotiations.

Question 1:
Do you think that the criteria for ex-ante determination of access prices presented remain appropriate?

5.2.2. Access Pricing Guidelines

Where the MCMC has determined that setting maximum regulated prices for facilities or services in the Access List is necessary, then these should be set based on appropriate criteria. These criteria are:

(a) Appropriate cost recovery:
- recovery of legitimate costs;
- recovery of reasonably efficiently incurred costs;
- reasonable rate of return on capital employed; and
- appropriate time period.

(b) Promotion of economic efficiency in investments:
- ensuring the right build/buy decisions are made;
- incentives to reduce costs and improve efficiency;
- incentives for innovation; and
- incentives to meet suitable levels of quality.

These criteria are described in more detail in the following subsections. The specific methods for calculating access prices are described in later chapters.

5.2.2.1. Appropriate cost recovery

As a general principle, service providers should be able to recover costs legitimately incurred in providing a service. This should include some proportion of fixed and common costs if they are necessarily incurred to support the service. If a regulated price does not allow for appropriate cost recovery, then a service provider may lack the incentive to offer the service or alternatively, if provided, service quality or timeliness may be inadequate.

In practice, however, establishing what constitutes a legitimate cost may be open to question and debate. As an example, service providers will often have a wholesale group or division responsible for "marketing" regulated wholesale services to Access Seekers. Efficient operations in this wholesale division that are clearly necessary to provide the regulated service, result in legitimate costs being incurred, but any activity purely associated with promotion of the service or with unregulated wholesale services should be excluded.

The underlying principle is that the activities must be necessary to provide the regulated service. Only those activities that, taken as a whole, are sufficient to provide the service should be considered in the cost base. Furthermore, a reasonable standard of efficiency should be applied to these activities so that only reasonably efficient costs are included in the cost base.

In defining "reasonably efficient" there are several approaches. Some National Regulatory Authorities (**NRA**s) undertake benchmarking of activities or costs in similar jurisdictions in order to assess whether an internationally comparable level of efficiency is being achieved. An NRA may also collect data on the costs incurred by service providers within its own jurisdiction and compare costs of providing the same service, assuming these services are offered by multiple operators. Finally, the NRA may use all sources of information available to assume a level of efficiency in its cost modelling and regulated pricing, with the objective of achieving consistency across modelling and price setting. The latter approach is the approach applied by the MCMC.

It is standard practice for service providers to finance operations with a combination of equity and debt. Firms aim to earn sufficient revenue to cover operating expenses and the costs of capital investments, and will also seek to maximise profit. The regulated price should cover (reasonably efficiently incurred) costs and a reasonable cost of capital but not any additional profit (because the cost of capital reflects a reasonable rate of return). The assumed cost of capital, however, must reflect the returns required for continued financing of the service provider; i.e. the returns that equity and debt providers require in order to continue investing.

For the costing of regulatory products and services, the standard approach to covering the financing costs of the service provider is to specify a WACC that includes, on average, reasonable returns for equity and debt holders. The WACC is then used to calculate the required annual return on the capital investments to cover the costs of financing. In calculating regulated prices for a service, it is standard regulatory practice to estimate an efficient WACC value. The details of the calculation of the WACC values are presented later in this PI Paper.

Once regulated prices have been set, the industry generally will undertake adjustments to accommodate the changes. The prices should therefore be set for a suitable period to provide regulatory certainty and to allow cost recovery for regulated services to occur.

The regulatory period cannot be excessively long, because uncertainty in forecasts over time coupled with the pace of technological change increases the margin of error associated with assumptions adopted in the price setting exercise. As such, some of the assumptions may not be appropriate beyond the short-to medium-term. Typically, NRAs use three (3) to five (5) years as the period for setting prices. The MCMC has determined a period of three (3) years from 2023 to 2025 as the appropriate period in this instance.

5.2.2.2. Promotion of economic efficiency in investments

NRAs seek to promote economic efficiency, encompassing:

(a) productive efficiency: achieved when the costs of production are minimised;
(b) allocative efficiency: achieved when prices are close to cost, so that resources are aligned to production; and
(c) dynamic efficiency: achieved when companies have appropriate incentives to invest and to innovate.

The economic assumption is that these efficiencies will be achieved in a fully competitive market. In response to competition, a firm reduces its production costs as much as possible, sets prices competitively close to its costs, and flourishes through productive investments and innovation. In a fully competitive market, prices will tend towards marginal cost. In cases where there is limited or less than full competition, that is, in areas of market failure often characterised by firms with significant market power (**SMP**), the regulated prices should be set to the levels that would be achieved in a fully competitive market.

Productive efficiency is achieved through setting prices for an efficient service provider. This has the effect of driving all competing service providers over time towards producing outputs (products and services) at minimal cost and adopting pricing to reflect efficiently incurred costs.

Allocative efficiency is achieved by setting prices based on costs. This ensures that investment choices are made in such a way as to favour LTBE.

Dynamic efficiency is achieved through setting regulated prices that would apply in a fully competitive market. As an example, setting mobile termination prices based on Long-Run Incremental Costs (**LRIC**) (see later chapters) encourages operators to compete through innovation (finding improved / more efficient ways of delivering services) rather than by exploiting price distortions. Cost-based termination pricing discourages retail pricing designed to discriminate between on-net and off-net calls which may result in a level of on-net pricing that smaller operators cannot match, creating incentives for large groups of callers to remain on the network with greater market share, making only on-net calls. Setting appropriate prices for Transmission Services also means that network operators are presented with competitively neutral build/buy decisions.

The principal aim of the costing and pricing methods presented in later sections of this PI Paper is to provide prices that resemble as closely as possible those that would arise from a competitive market, even when competition may not be fully effective.

Question 2:

Do you think that the approach to pricing which has been adopted is appropriate? Are there any other criteria or issues that should be considered?

5.2.3. Time Horizon

The cost models for this PI have been developed to calculate prices for the period from 2023 to 2025. This period has been chosen because it is sufficient to provide regulatory certainty for licensees without being so long that robust forecasts of demand and unit costs cannot reliably be developed. The MCMC believes that the potential impact of changes in customer behaviour and demand for voice and data over fixed and mobile services means that a three-year regulatory period is appropriate.

As such, the MCMC's intention is to set regulated prices for appropriate facilities and services in the Access List for the period 2023 to 2025, a period of three (3) years. This will address any concerns about the reliability of forecasts and provide regulatory certainty for network facility and service providers.

The MCMC will then have an opportunity to refresh its estimates of cost-based prices before the next period of regulatory decision from 2026 onwards.

Question 3: Do you have any comments on the appropriateness of setting regulated prices for the period up to and including 2025?

6. Cost Modelling General Issues

6.1. Background to the cost models

A range of potential costing methodologies is available. In the previous PI process the MCMC canvassed the opinions of licensees on appropriate costing methodologies with a Methodology Questionnaire circulated in February 2017. In response to this Questionnaire there was a level of broad agreement from stakeholders regarding the MCMC's proposed costing methodologies, with some notable variations.

The range of costing methodologies available for the current PI is considered in this chapter, concluding with the MCMC's recommendations. These recommendations are compared with the approaches applied in the previous PI and the outcome of the Questionnaire.

6.2. Regulatory considerations

In general, a well-functioning competitive market promotes an optimal allocation of resources. Buyers and sellers in any market are best placed to judge the consequences and risks arising from agreeing a price at any given level and they are likely to bear most of those consequences and risks themselves. Aligning the information and risk with those directly involved in the market in this manner will likely result in optimal resource allocation with neither too much, nor too little, consumed. Such an approach supports the best possible outcome for consumers. At the same time, efficient firms or suppliers may be expected to cover their costs and make a reasonable profit.

However, regulatory intervention may be required in markets where there is evidence of limited competition or an expectation that insufficient competition may develop. Typically such a requirement occurs as a result of one (monopolistic) or a few (duopolistic or oligopolistic) sellers in the market amassing sufficient power to raise prices without constraint, or to reduce the quality of supplied goods or services as compared to the supply conditions which would prevail in an effectively competitive market. Sellers with significant market power may also restrict supply in the expectation that this will lead to higher prices, without the fear that other suppliers will enter the market and drive prices down, or quality up.

In an industry such as telecommunications, suppliers must make long-term investments for which they hope to gain a return over a number of years. As a result, they may have to consider not only the potential actions of competitors already active in the market who will themselves have had to make investments, but also the possibility that others will enter the market with newer technologies providing competitive advantages based on price, quality, or other new features. Markets that offer the possibility of new competitors entering with improved technology in this way are said to be "contestable".

Market power can lead to reduced contestability, as well as adversely affecting competitiveness if sellers leverage this power to create barriers to deter potential entrants. For example, one strategy might be to price below cost for a limited period, particularly if the new entrant occupies a particular price-conscious segment of the market. However, other factors such as licensing restrictions, or a shortage of spectrum can also have the effect of reducing the contestability of a market.

Where an issue of market power and its actual or potential misuse has been identified, a primary remedy is to regulate the price that can be charged, for example by setting a ceiling. The task of the regulator is to ensure that the price is, as far as possible, within the range that would be expected to prevail under effective competition.

Since competition may be expected to drive prices towards costs over time, it is important to identify an appropriate method of calculating costs.

6.3. Fully-Allocated Cost

Fully allocated cost (**FAC**) is a methodology that distributes all costs incurred by a company to its various products and services. The advantage of FAC is that this methodology is closer to that typically used in compiling financial, regulatory and management accounts. It is therefore straightforward to undertake reconciliation, although it is unusual for such accounts to be compiled at the level of detail required to assess the costs of individual services.

A key issue with FAC from a regulatory perspective is that it is not a very satisfactory representation of the pricing behaviour that economic theory would lead us to expect in competitive and contestable markets. When a firm is evaluating whether to invest to launch a new service, it is reasonable to assume that it would construct a business case that would compare the additional revenues over time with the additional costs of proceeding with the proposal. Since some costs are likely to be fixed regardless of whether the project proceeds, costs calculated on this basis can differ substantially from FAC, in which all costs (including those that are fixed) are distributed amongst the different output services. For example, a hypothetical firm providing only on-net and off-net call origination services might decide to add call termination. It would already have network facilities in place and would only need to supplement these to the extent that additional capacity would be required for the terminating minutes.

6.4. Long-Run Incremental Cost

LRIC costing is forward-looking whilst FAC reflects backward-looking costs (i.e. those costs that have been incurred historically and are recorded in the accounts).

In a contestable market, in which there is the prospect of new competitors entering the market with improved technology, it may be anticipated that firms would reflect this in the way they recover costs over the lifetime of an asset. It might be rational for firms to charge a higher price in the early years, so that they can depreciate their assets and remain price-competitive against new entrants with newer technology in the future. This can be reflected through LRIC costing by "front-loading" the recovery of the costs of such assets.

Fixed costs may either be shared by a group of two, or more, services (for example voice services, but not data or SMS), or they may arise as a general cost of doing business (for example, costs associated with the CEO's office). Both types of costs, which are known as fixed shared and fixed common costs, respectively, would need to be recovered by a firm operating in a competitive market, or the firm would be unable to make normal profits and would go out of business. The question then becomes one of how such costs should be distributed across services.

Potential approaches for such cost allocation are discussed in Section 6.5.

As LRIC costing encompasses forward-looking costs the MCMC admits that there may be a possibility that an incumbent operator might over-recover its investment cost for the access network. This may occur in circumstances where assets in the access network are heavily or fully depreciated. The MCMC addressed such a possibility in the previous PI by ensuring that fully depreciated assets were not included in the costing calculation. In adjusting the current costs of the network by the value of the fully depreciated assets, any potential over-recovery is precluded. The MCMC has adopted a similar procedure for the current fixed cost model and excluded the fully depreciated assets from the calculation.

This approach represents best practice, as endorsed by the European Commission (**EC**) Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment.[1] The recommendation confirmed that the bottom-up LRIC methodology best meets regulatory objectives for setting prices of wholesale access services, allowing for recovery of total efficiently incurred costs and providing correct and efficient signals for market entry. However, the recommendation notes that certain long-lived assets are unlikely to be replicated, and in these cases allowance should be made for elapsed lifetimes.

> *(34) Unlike assets such as the technical equipment and the transmission medium (for example fibre), civil engineering assets (for example ducts, trenches and poles) are assets that are unlikely to be replicated. Technological change and the level of competition and retail demand are not expected to allow alternative operators to deploy a parallel civil engineering infrastructure, at least where the legacy civil engineering infrastructure assets can be reused for deploying an NGA network.*
>
> *(35) In the recommended costing methodology the Regulatory Asset Base (**RAB**) corresponding to the reusable legacy civil engineering assets is valued at current costs, taking account of the assets' elapsed economic life and thus of the costs already recovered by the regulated SMP [Significant Market Power] operator. This approach sends efficient market entry signals for build or buy decisions and avoids the risk of a cost over-recovery for reusable legacy civil infrastructure. An over-recovery of costs would not be justified to ensure efficient entry and preserve the incentives to invest because the build option is not economically feasible for this asset category.*[2]

6.5. LRIC+

The LRIC+ costing approach has been previously used in Malaysia and in many other countries, including Europe prior to the introduction of the Pure LRIC standard. The LRIC+ approach strikes a happy medium between the two limiting cases described above, in that shared and common costs are borne proportionately by all services. The exact proportions may vary, but the standard approach is to distribute shared costs in proportion to the

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1 European Commission (2013), Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment. 11 September 2013.

2 *Ibid*, page 8.

relevant volume measure (for example, minutes) and common costs in proportion to the respective incremental cost of each service.

An important advantage of LRIC+ is that it provides greater assurance that the regulated firm can recover all of its efficiently-incurred costs, whereas under the Pure LRIC standard, it is a matter of assumption that there will be scope for full cost recovery from other unregulated services (for example, at the retail level).

6.6. Pure LRIC

Towards one extreme of the spectrum of choices of LRIC costing is an approach that has been advocated by the EC for some regulated services, in which no fixed and shared or common costs are recovered. This is known as the Pure LRIC approach. As an example, mobile call termination charges are calculated without considering the costs of providing mobile coverage. The EC approach is based on the premise that subscribers to mobile telephone networks benefit from incoming calls, including those that originate on other networks and so it is reasonable for them to bear a share of the costs of those calls – in this case, all of the fixed shared and common costs. It was also a matter of policy for the EC to drive mobile termination rates (**MTR**) down towards the level of fixed termination rates, which tended to be significantly lower.

Pure LRIC is also applicable to modelling fixed telecommunications networks under the EC's framework, but the difference between Pure LRIC and the more traditional LRIC modelling (LRIC+) which includes fixed shared and common costs tends to be less for fixed. One reason for this is that the cost of providing coverage is not included in Pure LRIC, because coverage is already required for services other than call termination. In a fixed network, coverage is provided by the access network, which is excluded from call costs with either methodology, because its costs are generally recovered from line rental and connection charges.

6.7. Stand-Alone Cost

At the other extreme, a service might be made to bear all of the fixed shared and common costs. This is considered to be the maximum that a firm may be able to charge in an effectively competitive market. In the most recent European regulatory survey of costing methods applied to regulated wholesale markets there were no instances of the use of stand-alone cost (**SAC**).

6.8. Regulated Asset Base

The Regulated Asset Base (**RAB**) approach involves using the actual asset base as the basis for wholesale price setting. In theory it enables the access provider to recover efficient actual costs in addition to allowing for both depreciation and a reasonable rate of return on investment in sunk assets. Hence, prices calculated on this basis tend to reflect the actual cost of investment.

The RAB approach effectively locks in the value of the initial asset base which is then rolled over from one period to the next. Actual depreciation is taken into account, and there is no need to establish modern equivalent values of assets. This is in contrast to the LRIC approach which involves repeated optimised replacement cost revaluations of assets required to provide regulated services.

Implementation of the RAB approach requires agreement on the value of the initial asset base. While different approaches are possible, the most straightforward is cost-based, using depreciated actual cost. This relies on historic financial accounts, thereby minimising the need for assumptions. The RAB model calculates the total revenue required to cover costs including a reasonable return on capital. The revenue requirement is estimated by the addition of the building blocks or cost categories, which cover the forecast capital costs, operating costs and tax liabilities.

The main advantage of the RAB methodology, sometimes also referred to as the building blocks or step-by-step approach, is its relative simplicity – the model can be substantially smaller and simpler than for some other approaches – as well as its direct linkage to the financial accounts.

On the other hand, there are a number of disadvantages and practical difficulties associated with the RAB approach. In the first place it can be challenging to agree on the initial valuation of the regulated asset base and determining whether this represents the efficient economic value of the network. The methodology was originally developed in the context of the water and electricity industries, where the outputs are relatively homogeneous. In telecommunications, this is not generally the case. Typically in fixed networks, for example, there are multiple services and technologies involving various shared key facilities, such as trenches, poles and ducts. Whereas LRIC and FAC models allow for the costs of different services to be distinguished by reference to their respective use of different network facilities (using routing factors), this is much less easily accomplished using the RAB approach.

If the RAB approach is to promote the LTBE then the regulator must develop a satisfactory process for ensuring that any costs incurred inefficiently are not passed on to access seekers. This may involve regular regulator engagement and checking using ex-ante and / or ex-post efficiency mechanisms. Such a process enables the regulator to disallow any costs that it believes have been incurred inefficiently. Effectively, the regulator must become involved in the detail of capital expenditure decisions and the level of operating costs.

6.9. Conclusions

If the economic characteristics of the networks used to produce the facilities and services in the Access List differ, the appropriate costing methodology may not be the same in each case. The MCMC therefore has proposed appropriate methodologies for the main networks to be modelled as set out in the table below.

The proposed methodologies are consistent with those adopted for the 2017 PI. The 5G service was not in the previous PI.

In response to the 2017 Methodology Questionnaire, there was broad support from operators for the LRIC approach for fixed and mobile services. However, some respondents proposed use of Pure LRIC for mobile modelling, historical costs for the fixed access network and current costs for the fixed core network. With respect to the fixed network while the MCMC's proposed methodology encompasses current costs, it also takes account of historical costs for the access network through application of the EC long-lived assets compromise approach. The MCMC does not propose to apply Pure LRIC to any of the services for the reasons discussed in Section 6.6.

Table 3: Proposed Costing Methodologies

Access List services	Proposed methodology	2017 methodology	Notes
Fixed	LRIC+ with asset price adjustment to reflect the presence of fully-depreciated assets.	Fixed core – LRIC+ Fixed access – LRIC+ with asset price adjustment to reflect the presence of fully-depreciated assets.	For both the fixed access and core networks a LRIC approach provides a reasonable balance between ensuring that access seekers pay only for the costs incurred by a reasonably efficient operator in providing the service they buy and ensuring that access providers can recover their efficient investment in their networks. However, to ensure that there is no cost over-recovery the compromise approach endorsed by the EC should be applied in respect to long-lived assets which are unlikely to be replicated.
Mobile – 4G	LRIC+	LRIC+	The LRIC+ methodology which was also applied in the previous PI provides a reasonable balance between ensuring that access seekers pay only for the costs incurred by a reasonably efficient operator in providing the service they buy and ensuring that access providers can recover their efficient investment in their networks.
Mobile – 5G	LRIC+	Not in previous PI.	These services are new to the Access List and are offered by a monopoly Access Provider. Given that the Access Provider is deploying a new network it is expected that actual costs would closely resemble replacement cost. However, the RAB approach is not particularly suitable for costing purposes as the access provider is not operating a legacy network but is constructing a new network. Adoption of a bottom-up LRIC+ approach provides appropriate transparency of unit costs, although inclusion of some top-down costs may be unavoidable.
Infrastructure sharing	Simple, bottom-up model based on current asset costs.	Simple, bottom-up model based on current asset costs.	These services are provided by many firms, hence unit costs should reflect average or median values.

Access List services	Proposed methodology	2017 methodology	Notes
Digital Terrestrial Television Broadcasting (**DTTB**) Multiplexing Service	Simple, bottom-up model based on current asset costs.	Simple, bottom-up model based on current asset costs.	One single-product firm supplies transmission of digital TV channels to broadcasters so there is no issue of separating the cost of one service from another over a shared platform as is the case in the other telecommunications networks. The assets are all recently acquired with the digital switchover and so the replacement and historic values are likely to be comparable. Wherever possible a bottom-up approach to unit costs and allocation is desirable in order to allow for the possibility of benchmarking.

Question 4:

Do you have any comments on the proposed costing methodologies for each network type?

7. Key modelling issues

In addition to selecting the costing methodology, a number of key modelling choices must then be considered. For example, in implementing a LRIC approach it is possible to develop a top-down or a bottom-up model, and there are various potential depreciation methods. In this chapter, the MCMC has considered the features of the alternative possibilities for model implementation and presents initial proposals.

7.1. Top-down models

Top-down models are based on an operator’s actual financial accounts. It is not necessarily the case that actual accounts must reflect historic costs. Accounts prepared on a Current Cost Accounting (**CCA**) basis are consistent with a forward-looking view of costs as assets are re-valued to reflect today’s prices. Thus, it is possible to develop a top-down LRIC model based on information from an operator’s accounts which have been prepared under CCA.

The main advantage of this approach is that it should be possible to reconcile model estimates with the operator’s published and audited accounts.

However, a top-down LRIC model requires estimates of incremental costs. For this it is necessary to establish and apply a series of cost volume relationships (**CVR**s). For each category of costs a CVR indicates the linkage between changing costs and the related driver volume. This process is extremely information intensive, and may require deep mining of underlying information systems to extract the required data.

The main disadvantages of the top-down approach are:

(a) data complexity makes it challenging for a regulator to undertake this approach without requiring very extensive and possibly intrusive access to the operator's information base;
(b) significant difficulties in determining the extent to which the observed costs correspond to those of an efficient operator; and
(c) despite revaluation of assets on a CCA basis, company accounts are essentially backward-looking records and as such it may be difficult to evaluate varying assumptions for key issues, including future demand.

7.2. Bottom-up models

An alternative to top-down modelling is to develop models that simulate the operation of the network under consideration, commencing with the expected demand volumes on the network (number of subscribers, calls, data volumes, etc.) and applying efficient engineering principles to determine the network equipment and associated activities that will be required to meet that demand. Once the hypothetical network and activities are specified, their costs can be derived.

Bottom-up models have several advantages and few disadvantages. The main advantages include:

(a) relatively little data on the operator's actual costs is required;
(b) alternative assumptions and scenarios may be readily accommodated;
(c) the efficient provision of services may be transparently demonstrated; and
(d) forward looking costs for services may be estimated which assist in providing ongoing stability within the very dynamic telecommunications sector.

On the other hand, in reflecting a hypothetical efficient operator there is a risk that bottom-up models may underestimate the costs of an actual efficient operator, as real-world operators may encounter challenges in practice that are not foreseen in the modelling process and that nevertheless impose costs. This issue may be addressed by undertaking some degree of top-down reconciliation, comparing equipment quantities and, to a lesser extent, asset values and other financial data with the outputs of the model.

Given the advantages and disadvantages identified above the bottom-up approach is generally considered the most suitable for development by, or on behalf of, a regulator, for informing appropriate prices for regulated services.

The MCMC has therefore adopted a bottom-up approach for the cost modelling process.

7.3. Depreciation method

Many of the costs involved in operating a network are for long-lived capital items, such as duct and trench networks, base stations and switching centres, which involve significant initial investment. Many such assets continue to be used for a number of years, in some instances for decades. Since the benefits of the initial investment continue to be realised during the useful life of the equipment, it is reasonable that the costs should be recovered over that period, or annualised. This is the effect of accounting depreciation policies. However, since LRIC models must be forward-looking if they are to reflect efficient investment decisions, assets should be valued at the prevailing rate, year by year. This involves taking account of both price trends for the relevant equipment category and of the effects of technological advances as new equipment becomes available to accomplish the same, or a wider range of functions, often at a lower cost – the Modern Equivalent Asset (**MEA**) principle.

Furthermore, the intensity with which an asset is used and hence the benefit derived from it may vary over time as volumes rise and fall. An optimally efficient annualisation methodology should also reflect this.

There are several alternative annualisation methodologies in use, including straight line (generally used in statutory and published accounts), simple annuities, tilted annuity and sum of digits. However, the methodology that is accepted by regulators as coming closest to the ideal is Economic Depreciation (**ED**), which captures the impact of both price trends and changes in demand/volumes over time. A potential drawback with this method is that it is computationally more complex than the alternatives.

A further issue with ED is that its proper application requires that the annualisation time series be projected over the full lifetime of the most long-lived assets, although this can be somewhat shorter if a high discount rate (cost of capital) is applied. This period can be quite long – of the order of 20-50 years in some cases – and so the assumptions guiding the later years inevitably become less reliable. However, in practice the detailed assumptions for later years have little effect on the results, because of the effect of discounting.

ED also provides a way of recovering costs that extends to operational expenses. The aim of this costing study is to estimate the service prices that would apply in a competitive and contestable market. A player with initially very low volumes could not fully recover its operational expenses at the beginning of its life cycle. If it attempted to do so, it would price itself out of the market. It would rather attempt to recover its costs over the life cycle of the business. Hence, the recovery path of operational expenses must also reflect changes in output and input price levels. ED, in effect, produces a single figure for the cost per unit of output of an asset over the asset's lifecycle, varying year by year only to reflect asset price inflation.

To avoid the computational complexities of ED, other annualisation methodologies are used as proxies. The tilted annuity approach may be considered a form of ED, in that it provides an estimate of the revenue that would be required to produce a net present value for the investment in a capital asset over that asset's lifetime that is equal to the cost of capital. It may also be "tilted" to allow for changes in asset prices over time.

The MCMC considers that there are significant medium-term uncertainties in the fixed market, including possible further substitution by new mobile technologies such as 5G. This leads to the conclusion that the potential for inappropriate assumptions about the longer term growth path of the sector outweighs the theoretical merits of ED over tilted annuities. The MCMC therefore proposes to use tilted annuities for the fixed model.

The MCMC has decided to adopt a consistent approach for the cost models and therefore also proposes to adopt the tilted annuity form of annualisation for the mobile models. The MCMC recognises the level of uncertainty in the future trend for volume of voice and data services and has concluded that the tilted annuity approach will more appropriately ensure cost recovery under these circumstances.

The infrastructure sharing and DTTB models do not encounter the same issues of asset utilisation, because the cost is being calculated per site, rather than per tenant. There is therefore no need for the additional complexity of ED. As such, the tilted annuity approach is proposed to be adopted for consistency with the other sectors.

7.4. Allocation of common costs

While incremental costs represent the best available proxy for prices in a competitive market in the long term, a firm with multiple outputs would be unable to recover all costs if each product were priced purely on this basis. The existence of such multi-product firms in a competitive market is an indication that there are economies of scope available from producing the different products within a single firm. It is appropriate, therefore, to make some allowance for common costs, by marking up the incremental costs attributed to each product with a share of these costs.

In theory the optimal approach involves allocation based on the range of elasticities and cross-elasticities applicable to the relevant upstream (wholesale) and downstream (retail) products. This procedure, known as Ramsey pricing, is both technically complex and reliant on elasticity data that is unlikely to be available.

A generally accepted substitute is the equi-proportional mark-up (**EPMU**) approach, in which the proportion of common costs marked up to each increment relates to the relative size of each increment.

Consistent with previous practice in costing Access List services, the MCMC proposes to include appropriate common costs in the cost models apportion these to services using the EPMU approach to ensure that this cost is not transferred to consumers.

7.5. Allocation of costs to services

Following assessment of the incremental costs for a large increment, such as with LRIC+, an allocation of cost is undertaken by service. The standard practice is to apply routing factors. These factors reflect the use of each network component distinguished and costed within the model. For example, an on-net mobile call would pass through a base station twice, once on the originating leg of the call and once on the terminating leg. By contrast, an incoming call from another network would pass through a base station only once. The on-net call would have a routing factor of two for the base station network components and the incoming call a routing factor of one. This means that the on-net call will receive twice the allocation of cost from use of these components.

Using these principles of cost causation, services are allocated a share of each of the various network component costs in proportion to their use of them. In addition, a share of network indirect costs, such as network management systems, is apportioned to services, together with a mark-up to cover common costs. Costs within the retail increment (e.g. the retail billing system, sales and marketing) are not included in network costs.

Consistent with practices adopted in previous Access List PIs, the MCMC proposes to adopt the above principles of cost causation within the models.

Question 5:

Do you have any comments on the proposed approach for allocating costs to services?

7.6. Treatment of Licence and Spectrum fees

Licence and spectrum fees are chargeable to operators in Malaysia and so form part of the costs of undertaking network activities. As such, they should be included in the models as appropriate and depreciated over the period for which the corresponding licences are valid.

7.7. Defining the Increment

An incremental cost is cost that is incurred in supporting a particular increment of demand, assuming that other increments of demand remain unchanged. The incremental cost can also be calculated as the avoidable costs of not supporting the increment. There is considerable flexibility in the definition of the increment – or increments – to apply in a costing model, and the choice should be suitable for the specific application. The range of choices includes (from narrower to broader):

(a) A marginal unit of demand for a service;
(b) The demand for a service as a whole;
(c) The demand for a group of services; and
(d) The demand for all services or traffic on the network.

A narrow increment more closely resembles marginal cost which is the theoretical ideal. However, the narrower the definition, the greater the proportion of costs that are common and so must be allocated across services. In other words, with a broad increment, more of the economies of scale and scope that arise from providing multiple services will be incorporated in the increment.

On the other hand, if the purpose of the model is to derive costs for a single service and an increment encompassing multiple services is chosen, then it would be necessary to determine the share of costs to be borne by the service in question.

This task is affected by the type of increment that is selected, the main options being average, incremental or marginal. A standard approach is to use an average increment, which supports simpler construction of the model, though it requires all traffic to be expressed on an equivalent basis, for example minutes in the case of a predominantly voice network. Having done that, the costs can be apportioned on the basis of usage (all minutes are treated as having an equal cost).

7.8. Network structure: scorched earth versus scorched node

Similar considerations apply in bottom-up fixed and mobile networks with respect to the degree to which the structure of existing networks should be reflected in the models. In the case of fixed networks, a scorched node approach encompasses taking as given the location of main network nodes (sites containing switching centres, concentrators, routers and associated equipment). However, the modelling process may determine that the use made of each site is sub-optimal and so, for example, a site currently hosting switching equipment should contain only a multi service access node (**MSAN**). The MSAN and optical line termination (**OLT**) act as access nodes at the border between access and core networks. To this extent, the scorched node approach also provides a starting point for the access network model. The role of individual sites as 'switch + MSAN/OLT', or 'MSAN-only or OLT-only' can, however, be optimised within the model.

In the case of mobile networks, the location of the main core network sites is generally taken as a given when modelling individual mobile networks under scorched node.

Question 6:

Do you have any further comments on the elements of cost modelling which the MCMC proposes to adopt?

7.9. Model calibration and reconciliation

Model calibration involves comparing the modelled network quantities with the deployed network of a real operator in one or more past years, given the known service demands for that operator in those years. A well-designed bottom-up model should deliver network quantities similar to those of the deployed network or any significant divergence should be explicable, for example by efficiency adjustments. The calibration process may be undertaken for significant operators as a useful sanity check, ensuring that the bottom-up model is reflective of the real situation faced by service providers.

Model reconciliation involves comparing the level of costs calculated in the model to the actual costs incurred by a real operator in some past year when the model service demands are set to the actual demands experienced in that year. The comparison has two parts.

Firstly, the level of operating expenses and the overall asset values (when adjusted to the same basis, either historic or current costs) should be similar to the observed values (or any divergence should be explicable). This ensures that the bottom-up model is capturing all of the relevant service costs.

The second part of model reconciliation is to set an appropriate level of mark-up for common costs. In past years, the service providers' accounts will show some level of common costs and the proportion of these costs compared to total costs can be calculated.

If the model is calibrated and reconciled in the first part, then it will produce costs in past years that correspond to the observed values. For future years, the model needs to take account of the fact that costs that are not directly modelled (such as retail costs) will also vary. For example, the retail cost per subscriber may be held constant and the overall level of retail costs will then vary linearly with the number of subscribers. By extrapolating these other costs for a real operator, using the real operator's forecasts, the model can calculate a proportionate mark-up for common costs in future years. A mark-up for the efficient operator model can then be estimated from these calculated values. This ensures that the model can account for common costs.

The bottom-up LRIC+ models presented in this PI Paper have been calibrated and reconciled with reported data from the Malaysian operators.

Question 7:
Do you have any comments on the model calibration and reconciliation?

7.10. Glide paths

When new cost modelled prices are significantly lower than previous regulated prices, regulators sometimes apply glide paths to avoid causing significant disruption to existing Access Providers and their finances. However, this approach does mean that an economically inefficient outcome (i.e. rates that are not appropriately set equal to costs) may be sustained for longer than absolutely necessary. Effectively, by allowing Access Providers to retain benefits in the form of returns which exceed a reasonable cost of capital, even for a relatively short time-period, a window of opportunity is created for access providers to make gains at the expense of other market players. This may impede efficient competition and reduce the consumer surplus that results from efficient competition. Glide paths therefore have mixed impacts and should be applied with caution.

The MCMC has compared modelled costs from the current exercise with output from the previous PI and chosen to use a glide path from the existing regulated prices to new ones, where the prices are sufficiently different. In particular, this has been adopted for the mobile origination and termination and transmission services. The glide paths start from the previous regulated rate and reach the price calculated from the cost models in 2025, with a linear interpolation between these values for the intervening years.

Question 8:
Do you have any comments on the appropriateness of using glide paths and the method by which the glide paths have been calculated?

7.11. Use of Cost Models in Arbitrating Disputes

The cost models presented in this PI Paper have been developed to establish the cost base, and hence cost-based prices, for the facilities and services in the Access List. In some cases, the calculated values will be used to set regulated prices.

In all cases, however, the cost models provide an estimate of average costs of Access List services. The MCMC intends to also use the outputs from the cost models in any dispute that may be notified to it between an access provider and an access seeker where the price of the access services is an issue. The MCMC may seek further information from the access provider in order to estimate its individual costs as a basis for comparison with the average price from the relevant cost model.

Question 9:

Do you have any comments on the appropriateness of using the cost model results in arbitrating disputes over access pricing?

7.12. Exceptions and adjustments to LRIC-based Prices

7.12.1. Network Co-Location, Duct and Manholes and Infrastructure Sharing services

The Access List contains some facilities and services that involve the sharing of existing facilities for the purpose of avoiding competitive bottlenecks and enhancing productive efficiency. For example, an incumbent fixed access operator may have spare space in ducts, manholes and exchanges. At the same time, the cost of installing such facilities can be a formidable barrier to entry for competing operators. Since, by definition, the incremental cost of providing access to such facilities is close to zero, a strict incremental costing approach would tend to yield a very low price. On the other hand, offering access at such low prices might be seen as inequitable and risk encouraging inefficient entry. Sharing such facilities may also present difficulties for the incumbent wishing to rationalise its own usage of these facilities, for example when demand is in decline, or where adoption of a new technology reduces the need for such resources.

In view of issues such as these, the approach that is generally adopted for regulatory pricing is to calculate the cost based on the average FAC of the facility in question. Access Seekers may then be charged an equitable share of these costs. This calculation can be based on historic or current costing principles, depending upon the competitive context. For example, a calculation based on historical cost may be more appropriate in situations where a significant proportion of assets are close to or at full depreciation.

In circumstances where the bottleneck effect is considered to be weak and the market prospectively competitive, best practice would suggest a shift in costing principles towards weaker controls that are more closely aligned with the characteristics of an effectively competitive market. In such cases, a multi-product firm operating in a reasonably competitive market would be expected to price each of its outputs (including infrastructure made available for sharing) at a point between LRIC and SAC. The latter is the cost of providing the output on its own, in the absence of other services to share the costs. Thus, a regulator may impose a ceiling based on SAC and a floor (pure LRIC), rather than proposing a maximum or fixed point price.

A further point to note regarding these facilities is that externality effects may be present. Such effects encompass wider costs and benefits than those arising directly from production and consumption of the service that is being traded. For example, mobile communications towers are sometimes regarded as an unwelcome addition to the landscape, particularly in areas of historic interest or natural beauty. Thus, a wider community benefit accrues from keeping the number of towers in an area to a minimum through sharing. It may be appropriate for regulated prices and other measures to reflect this.

Equally, locating towers in remote areas, where the density of population is low may be uneconomic without subsidy and yet the availability of services can contribute to economic development and social inclusion in such areas. Similarly, economic and political objectives may be served by a faster and more widespread roll-out of high-speed fixed broadband services. The solution to these issues may be subsidies to provide incentives to operators to undertake investments that would otherwise be uneconomic or commercially unattractive. Schemes for both these purposes exist in Malaysia in the form of the Universal Service Provision (**USP**) and High-Speed Broadband (**HSBB**) programmes. As such care needs to be taken that access pricing is consistent with the aims of these schemes. The proposed treatment of these schemes is discussed in the next section.

7.13. Treatment of HSBB and USP subsidies

Schemes to encourage more widespread or faster provision of communications services are not uncommon around the world and Malaysia is no exception. The two schemes discussed in this section operate quite differently from each other, and it is important to understand these differences in order to determine what (if any) impact they may have in relation to the modelled hypothetical operator.

In Malaysia the USP, like many universal service programmes, operates by exacting a levy on the revenues of operators, including both retail and wholesale revenues. The proceeds of the levy are distributed to operators as subsidies for the investment costs of projects that meet the objectives of the fund.

By encouraging such investment, it is hoped that citizens who would not otherwise be able to consume the resulting services are able to do so, with consequent benefits consistent with the objectives of the programme. For the desired benefits to be realised, however, appropriate downstream investment and consumption choices must be made. For example, the subsidy may pay for the construction of a mobile tower, but end-users can only consume mobile services if further investment is made in equipping the tower with the necessary electronics and backhaul facilities and if the price is affordable. It will be necessary, therefore, to ensure that access prices deliver the appropriate downstream investment and consumption signals.

The HSBB and the later HSBB2 and Sub-Urban Broadband (**SUBB**) extensions, by contrast, operate through the co-investment of public funds in fixed high-speed broadband service provision on a risk-sharing basis. The terms of the current HSBB2 / SUBB agreement (dated December 2015, for a ten-year time-period) between the Government and TM[3] include approximately 28% public funding in return for a revenue sharing / cost saving passthrough arrangement, with repayment obligations. In other words, a commercial return is expected on the investment through the recipient operator selling the HSBB services on a retail or wholesale basis. At face value, this is very different from the straightforward subsidy involved in USP payments. However, the scheme would not be necessary to meet its primary aim of promoting HSBB roll-out if commercial returns on such a scheme were expected to be sufficient to justify private capital investment, given the level of risk involved. The degree of subsidy, therefore, to the extent that it exists, arises in the difference in expected returns to the public funds from that expected by the capital market. For the purposes of the hypothetical operator approach, the expected return on capital equates to the WACC. In other words, no adjustment is required in the model in relation to HSBB funding.

7.14. Installation charges

Installation charges are one-off charges associated with initial service provision. While these are often calculated as part of a LRIC modelling exercise, their costs are generally not calculated using a LRIC approach.

The most straightforward and transparent approach to setting these charges is to identify the direct operational costs efficiently incurred in making the service operational. Typically, this is a matter of reviewing benchmark information on the time and materials involved in

[3] TM (2021), Integrated Annual Report, 2021. Page 120.

the installation process, together with local labour costs. This is the approach that has been adopted by the MCMC.

Question 10:

Do you have any comments on the approach to setting prices for installation charges?

PART C: WEIGHTED AVERAGE COST OF CAPITAL

To remain in business, firms must be able to cover the cost of raising capital. This is accomplished by the issue of shares and other equities, for which shareholders will expect to be remunerated by some combination of dividend payments and capital appreciation, and also through various forms of interest-bearing loans.

The network operators providing facilities and services in the Access List have different ownership structures and some, including TM, Maxis and Digi, are listed on the Kuala Lumpur stock exchange. The characteristics of the operators vary and as such the terms and conditions of capital market funding are also likely to differ. Nevertheless, the regulatory objective is to assess the costs of a reasonably efficient operator in an effectively competitive market, rather than to assess the circumstances of each individual operator.

Consistent with the previous PI, the MCMC proposes to adopt the generally accepted methodology for calculating capital costs, i.e. the Capital Asset Pricing Model (**CAPM**), which generates an appropriately weighted estimate of the cost of capital. Since efficiency considerations apply to capital as well as to other inputs, the optimal balance of debt and equity funding and other parameters may not correspond exactly to that actually applied by operators.

The WACC is derived:

(a) in nominal terms, since wholesale prices are fixed in nominal terms; and
(b) pre-tax, since regulatory price-setting normally uses a pre-tax cost of capital to apply to the capital base to calculate annual capital costs before taxes and the prices themselves are expressed net of tax.

The WACC may in principle be different for particular services or types of investment, depending on the level of risk associated with each. For example, the WACC for a fibre to the home (**FTTH**) network may be higher than other parts of the network due to its perceived higher risk. However, if such a network has received direct or indirect government funding then the level of risk may be somewhat mitigated. On the other hand, equity and corporate bond funding, for example, tend to operate at the level of the total enterprise. Moreover, technology-or project-related benchmark data are likely to be difficult to obtain. Consequently, the MCMC has differentiated the WACC only on the basis of the type of business – that is, fixed operators, 4G mobile operators, 5G wholesale operator, tower companies and the DTTB operator.

The formula used by the MCMC is:

WACC = [Wd*Kd] + [We*Ke/(1-t)]
where
Wd = Weighted average amount of current cost of debt
We = Weighted average amount of market value of equity
Kd = Cost of debt
Ke = Cost of equity
t = Corporate income tax rate

Question 11:
Do you have any comments on the approach to estimating the WACC?

8. Common Parameters

Three parameters of the WACC calculation are common to all of the modelled sectors, because they relate to the broader characteristics of the capital market in Malaysia and not to specific sectors. These are:

(a) The risk-free rate;
(b) The Equity Risk Premium (**ERP**); and
(c) The marginal corporate tax rate.

The estimation of these parameters is addressed in this section and the parameters that are specific to the respective sectors (fixed, 4G mobile, 5G wholesale, infrastructure sharing and DTTB) are discussed in the succeeding sections.

8.1. Risk-free rate

The MCMC estimates the risk-free rate (**RFR**) with reference to ten-year Malaysian Government bonds. Current yields are used in preference to historical yields, on the basis that current yields encompass all expectations of future earnings. For regulatory purposes it is important that the assumed risk-free rate reflects the best available predictor of future yields. Assuming capital markets are generally efficient current risk-free rates provide a superior future estimate than long-run historical averages. However, to avoid bias from very short-term volatility in risk-free rates (for example, as a result of institutional factors) the MCMC applies an average of very recent bond market yields. This approach ensures that the most recent information and inflation expectations are captured while reducing the impact of any very short-term fluctuations. In keeping with this methodology the MCMC plans to update the risk-free rate as close as possible to the date of the Final Public Inquiry Report.

The risk-free rate which has been used in the current WACC estimation is 4.09%, which is the three-month average daily yield of ten-year Malaysian Government bonds for June to August 2022. This value is higher than the average and median estimates provided by operators for 2021 and 2022 (Table 4). As inflation expectations and interest rates have recently been increasing, it is not surprising that in general the MCMC's estimate is higher than submission data based on historical rates.

Table 4: Risk-free rate submissions

	2021	2022
Median	3.58%	3.86%
Mean	3.44%	3.83%
Range	1.79% - 5.60%	2.11% - 5.60%

[Source: Malaysian operators]

8.2. Equity Risk Premium

The ERP is a measure of expected return, additional to the risk-free rate, which investors seek as compensation for a market portfolio. As it is a premium for holding market assets rather than risk-free assets, it is not specific to any one company. The MCMC acknowledges that there is no single accepted methodology for estimating the ERP, and therefore considers results based on alternative approaches. This practice is common among regulators. As an example, the New Zealand Commerce Commission referred to five alternative approaches to inform its selection of a point estimate for the ERP for its Fixed Fibre Local Access Services (**FFLAS**) Determination and did not weight any one method as being superior to the others.[4]

A valid approach is to consider a sample of ERP values from local companies and investors on the grounds that these encompass alternative underlying methodologies. Values for the ERP were submitted by 13 Malaysian operators / service providers with a range from 3.75% to 8.20%. From this sample we estimated the median and mean which were both 5.99%. The stated sources of the submitted values included:

(a) Bloomberg;

[4] Commerce Commission (2020), Fibre input methodologies: Main final decisions – reasons paper, 13 October 2020. Page 448.

(b) various Malaysian brokers;
(c) in-house Treasury or Finance Department estimates; and
(d) http://www.market-risk-premia.com/my.html.

European regulators also use a mix of approaches to ERP estimation,[5] with a range of results only slightly lower than the median and mean Malaysian values (Table 5). The New Zealand regulator obtained higher median and mean values from its sample and then rounded up for its point estimate.

Table 5: Equity risk premium – benchmarks, 2021 / 2022

	Median	Mean	Point estimate
Malaysian operators	5.99%	5.99%	5.99%
European regulators	5.71% - 5.86%	5.80% - 5.83%	-
New Zealand Commerce Commission	6.71%	6.81%	6.91%

[Source: Malaysian operators; BEREC; Commerce Commission]

The Malaysian estimate is not inconsistent with the benchmark regulatory data, hence we have applied 5.99% as the ERP in the WACC formula.

8.3. Tax rate

The company tax rate (t) remains unchanged, at 24%, from the last regulatory period.

Question 12:

Do you have any comments on any of the proposed common parameters to be included in the WACC calculation?

9. Fixed Network

9.1. Beta and gearing

The MCMC has selected a comparator set of companies to inform estimates of the beta and gearing for regulated fixed line services. The criteria used in compiling the comparator set for these services encompasses:

(a) publicly listed companies based in the Asia-Pacific region;

5 Body of European Regulators for Electronic Communications (2021), BEREC Report on WACC parameter calculations according to the European Commission's WACC Notice of 6th November 2019 (WACC parameters Report 2021), 10 June 2021. See page 24.

(b) a significant proportion of revenues is generated from fixed line activities; and
(c) current and historical financial and business information is publicly available.

The starting point was to identify all firms which satisfy the above criteria (Table 6). The MCMC then examined the characteristics of the individual firms to determine whether any should be excluded from the sample. This analysis considered the likelihood of significant divergences in systematic risk between the proposed comparator company and Malaysian fixed line operators. When estimating the asset beta, ideally comparator companies would have a similar degree of exposure to systematic risk as the regulated entities.

Table 6: Possible fixed comparator companies – characteristics

Company	Market capitalisation June 2022 (USDbn)	Revenue from fixed or broadband services / Total operating revenue	Credit rating (most recent available)	Notes
Singtel (Singapore)	30.01	15.96%	A1 (Moodys)	Included in the MCMC's draft sample 2017 but excluded in final – no wholesale fixed network
Spark New Zealand	5.59	18.65%	A- (S&P)	Included in the MCMC's draft sample 2017 but excluded in final – no wholesale fixed network
NTT (Japan)	104.56	65.72%	A1 (Moodys)	Included in the MCMC's 2017 final sample
PLDT (Philippines)	6.99	41.16%	Baa2 (Moodys)	Included in the MCMC's 2017 final sample
Telstra (Australia)	30.57	49.00%	A2 (Moodys)	Included in the MCMC's 2017 final sample
Telkom Indonesia	26.99	39.10%	Baa1 (Moodys)	
Chunghwa Telecom (Taiwan)	32.69	35.10%	AA (S&P)	
PCCW (Hong Kong)	4.06	64.23%	Baa2 (Moodys)	
Sri Lanka Telecom	0.15	51.70%	AA (Fitch)	
Symphony Communications (Thailand)	0.08	95.70%	n.a.	

[Source: FT.com, operator reports]

In both Singapore and New Zealand, a separate fixed fibre company provides wholesale services, and therefore Singtel and Spark are likely to face different systematic risk compared to vertically integrated counterparts. This is also reflected in relatively low revenue from fixed or broadband services as a proportion of total operating revenue – approximately 16% (Singtel) and 19% (Spark), while all of the other proposed comparator companies obtain between 35% and 96% of revenue from fixed services. On this basis, it was concluded that these two companies should be excluded from the sample. This is consistent with the decision taken by the MCMC in the final Public Inquiry decision of 2017.

Ideally the comparator companies should have a similar investment grade rating to the regulated entity or entities. In 2021, TM had the following credit ratings from international and national sources:

(a) Standard & Poors (S&P): A-;
(b) Moodys: A3; baseline credit profile Baa1; and
(c) RAM Rating Services (Malaysian): AAA.

As it was not possible to identify a credit rating for Symphony Communications of Thailand, this company was excluded from the comparator set. Given that the lowest credit rating associated with TM is Moody's Baa1, the two companies with credit ratings lower than Baa1 – namely, PLDT and PCCW – were excluded.

After this review process, a comparator sample consisting of five companies remained. As betas cannot be directly observed, the MCMC has relied on five-year historical betas (2018 – 2022) which were then de-levered to remove the impact of differing gearing ratios. Gearing is defined as the proportion of debt in the total value (debt plus equity) of the company. Equity is expressed in market terms, while the book value of debt is assumed to be a reasonable proxy for the market value of debt. Using these definitions, the average value of debt and equity over the most recent two years was estimated.

The equity beta was de-levered using the Hamada (tax neutral) equation which is used by many regulatory authorities, including the EC and the New Zealand Commerce Commission. The MCMC also assumed a zero debt beta, as is also common practice among regulators.

This resulted in a median asset beta of 0.45 and an average of 0.37, with median gearing 29% and mean gearing 27% (Table 7). With an extremely low equity beta of 0.02 and little debt financing Chunghwa Telecom's asset beta is, as expected, almost identical to the equity beta. Excluding Chunghwa Telecom, the range of asset betas is between 0.27 and 0.65. As such, this company has been excluded from the comparator set as it represents an outlier. The median asset beta remains at 0.45 while the average increases to 0.46.

Table 7: Fixed comparator sample – beta and gearing

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
NTT	0.46	0.27	0.41
Telstra	0.64	0.45	0.29
Telkom Indonesia	0.76	0.65	0.15
Chunghwa Telecom	0.02	0.02	0.04
Sri Lanka Telecom	0.86	0.45	0.48
Median	0.64	0.45	0.29
Mean	0.55	0.37	0.27
Median (excluding Chunghwa)	0.70	0.45	0.35
Mean (excluding Chunghwa)	0.68	0.46	0.33

[Source: FT.com]

The asset betas of the remaining four comparators were re-levered using the average gearing ratio of 33%. The resultant equity beta was 0.63. This value has been used in the WACC calculation for fixed services.

As a sanity check the estimated asset beta and gearing was compared with other regulatory benchmarks (Table 8). The MCMC's gearing estimate of 33% is within the range of regulatory benchmarks (29% to 40%) while the asset beta estimate of 0.46 is slightly below the lower bound of the regulatory benchmark range (0.48 to 0.55).

Table 8: Asset beta and gearing – regulatory benchmarks

	2021	2020	2019	2018
Asset beta				
Median – EC	0.53	0.54	0.55	0.54
Mean – EC	0.53	0.55	0.54	0.53
ComReg – Ireland	-	-	0.48	-
Commerce Commission – New Zealand	0.50	-	-	-
Gearing				
Median – EC	0.37	0.40	0.40	0.40
Mean – EC	0.37	0.38	0.38	0.37
ComReg – Ireland	-	-	0.40	-
Commerce Commission – New Zealand	0.29	-	-	-

[Source: BEREC, ComReg, Commerce Commission]

The MCMC also compared the results with estimates of TM's average gearing and five-year asset beta which were 30% and 0.76 (respectively). While TM's gearing is comparable with the MCMC gearing estimate, its asset beta is considerably higher, and above the upper bound of the regulatory range. The MCMC has considered whether TM is likely to have higher systematic risk than the comparator set which might explain TM's relatively high asset beta. Like TM, the comparator companies are all vertically integrated communications providers, providing predominantly fixed services and located in the region. As such the share market values of these companies are likely to be affected by similar factors. The MCMC also did not identify any particular regulatory risk for TM which might contribute to an elevated risk profile.

The MCMC proposes to use the results of the comparator analysis as the base case point estimate for gearing and asset beta assumptions as shown in Table 9. A high estimate has also been specified, using the upper limits of the regulatory benchmark range.

Table 9: Beta and gearing assumptions – fixed

	Levered (equity) beta	Unlevered (asset) beta	Gearing
Base case point estimate	0.63	0.46	0.33
High estimate	0.91	0.55	0.40

[Source: MCMC]

Question 13:

Do you have any comments on the approach used for determining the asset beta and gearing assumptions for fixed services?

9.2. Debt premium

The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds.

Two submissions were received on the quantum of the debt premium for fixed line businesses. Both had been based on calculations of the actual cost of debt to the company – defined as the total interest expense as a proportion of average debt. The risk-free rate that prevailed at the time was then subtracted from this proportion to derive a notional debt premium. As a result one of the estimated debt premium was 2.58% and the other was a negative value. While this approach may be appropriate for financial management purposes, it does not adequately reflect the premium which might be expected to prevail in the current bond market for debt issuances of a fixed operator.

In seeking a suitable reference point, the MCMC has reviewed TM bond issuances on the local bond market. TM does not appear to have any outstanding conventional bonds, although it has in the market a number of medium-term Islamic notes with an AAA RAM rating from the Malaysian ratings agency.

The MCMC then considered the spread between conventional Government ten-year bonds and ten-year AAA rated bonds. As at 30 August 2022 this spread was 0.66%. As shown in Table 10, the spread increases to 0.84% for AA1 / AA+ credit ratings and just over 1% for AA2/AA credit ratings. While these values are based on averages and not specific to fixed operators, in the absence of other suitable data the MCMC considers that these values represent a reasonable benchmark.

As noted above, in 2021 TM's credit rating from the local rating agency was AAA, while those from international ratings agencies were lower although remaining in the A range.

Taking this information into account, the MCMC has therefore assumed a hypothetical fixed operator in Malaysia may expect a AA2 / AA credit rating, with a spread of 1.02%. This is the value that has been used as the point estimate in the base case.

Table 10: Spread between Government ten-year bonds and corporate securities, 30 August 2022

Credit rating	Spread
AAA	0.66
AA1 / AA+	0.84
AA2 / AA	1.02
AA3 / AA1	1.24
A1 / A+	1.58
A2 / A	2.16
A3 / A-	2.71
BBB	3.96
BB and below	5.75

[Source: Bank Negara Malaysia]

Question 14:

Do you have any comment on the approach used for determining the estimate for the debt premium for fixed services?

9.3. WACC estimate for fixed sector

The cost of debt is estimated as the sum of the risk-free rate and the debt premium. The MCMC's preliminary conclusion is that this should be 5.11% for the fixed service operator. The cost of equity is calculated by adding to the risk-free rate a premium that reflects the greater perceived risk of investing in the stock market, as compared to government bonds (the ERP) and modifying this by a factor (the beta) that reflects the relative volatility of stocks in the sector (fixed telecommunications), as compared to the market as a whole. On average, the value of the beta will, by definition, be one. Values of less than one reflect stocks that tend to move up or down less than the market as a whole. The cost of equity is estimated for a base case as 7.84%.

After weighting by the target gearing ratio of approximately 33%, the pre-tax WACC of 8.61% is derived. This represents a point estimate for the base case, and the individual components are shown in Table 11.

A second scenario – the high case – is also presented. This encompasses a higher cost of equity, as a result of inclusion of an asset beta and gearing level based on the maximum values of the benchmark regulatory range.

Table 11: WACC – fixed sector

	Base case	High case
WACC – pre-tax	**8.61%**	**9.61%**
WACC – post-tax	6.54%	7.30%
Cost of debt		
Risk-free rate	4.09%	4.09%
Debt premium	1.02%	1.02%
Cost of debt	5.11%	5.11%
Cost of equity		
Risk-free rate	4.09%	4.09%
Equity beta	0.63	0.91
Equity risk premium	5.99%	5.99%
Cost of equity	7.84%	9.54%
Other parameters		
Tax rate	24.00%	24.00%
Gearing	32.87%	39.54%

[Source: MCMC]

Question 15:

Do you have any comments on the proposed WACC for the fixed sector?

10. Mobile sector

10.1. Beta and gearing

In selecting a comparator set of companies to inform estimates of the beta and gearing for regulated mobile services, the MCMC has applied similar criteria as for the fixed sector:

(a) publicly listed companies based in the Asia-Pacific region;
(b) a significant proportion of revenues is generated from mobile activities; and
(c) current and historical financial and business information is publicly available.

The starting point was to identify all firms which satisfy the above criteria (Table 12). The characteristics of the individual firms were then examined to determine whether any should be excluded from the sample. In particular, the MCMC considered the likelihood of significant divergences in systematic risk between the proposed comparator company and Malaysian mobile operators. The MCMC considers that SoftBank (Japan) should be excluded from the sample, on the basis that data was only available for the consolidated group, encompassing many businesses which were not directly relevant to mobile services.

The MCMC also compared the proportion of operating revenue obtained from mobile services in order to ensure that mobile services represent a major line of business for each of the comparator companies. It should be noted that as there is no standard approach used by operators to present revenue breakdowns, it is not possible in all cases to be sure that like with like comparisons are being made. Each company’s annual reports were reviewed in an attempt to identify revenue from mobile services (excluding revenue from handset and accessory sales), but it is difficult to be certain in some cases whether “mobile” revenue included non-service revenue.

The estimated range for the proportion of operating revenue obtained from mobile services is large – from 26% to 95%. As such, it is likely that for some of the higher observed percentages non-service mobile revenue has been included. Nevertheless, nearly two-thirds of the companies in the proposed sample earned at least 50% of operating revenue from mobile activities. The MCMC reviewed the services of the seven companies which earned less than 50% of operating revenue from mobile services, and was satisfied that mobile services were a significant revenue item for each. The relatively low proportion of revenue from mobile services for these companies appeared to be explained by one or more of the following factors:

(a) revenue streams are highly disaggregated leading to mobile services appearing to be a smaller proportion of overall revenue than indicated by descriptions of the company’s main business;
(b) revenue streams are delineated by customer type (e.g. enterprise, consumer) while mobile services are not separately identified within these groupings; and
(c) other definitional issues.

Table 12: Possible mobile comparator companies – characteristics

Company	Market capitalisation June 2022 (USDbn)	Revenue from mobile services / Total operating revenue	Credit rating (most recent available)	Notes
Advanced Info Service (Thailand)	16.64	65%	AA+ (Fitch)	
China Mobile	136.78	50%	A1 (Moodys); A+ (S&P)	Included in the MCMC's 2017 sample.
CITIC (Hong Kong)	1.22	35%	A3 (Moodys)	
Dialog Axiata (Sri Lanka)	0.20	64%	AAA (Fitch)	
FarEasTone (Taiwan)	9.04	51%	AA- (tw)	Included in the MCMC's 2017 sample.
Globe (Philippines)	5.17	69%	n.a.	Claims to have an investment grade credit rating
Hutchison Telecom (Hong Kong)	1.04	60%	Baa1 (Moodys)	Included in the MCMC's 2017 sample.
Indosat (Indonesia)	3.58	81%	Baa3 (Moodys); A- (S&P)	
KDDI (Japan)	75.51	45%	AA- (R&I – local)	
KT Corp (South Korea)	7.26	28%	A3 (Moodys)	
Okinawa Cellular Telephone Company	1.09	n.a.	n.a.	Revenue split unavailable; mobile is main business
Singtel	30.01	30%	A1 (Moodys)	
SK Telecom (South Korea)	8.77	66%	A3 (Moodys); A- (S&P)	Included in the MCMC's 2017 sample.
Smartfren (Indonesia)	1.75	95%	CCC+ (Fitch)	
SmartOne (Hong Kong)	0.57	59%	Not rated	

[Source: FT.com, operator reports]

Table 12: Possible mobile comparator companies – characteristics (cont.)

Company	Market capitalisation June 2022 (USDbn)	Revenue from mobile services / Total operating revenue	Credit rating (most recent available)	Notes
Softbank (Japan)	52.68	n.a.	BB+ (S&P)	Included in the MCMC's 2017 sample. Results for consolidated business including investment vehicles
Spark New Zealand	5.59	36%	(S&P)	
Starhub (Singapore)	1.52	26%	n.a.	Included in the MCMC's 2017 sample.
Taiwan Mobile	12.82	26%	AA- (Fitch)	Included in the MCMC's 2017 sample.
Total Access Communications (Thailand)	3.04	71%	n.a.	
TrueMove (Thailand)	4.43	69%	n.a.	Included in the MCMC's 2017 sample.
XL Axiata (Indonesia)	1.79	93%	Baa3 (Moodys)	

[Source: FT.com, operator reports]

The MCMC also reviewed the credit ratings of the proposed sample companies. 76% of the proposed sample companies had credit ratings (from an international or local rating agency), while for the remainder it was either not possible to identify a recent credit rating or the company was unrated. Again, a wide range of credit ratings was observed. In developing these ratings, credit agencies consider business risk and financial performance – thus the ratings are not a direct measure of systematic risk, which is the objective of the asset beta. Nevertheless, it is likely that a firm with relatively high business risk may also face higher than average systematic risk.

The EC includes as a criterion for the selection of peer / comparator companies an investment grade credit rating – that is, BBB/Baa3 or above[6]. Using this criterion 70% of our proposed comparator companies should be included in the sample. However, in any benchmarking exercise a larger sample size is often preferred on the basis that it may reduce the risk of unexplained variation in the results. This may be compromised by excluding 30% of the proposed comparators. At the same time some of the companies in the larger sample may be less appropriate than others, which supports the notion of a small more targeted sample.

The EC specifies four additional criteria:

(a) listed on a stock exchange and have liquidly traded shares;
(b) own and invest in electronic communications infrastructure;
(c) main operations are located locally (that is, within Europe); and
(d) no current or recent involvement in any substantial mergers and acquisitions (**M&A**).

The Commission states that satisfying four out of the five criteria is sufficient for admission to a peer group, with the exception of the requirement to be publicly listed which is essential for this type of analysis.[7] The MCMC proposes to follow the EC's precedent and relax the investment grade credit rating if the other criteria are satisfied for the companies with either a credit rating of less than BBB/Baa3 or no rating. There are seven such companies, and we have confirmed that all of these are listed with main operations located in the Asia-Pacific region, own mobile infrastructure and are not currently involved in M&A activity. Consequently, all of these have been included in the final sample for mobile services.

The approach the MCMC has applied for mobile services differs from the approach for selection of a peer group for fixed services. The reason for this relates to sample size. In deriving a comparator sample for fixed services we were faced with a relatively small potential peer group. In this situation the MCMC attempted to match comparators as closely as possible to the risk profile of the largest fixed operator in Malaysia. As such, in selecting the final sample the credit rating of TM was considered. However, in the case of mobile services a considerably larger peer group is available and there is no single Malaysian mobile network operator (**MNO**) to which a common risk profile could be matched.

After the review process a mobile comparator sample consisting of 21 companies remained. The same process was followed for delivering equity betas for these companies

[6] Body of European Regulators for Electronic Communications (2021), BEREC Report on WACC parameter calculations according to the European Commission's WACC Notice of 6th November 2019 (WACC parameters Report 2021), 10 June 2021. See section 3.2.

[7] Ibid, page 18.

as described for the fixed comparator companies. This resulted in a median asset beta of 0.39 and an average of 0.48, with median gearing of 35% and mean gearing of 31% (Table 13).

Table 13: Mobile comparator sample – beta and gearing

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
Advanced Info Service (Thailand)	0.30	0.24	19%
China Mobile	0.61	0.57	6%
CITIC (Hong Kong)	0.66	0.41	38%
Dialog Axiata (Sri Lanka)	0.45	0.29	35%
FarEasTone (Taiwan)	0.04	0.03	25%
Globe (Philippines)	0.61	0.39	35%
Hutchison Telecom (Hong Kong)	0.78	0.73	7%
Indosat (Indonesia)	2.47	1.53	38%
KDDI (Japan)	0.31	0.26	16%
KT Corp (South Korea)	0.72	0.36	49%
Okinawa Cellular Telephone Company	0.45	0.44	0%
Singtel	0.89	0.68	23%
SK Telecom	0.82	0.50	39%
Smartfren (Indonesia)	2.07	1.20	42%
SmartOne (Hong Kong)	0.48	0.31	35%
Spark (New Zealand)	0.48	0.39	18%
Starhub (Singapore)	0.67	0.41	39%
Taiwan Mobile	0.14	0.12	18%
Total Access Communications (Thailand)	0.57	0.32	44%
TrueMove (Thailand)	0.97	0.28	72%
XL Axiata (Indonesia)	1.12	0.52	53%
Median	0.61	0.39	35%
Mean	0.74	0.48	31%

[Source: FT.com]

The asset betas were re-levered using the average gearing ratio of 31%. The resultant equity beta was 0.69. These gearing and equity beta values have been used in the WACC base case calculation for mobile services.

The asset betas were also re-levered using the median gearing ratio of approximately 35%. The resultant equity beta was 0.61. Taken together these values deliver a lower WACC and have been used in a low case sensitivity test.

As a sanity check, the estimated asset beta and gearing was compared with other regulatory benchmarks (Table 14). The gearing estimate of 31% is slightly below the lower bound of the range of regulatory benchmarks (33% to 40%) while the asset beta estimate of 0.48 is slightly below the lower bound of the European regulatory benchmark range (0.50 to 0.61).

Table 14: Mobile asset beta and gearing – European regulatory benchmarks

	2021	2020	2019	2018
Asset beta				
Median – EC	0.53	0.60	0.60	0.61
Mean – EC	0.56	0.59	0.57	0.58
ComReg – Ireland	-	-	0.50	-
Gearing				
Median – EC	36%	35%	35%	33%
Mean – EC	35%	34%	34%	33%
ComReg – Ireland	-	-	40%	-

[Source: BEREC, ComReg]

There are only two publicly listed MNOs in Malaysia – Digi and Maxis. The average five-year asset beta for these two companies is 0.65 while average gearing is 19% (Table 15). This gearing ratio is substantially lower than both the estimate of 31% and the regulatory benchmark range of 33% to 40%. However, submissions from the Malaysian MNOs revealed a much larger range of gearing ratios – from 9% to over 100%. Note that the gearing ratios of unlisted MNOs are based on the book value of equity. The MCMC has concluded that local gearing ratios cannot reliably be used as a reference point as a result of the observed wide variation.

The average asset beta of the two local MNOs is 0.58, which is higher than the asset beta estimate of 0.48 but within the European regulatory benchmark range. However, the

MCMC prefers to rely on the estimate which was calculated from the Asia-Pacific peer group, given that the local sample consists of only two companies.

Table 15: Betas and gearing – Malaysian MNOs

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
Digi	0.82	0.73	14%
Maxis	0.57	0.57	23%
Mean	0.70	0.65	19%

[Source: FT.com]

Question 16:

Do you have any comments on the approach used for determining the beta and gearing assumptions for mobile services?

10.2. Debt premium

Four Malaysian mobile companies submitted debt premia with an average of 2.59% (Table 16). The MCMC considers that the highest value submitted is an outlier and should be omitted from the analysis. The average debt premium is 1.03%, excluding this outlier.

Table 16: Debt premium – Malaysian mobile operators

	Debt premium (four operators)	Debt premium (three operators)
Range	0.34 – 7.26	0.34 – 1.38
Median	1.38	1.38
Mean	2.59	1.03

[Source: Mobile submissions]

The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds. The MCMC notes that Digi is the only mobile operator to have current bonds active in the market with a rating of AAA (RAM). However, during the last three months, there were insufficient trades on the secondary market of active Digi bonds to provide a reliable indication of the current debt premium. As at September 2022 the spread between Government ten-year bonds and ten-year AAA rated bonds is 0.66%.

The above information indicates that a suitable range for the debt premium for mobile services may be between 0.66% and 1.38%. For the base case, the MCMC has selected 1.03 as the debt premium which is the average debt premium of three operators, and also close to the mid-point of the suitable range.

10.3. WACC estimate for mobile services

The cost of debt is estimated as the sum of the risk-free rate and the debt premium. The MCMC's preliminary conclusion is that this should be 5.12% for the mobile sector, using a debt premium of 1.03% and the risk-free rate of 4.09%. The cost of equity is estimated for a base case as 8.22%.

After weighting by the target gearing ratio of approximately 31% the pre-tax WACC of 9.04% is derived. This represents a point estimate for the base case, and the individual components are shown in Table 17.

Two additional scenarios for high and low cases are also presented in Table 17.

The low case encompasses a lower cost of equity and higher gearing, as a result of inclusion of an asset beta and gearing level based on the median results from the comparator sample. In this scenario the cost of debt remains the same as the base case while the cost of equity reduces to 7.73%. The resultant pre-tax WACC is 8.38%.

The high case scenario includes a higher cost of debt at 5.47%, using the maximum point from the debt premium range. In addition, the cost of equity is higher, at 8.35%. The latter is based on the Malaysian MNO sample. The asset betas were re-levered using the average gearing ratio of approximately 19%. The resultant equity beta was 0.71. Using these parameters, the high scenario pre-tax WACC is estimated at 9.95%.

Table 17: WACC – mobile

	Base case	Low case	High case
WACC – pre-tax	**9.04%**	**8.38%**	**9.95%**
WACC – post-tax	6.87%	6.37%	7.45%
Cost of debt			
Risk-free rate	4.09%	4.09%	4.09%
Debt premium	1.03%	1.03%	1.38%
Cost of debt	5.12%	5.12%	5.47%
Cost of equity			
Risk-free rate	4.09%	4.09%	4.09%
Equity beta	0.69	0.61	0.71
Equity risk premium	5.99%	5.99%	5.99%
Cost of equity	8.22%	7.73%	8.35%
Other parameters			
Tax rate	24.00%	24.00%	24.00%
Gearing	31.12%	35.43%	18.91%

[Source: MCMC]

Question 17:

Do you have any comments on the WACC values proposed for the Mobile Network Services?

11. 5G services

11.1. Beta and gearing

As the sole Malaysian provider of wholesale 5G services DNB is unique in the world. Consequently, there are no directly comparable companies which may be considered as providing reference points to inform beta and gearing estimates for an appropriate WACC. As such, the MCMC has considered information provided in:

(a) submissions from DNB;

(b) submissions from MNOs; and
(c) WACC decisions for regulated wholesale only telecommunications businesses.

DNB considers that benchmarks for the beta and gearing assumptions of its WACC should refer to data on betas and gearing from Digi, Maxis and TM.

On this basis DNB's initial analysis appears to conclude that an equity beta of between 0.86 (mean) and 0.97 (median) may be appropriate, with gearing of 27%.

The MCMC's view is that it would be wholly inappropriate to use these three companies as a comparator sample for DNB. The systematic risk facing DNB is quite dissimilar to that facing Digi, Maxis and TM. DNB is a wholesale only operation which effectively has an immediate and guaranteed customer base and income stream. Its risk profile is therefore different from other local telecommunications companies with vertically integrated operations. In addition, regulatory risk is likely to be low, given the importance of DNB to Government policy objectives. As such, the beta and gearing information of Digi, Maxis and TM should not be relied upon to form the basis of a comparator sample.

As there are no other comparable 5G wholesale operators worldwide, the MCMC sought comparators from other telecommunications businesses. The MCMC identified only one overseas company which is a wholesale only telecommunications access provider, namely Chorus New Zealand. While Chorus is a regulated provider of fibre access services rather than mobile services, it faces little competition and offers essential input services to retailers. The New Zealand Commerce Commission's most recent WACC determination for Chorus[8] included the following parameters:

(a) Asset beta: 0.50; and
(b) Gearing: 29%.

However, the MCMC noted that the above parameters were derived from analysis conducted in 2019. Using the latest available (as at June 2022) company information, Chorus actuals are:

(a) Asset beta (2018 – 2022): 0.25; and
(b) Gearing (average, last two financial years): 50%.

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8 Commerce Commission (2022), Cost of capital determination for Chorus, Enable, Tuatahi, and Northpower Fibre ID, 1 February 2022.

In the absence of any other suitable benchmarks, the MCMC has used the latest Chorus actual data for asset beta and gearing assumptions for the initial WACC in the 5G model. The resultant equity beta is 0.43.

It is standard practice for regulators to assume an efficient target gearing ratio for WACC estimates, rather than the actual gearing of the regulated entity. Nevertheless, the MCMC has reviewed the current and likely future capital structure of DNB, in view of the unique approach adopted by Malaysia to 5G deployment. It appears at this stage that DNB will be financed primarily with debt funding with little equity investment, although this is not certain. As such the MCMC has included a low case reflecting zero equity for sensitivity testing of the 5G model results.

The MCMC has also included a high Malaysian market case for sensitivity testing which reflects DNB's recommended approach for estimating a benchmark WACC. The four listed Malaysian telecommunications operators were included in this sample: Digi, Maxis, TT dotCOm and TM. Axiata was omitted on the basis that the company's operations include multiple Asian markets. Information on the range, average and median betas and gearing is presented in Table 18.

Table 18: Betas and gearing – Malaysian listed telecommunications companies

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
Range	0.15 – 1.08	0.15 – 0.82	3% - 30%
Median	0.70	0.60	19%
Mean	0.66	0.54	17%

[Source: FT.com]

The asset betas were re-levered using the average gearing ratio of approximately 17%. The resultant equity beta was 0.62. These values have been included in the high case scenario.

Question 18:

Do you have any comments on the approach used for estimating beta and gearing parameters for 5G?

11.2. Debt premium

DNB has submitted that the debt premium it incurs is approximately 40 basis points above the risk-free rate. The MCMC accepts this value as reasonable in the light of information on spreads presented in Section 10.2. As such this value has been used in the cost of debt calculation.

11.3. WACC estimate for 5G

For the base case, the MCMC has estimated a WACC of 6.63%, based on a cost of debt of 4.49% and a cost of equity of 6.69%. As noted above the equity beta and gearing assumptions reflect the Chorus benchmark. The low case WACC is 4.49% and assumes no equity funding. The high case WACC is 9.26%, with equity beta of 0.62 and gearing assumption at approximately 17%, based on the Malaysian market sample information. The breakdown of the components of the base, low and high case is presented in Table 19.

Table 19: WACC – 5G

	Base case	Low case	High case
WACC – pre-tax	**6.63%**	**4.49%**	**9.26%**
WACC – post-tax	5.04%	3.41%	7.04%
Cost of debt			
Risk-free rate	4.09%	4.09%	4.09%
Debt premium	0.40%	0.40%	0.40%
Cost of debt	4.49%	4.49%	4.49%
Cost of equity			
Risk-free rate	4.09%	4.09%	4.09%
Equity beta	0.43	0.43	0.62
Equity risk premium	5.99%	5.99%	5.99%
Cost of equity	6.69%	6.69%	7.80%
Other parameters			
Tax rate	24.00%	24.00%	24.00%
Gearing	50.35%	100%	17.44%

[Source: MCMC]

Question 19:

Do you have any comment on the WACC estimate for 5G?

12. Infrastructure Sharing

12.1. Beta and gearing

In selecting a comparator set of companies to inform our estimates of the beta and gearing for infrastructure sharing services the MCMC initially applied similar criteria as for fixed services:

(a) publicly listed companies based in the Asia-Pacific region;
(b) a significant proportion of revenues is generated from infrastructure sharing activities; and
(c) current and historical financial and business information is publicly available.

However, only seven such companies were identified with headquarters in the Asia-Pacific region. It was therefore decided to expand the sample with the addition of European and North American tower companies. Such an approach has previously been adopted by the MCMC. A further six companies were identified, bringing the total sample size to 13 comparators. The main business of each of these companies is infrastructure sharing which comprises at least 79% of total revenues (Table 20).

The characteristics of the individual firms were examined to determine whether any should be excluded from the sample. In particular, the MCMC considered the likelihood of significant divergences in systematic risk between the proposed comparator company and Malaysian tower companies. A number of Malaysian tower companies are State Backed Companies (**SBC**s). This status may reduce systematic risk compared to the proposed comparator companies. Another larger Malaysian tower company, Edotco, is a subsidiary of Axiata, a large listed entity which owns telecommunications companies in Malaysia and other Asian markets. Edotco would likely face similar systematic risk to the proposed comparator companies. Thus, there is no compelling reason to exclude any of the 13 comparators from the sample. A review of credit ratings was uninformative as it was not possible to identify ratings for seven of the proposed comparators.

Table 20: Possible tower comparator companies – characteristics

Company	Market capitalisation June 2022 (USDbn)	Revenue from infrastructure sharing services / Total operating revenue	Credit rating (most recent available)	Notes
American Tower	109.75	97%	Baa3 (Moodys)	Headquarters – North America; Included in the MCMC's 2017 sample
Cellnex	26.76	87%	unrated	Headquarters – Spain
China Tower	21.30	88%	n.a.	Headquarters – China
Crown Castle	67.62	90%	Baa3 (Moodys)	Headquarters – North America; Included in the MCMC's 2017 sample
Digital Telecommunications Infrastructure Fund	3.99	79%	n.a.	Headquarters – Thailand
Indus Towers	7.20	100%	n.a.	Headquarters – India
Infrastrutture Wireless Italiane	9.56	100%	BB+ (S&P)	Headquarters – Italy
J Tower	0.90	100%	n.a.	Headquarters – Japan
Rai Way	1.46	84%	n.a.	Headquarters – Italy
Sarana Manara Nusantara	3.29	82%	Baa3 (Moodys)	Headquarters – Indonesia
SBA	31.49	100%	Ba3 (Moodys)	Headquarters – North America
Solusi Tunas	2.98	84%	n.a.	Headquarters – Indonesia
Tower Bersama	4.34	100%	n.a.	Headquarters – Indonesia

[Source: FT.com, operator reports]

Information was then compiled on the five-year equity betas and average gearing of the comparator sample (Table 21). Unfortunately, as a result of gaps in the data it was necessary to exclude J Tower and Solusi Tunas from the sample at this stage. The median and mean asset beta of the remaining sample was 0.39 with gearing of 24% and 26% respectively. Reducing the sample to only the five Asian companies led to a higher median and mean asset beta of 0.47 with gearing of 29% and 30% respectively.

Table 21: Infrastructure Sharing comparator sample – beta and gearing

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
American Tower	0.51	0.39	23%
Cellnex	0.16	0.11	31%
China Tower	0.56	0.34	39%
Crown Castle	0.64	0.51	20%
Digital Telecommunications Infrastructure Fund (Thailand)	0.34	0.27	21%
Indus Towers	0.62	0.47	24%
Infrastrutture Wireless Italiane	0.31	0.22	30%
Rai Way	0.46	0.43	5%
Sarana Manara Nusantara	0.86	0.55	37%
SBA	0.46	0.35	24%
Tower Bersama	0.99	0.70	29%
Median	0.51	0.39	24%
Mean	0.54	0.39	26%
Median (Asia-Pacific companies only)	0.62	0.47	29%
Mean (Asia-Pacific companies only)	0.67	0.47	30%

[Source: FT.com]

Six Malaysian tower companies provided submissions on beta and gearing levels with a wide range of values (Table 22). Malaysian gearing ratios were considerably higher on average than the results from our full and reduced samples. This may be explained by the use of book values for equity in the Malaysian ratios, whereas market value of equity was used in the comparator sample. The average Malaysian asset beta was 0.47 which is the same as the average for the five Asia-Pacific companies, but higher than the average asset beta of 0.39 from the full comparator sample.

Table 22: Infrastructure Sharing comparator sample – beta and gearing

	Levered (equity) beta	Unlevered (asset) beta	Gearing
Range	0.10 – 1.00	0.04 – 0.99	1% - 59%
Median	0.94	0.42	50%
Mean	0.78	0.47	42%

[Source: FT.com]

Given the wide variation in the submissions on beta and gearing the MCMC has re-levered the asset betas of the full comparator sample using the average gearing ratio of 26%. This resulted in an equity beta of 0.57 which has been used in the WACC calculation for infrastructure sharing services.

Question 20:

Do you have any comments on the proposed approach for estimating betas and gearing for the tower sector?

12.2. Debt premium

Six Malaysian tower companies submitted debt premia with an average of 1.83% and a median value of 1.59% (Table 23).

Table 23: Debt premium – Malaysian tower companies

	Debt premium
Range	0.64% - 3.50%
Median	1.59%
Mean	1.83%

[Source: Tower company submissions]

Given the relatively wide range of submitted debt premia, the MCMC has opted to test the median (base case), mean (higher case) and lower bound (low case) in sensitivity tests. The median has been selected as the base case, as the average has been affected by the unusually high value of the upper bound of the range.

Question 21: Do you have any comments on the proposed approach for estimating the debt premium for the infrastructure sharing sector?

12.3. WACC estimate for Infrastructure Sharing

The cost of debt for the base case is 5.68%, based on the median debt premium value of 1.59%. The cost of equity for the base case is 7.48%, based on the sample average gearing of approximately 26% and an equity beta of 0.57, using the full comparator sample. For the high case scenario, the debt premium was increased to 1.83% – the average of the operator submissions – while all other parameters remained the same as the base case. The resultant WACC was only slightly higher than the base case, at 8.83%. For the low case scenario, the cost of debt was 4.73%, reflecting a lower debt premium of 0.64% – the lower bound of the range of submitted values. The low case used the median gearing and asset beta of the comparator sample, resulting in a cost of equity of 7.35%. The resultant low case WACC was 8.25%. The components of the base, low and high case WACCs are shown in Table 24.

Table 24: WACC – Infrastructure Sharing

	Base case	Low case	High case
WACC – pre-tax	**8.77%**	**8.25%**	**8.83%**
WACC – post-tax	6.66%	6.27%	6.71%
Cost of debt			
Risk-free rate	4.09%	4.09%	4.09%
Debt premium	1.59%	0.64%	1.83%
Cost of debt	5.68%	4.73%	5.91%
Cost of equity			
Risk-free rate	4.09%	4.09%	4.09%
Equity beta	0.57	0.54	0.57
Equity risk premium	5.99%	5.99%	5.99%
Cost of equity	7.48%	7.35%	7.48%
Other parameters			
Tax rate	24.00%	24.00%	24.00%
Gearing	25.74%	28.66%	25.74%

[Source: MCMC]

Question 22:

Do you have any comment on the WACC estimate for Infrastructure Sharing?

13. DTTB Multiplexing Service

No submissions were received on the value of the WACC or its parameters for the DTTB service.

13.1. Beta and gearing

Potential comparators for the DTTB service include a number of the tower companies previously identified (Section 12.1) which have customers from the broadcasting industry (Table 25). However, not all of these companies provide services which exactly match the segment of the value chain in which the Malaysian DTTB provider operates. The Malaysian

DTTB service encompasses infrastructure (towers) and transmission, whereas some of the potential comparators provide only the passive infrastructure. The total number of potential comparators identified is eight, including only two Asian companies. Clearly it is not ideal to have such a small Asian representation in the sample. Furthermore, of the eight companies the MCMC has confirmed that only four operate transmission services.

In considering the systematic risk faced by companies providing only passive infrastructure compared to DTTB operators it is important to note that there are likely to be underlying similarities in the nature of the businesses. Specifically, companies in the business of providing infrastructure for mobile / wireless communications engage in the operation and management of assets which are similar (and in some cases substitutable) for assets of the DTTB operator. Indeed, in Malaysia DTTB operations and management functions are outsourced to TM.

Given the likely similarities in systematic risk together with the limited number of comparator companies available the MCMC favours use of the full sample, with some additional consideration of results from a reduced sample of the four transmission providers.

Table 25: Possible DTTB comparator companies – characteristics

Company	Market capitalisation – June 2022 (USDbn)	Relevant services	Credit rating – most recent available	Notes
American Tower	109.75	Leases space on communications sites to radio and television broadcast companies.	Baa3 (Moodys)	Headquarters – North America
Cellnex	26.76	Operates DTTB transmission services.	Unrated	Headquarters – Spain
Crown Castle	67.62	Leases space on communications sites to radio and television broadcast companies.	Baa3 (Moodys)	Headquarters – North America
Dafeng TV	0.26	Operation of community antenna television systems.	n.a.	Taiwanese company
Digital Telecommunications Infrastructure Fund	3.99	Provision of tower-based broadcast transmission services.	n.a.	Thai company
Infrastrutture Wireless Italiane	9.56	Provision of infrastructure for broadcasting services.	BB+ (S&P)	Headquarters – Italy
Rai Way	1.46	Operation of transmission and broadcasting network.	n.a.	Headquarters – Italy
SBA	31.49	Leases space on communications sites to radio and television broadcast companies.	Ba3 (Moodys)	Headquarters – North America

[Source: FT.com, operator reports]

The gearing levels of the full and reduced samples are very similar at between 20% and 24% (Table 26). However, the asset beta of the full sample (0.32 to 0.33) is higher than that of the reduced sample (0.22 to 0.25).

Table 26: DTTB comparator sample – beta and gearing

Company	Levered (equity) beta	Unlevered (asset) beta	Gearing
American Tower	0.51	0.39	23%
Cellnex	0.16	0.11	31%
Crown Castle	0.64	0.51	20%
Dafeng TV	0.19	0.16	24%
Digital Telecommunications Infrastructure Fund	0.34	0.27	21%
Infrastrutture Wireless Italiane	0.31	0.22	30%
Rai Way	0.46	0.43	5%
SBA	0.46	0.35	24%
Median (full sample)	0.40	0.33	24%
Mean (full sample)	0.48	0.32	22%
Median (reduced sample)	0.27	0.22	23%
Mean (reduced sample)	0.29	0.25	20%

[Source: FT.com]

There are few other recent international regulatory benchmarks for WACC parameters for broadcasting services. However, previously the MCMC had regard to broadcasting gearing and asset beta estimates by the Irish regulator, ComReg. As such, we compared the above results with the latest available from ComReg which date from a 2019 analysis (Table 27). The ComReg gearing estimate of 25% is very close to the results of the full sample (22% to 24%), while the lower bound of the ComReg asset beta estimate (0.38) is much closer to the full sample results (0.32 to 0.33) than the reduced sample results (0.22 to 0.25).

Table 27: Irish broadcasting sector – beta and gearing

	Unlevered (asset) beta	Gearing
Range	0.38 – 0.49	25%
Point estimate	0.45	25%

[Source: ComReg]

The final conclusion is to apply a gearing value of 22% and an asset beta of 0.32 in the WACC calculation as the base case. The re-levered equity beta is 0.42. Using the results of the reduced sample a second low case scenario has also been defined, with gearing of 20% and an asset beta of 0.25. The re-levered equity beta for this scenario is 0.29.

13.2. Debt premium

No information is available on which to base the debt risk premium for DTTB services. Given that DTTB operations are outsourced to TM in Malaysia, the MCMC's initial proposal is to adopt the same debt premium as has been used for the fixed sector – that is 1.02%.

13.3. WACC estimate for DTTB

Based on the full sample, the base case WACC is estimated to be 7.88%, with a cost of debt of 5.11% and cost of equity of 6.60%. A low case scenario, based on the reduced sample, produces a WACC of 7.15%, encompassing a lower cost of equity at 5.82% and the same cost of debt as the base case. The components of the base case and low case WACCs are shown in Table 28.

Table 28: WACC – DTTB

	Base case	Low case
WACC – pre-tax	7.88%	7.15%
WACC – post-tax	5.99%	5.44%
Cost of debt		
Risk-free rate	4.09%	4.09%
Debt premium	1.02%	1.02%
Cost of debt	5.11%	5.11%
Cost of equity		
Risk-free rate	4.09%	4.09%
Equity beta	0.42	0.29
Equity risk premium	5.99%	5.99%
Cost of equity	6.60%	5.82%
Other parameters		
Tax rate	24.00%	24.00%
Gearing	22.35%	20.00%

[Source: MCMC]

Question 23:

Do you have any comments on the WACC estimate for DTTB Multiplexing Service?

14. Summary

The central estimates of the WACC and its supporting parameters for the five sectors, fixed, mobile, 5G, infrastructure sharing and DTTB service, are set out in the table below.

Table 29: Point estimates of WACC and associated parameters

	Fixed	Mobile	5G	Towers	DTTB
WACC					
Nominal pre-tax WACC	**8.61%**	**9.04%**	**6.63%**	**8.77%**	**7.88%**
Cost of Debt = RF + DP					
Risk-free rate (RF)	4.09%	4.09%	4.09%	4.09%	4.09%
Debt Premium (DP)	1.02%	1.03%	0.40%	1.59%	1.02%
Cost of Debt (CD)	**5.11%**	**5.12%**	**4.49%**	**5.68%**	**5.11%**
Cost of Equity = RF + β*ERP					
Risk-free rate (RF)	4.09%	4.09%	4.09%	4.09%	4.09%
Beta (β)	0.63	0.69	0.43	0.57	0.42
Equity Risk Premium (ERP)	5.99%	5.99%	5.99%	5.99%	5.99%
Cost of Equity (CE)	**7.84%**	**8.22%**	**6.69%**	**7.48%**	**6.60%**
Other parameters					
Tax rate (t)	24.00%	24.00%	24.00%	24.00%	24.00%
Gearing (G)	32.87%	31.12%	50.35%	25.74%	22.35%

[Source: MCMC]

15. Recommendation

The MCMC proposes to use the point estimates set out in the table above as the base case, in calculating the costs of the regulated wholesale facilities and services in the Access List. Sensitivity analyses will also be conducted using the maximum and minimum bounds of the ranges identified in this chapter.

PART D: FIXED SERVICE

16. Introduction to Fixed Services

16.1. Fixed Services

The category of Fixed Services encompasses those facilities and services in the Access List that are provided on a fixed telecommunications network.

The following fixed services are included in the Access List.

(a) Fixed termination and origination services
- Fixed Network Origination Service
- Fixed Network Termination Service

(b) Transmission-related services
- Interconnect Link Service
- Wholesale Local Leased Circuit Service
- Domestic Connectivity to International Services – Connection services to the submarine cable system
- Trunk Transmission Service
- End-to-End Transmission Service
- IP Transit Service

(c) HSBB Services
- Layer 2 HSBB Network Service with QoS
- Layer 3 HSBB Network Service

(d) Other services
- Network Co-Location Service
- Duct and Manhole Access

16.2. Fixed Services Cost Model

The MCMC has developed a cost model using a bottom up LRIC+ methodology in order to estimate a complete set of costs for the Fixed Services in the Access List. Consistent with international best practice, the model represents the fixed network of a hypothetical operator, based on modern access technologies and an IP core network.

Model assumptions and inputs are based largely on information from the incumbent operator in Malaysia, namely TM which has a fixed broadband market share of almost 75% as shown in the Table below.

Table 30: Fixed broadband market share, 4Q 2021

Service Provider	Market share
TM	74.5%
Maxis	14.4%
TT dotCom	8.9%
Others	0.6%

[Source: MCMC]

The model was also informed by data provided by a number of other operators which offer a limited number of fixed regulated services. The latest available network and cost information provided by the Malaysian operators is reflected in the model, in addition to suitable benchmark information.

The model applies detailed engineering design rules and optimisation algorithms, informed by best practice. The costs of the network assets, which reflect the efficient costs incurred by the operator, are then estimated and allocated to the services provided. The model delivers per line costs, per minute cost of voice services and per Mbit/s cost of data services.

The duct sharing, physical connection and co-location services have not been modelled using the LRIC methodology, as these services do not generate connection-based or traffic-based demand. The costing of these services is undertaken using the principle of cost sharing with other connection-based services and/or annualisation of unit costs of the resources required to provide the service. Thus, for example, installation costs for some services are calculated based on man-hour costs in Malaysia and estimated time and effort.

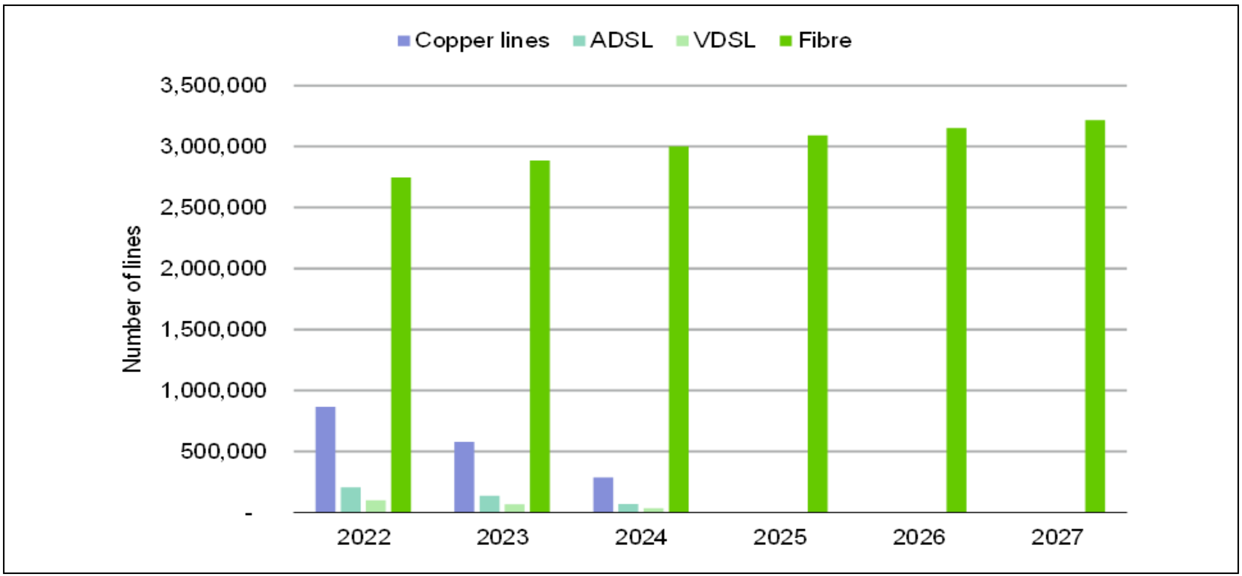
The basic components of the model are demand and traffic forecasts, network dimensioning, network costing and allocating network cost to services.

16.3. Service demand and traffic

The hypothetical operator is assumed to offer both wholesale and unregulated / retail services. In order to estimate the cost of the regulated wholesale services, the costs of any network elements that are shared between wholesale and unregulated / retail services must be appropriately allocated. As such the model includes demand for unregulated / retail services offered by the hypothetical operator.

A key demand assumption is the suspension of copper-based services by 2025. As copper subscribers migrate to fibre-based services, it has been assumed that demand for copper-based services will drop by 25-50% annually over 2022-2024. National retail fixed broadband penetration of 33% has been estimated in 2021, based on data provided by TM. This is assumed to increase to approximately 35.4% by the end of 2027 which is the equivalent of over 3.2 million fibre lines as shown in Figure 1.

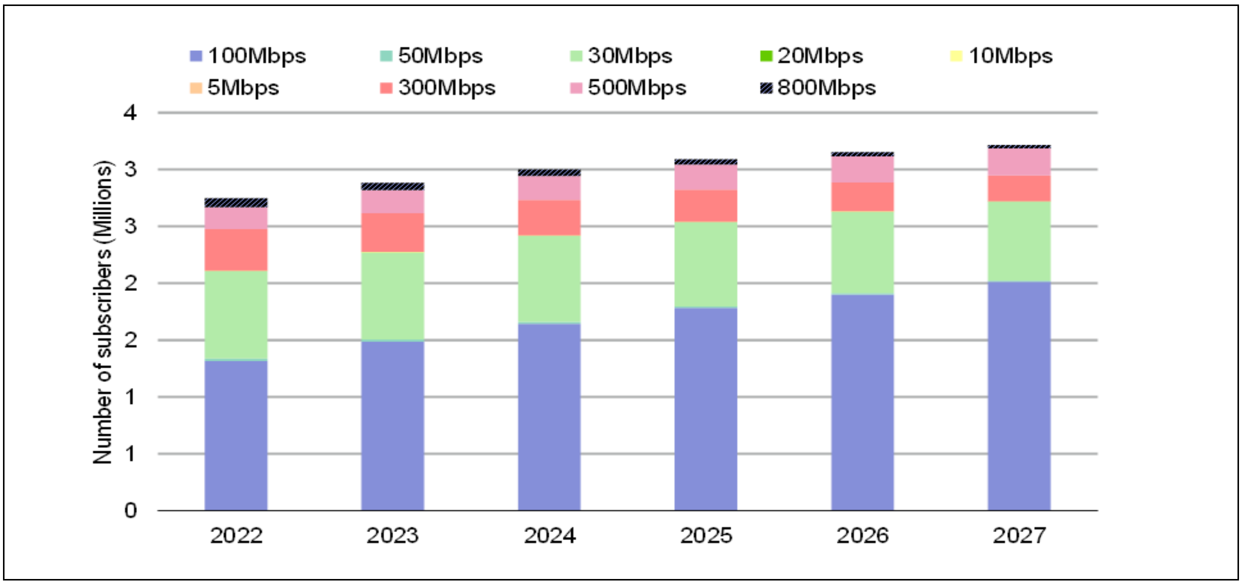
Figure 1: Demand forecast – by type of access line



[Source: MCMC]

During the modelling period, it is assumed that customers will migrate from lower data rate to higher data rate subscriptions, with approximately 63% of customers having a 100Mbit/s fibre subscription by 2027 compared to just below 44% in 2021. This represents over 2 million subscriptions as illustrated in Figure 2.

Figure 2: Forecast fibre subscriptions by data rate (Mbit/s)



[Source: MCMC]

Leased line forecasts are based on a combination of TM forecasts and historical trends. Leased lines are forecast to grow over the modelling period, however, with a declining growth rate from 6% to 2% by 2027.

Fixed voice volumes have been in rapid decline over past years due to increased reliance on mobile and Over The Top (**OTT**) applications. Voice volumes forecast for the modelling period (2022-2027) follow a smoothed historical trend, with annual decreases in the range of -6% to -30%.

A number of assumptions are applied regarding voice and data traffic in order to calculate busy hour traffic demand and conduct necessary unit conversions to dimension and cost the network. Most traffic parameters were provided by TM. In some cases, industry accepted standards or assumptions are used.

16.4. Network dimensioning

The model calculates the number of required network elements by dimensioning a network with capacity that will meet the above service demands each year at an appropriate quality of service. Dimensioning is based on connections for access elements, busy hour traffic in Mbit/s (voice and data traffic) for traffic-carrying elements, subscribers and concurrent sessions for voice switching, registry and control elements. The capacity of traffic carrying elements such as switches and routers is defined by the number of ports and by busy hour traffic.

The costs of the modelled elements are then allocated to the services, so that a cost per connection (line), cost per minute or cost per Mbit/s can be determined. Many services use a combination of bases for dimensioning, according to the particular equipment or resources involved. Note that when used to dimension traffic-driven network elements, annual call minutes are converted to equivalent busy hour traffic (in Mbit/s) and concurrent call sessions.

To reflect local Malaysian conditions, a scorched node approach is used. This is reflected in the cabling lengths of the access and core networks and the number of nodes at aggregation and core levels of the network. Consistent with recent international regulatory fixed network practices, the core part of the network is assumed to be entirely IP based. However, it is assumed that a part of the access network is still copper-based – that is, copper cables have been included.

The access network was dimensioned based on the number of access lines and the average cable lengths for each segment of the access network in TM's network.

The core network cables were dimensioned based on the number of nodes and the distances between these nodes in the TM network.

The core network transmission and switching equipment were dimensioned based on the traffic traversing the network elements and based on other drivers including the number of subscribers. The unit capacities and utilisation of the equipment were provided by TM.

16.5. Network costing

The annual costs of the network elements are calculated by multiplying the quantities of the network elements by their unit prices, annualising the capital expenditure and including annual operational costs.

Consistent with the bottom-up LRIC+ methodology, the model uses replacement costs for network equipment which reflects replacement value at current prices.

In addition to equipment prices, annual operational costs were also collected from TM and adjusted for efficiency based on benchmark information. These costs are represented as a percentage of equipment cost and reflect the cost of power consumption and probability of replacement due to failure.

Price trends were applied to adjust equipment prices and operational costs for future years. There are generally different price trends for equipment prices and for operational costs associated with equipment.

To annualise the capital expenditure, the economic lives of the network equipment were required, which were supplied by TM. These were compared against benchmark data and adjusted where necessary.

The model uses a tilted annuity formula to calculate annualised capital expenditure. As already discussed, this is the preferred approach as it provides the closest approximation to ED (which is the theoretical depreciation appropriate for an economic cost model).

16.6. Service costing

The access network elements are allocated to services based on the number of lines and usage of different access network elements by individual line types using routing factors. The core network elements are allocated to services based on the service traffic multiplied by routing factors.

In addition to the direct network costs discussed above, there are indirect network costs and general overheads associated with providing services. Common network costs are independent of demand and therefore cannot easily be allocated to services. Examples of common network costs are interconnect billing and network IT systems. The total common network costs are applied as a mark-up on the direct network costs.

Indirect capital costs include non-operational buildings, corporate IT, office supplies, administration, bank commissions, professional services, insurance, employee costs, office maintenance utilities costs. These indirect capital costs are applied as a mark-up on the direct network costs, together with a mark-up for USP and network licence fees.

16.7. Model reconciliation

The fixed network model has been subject to a process of model calibration and reconciliation. Where appropriate, the original data provided by TM has been used, but in some cases the values have been amended to reflect efficient price levels achievable by operators in Malaysia and efficient operating costs. For ducts and manholes, the capital costs provided by TM have been replaced by costs provided by other Malaysian operators owning similar assets. The network element quantities calculated by the bottom-up model were also reconciled with top-down quantities provided by TM to validate the model results. Furthermore, the following adjustments were conducted in the model:

(a) The cost of access network elements and long-life network assets were replaced with their respective net book values. This includes costs for:
- ducts and manholes;
- copper cables and MSANs;
- fibre cables;
- submarine cables and landing stations; and
- satellite earth station; and

(b) The operating expenditure (**OPEX**) levels associated with some assets were reduced based on benchmark data.

A key uncertainty in the data provided is the allocation of duct and trenching costs to the access and core networks. While TM has provided the total length of ducts deployed in its network, it did not distinguish between ducts used by the access, aggregation and core networks. We acknowledge that this can be challenging for TM due to the fact that a considerable proportion of ducts is shared between the access and core networks. The lengths of ducts used in the aggregation and core networks were calculated bottom-up based on the number of rings and average ring lengths. To reconcile the model, a proportion of ducts is assumed to be shared with the access network. The calculated access and core duct costs were compared against top-down costs provided by TM. It was found that allocating 82% of total duct costs to the access network is consistent with the data provided by TM. The impact of this assumption is demonstrated in the sensitivity analysis of transmission and broadband service costs. Two scenarios were tested:

(a) Base case: 82% of the total duct costs are allocated to the access network.
(b) Test case: assumes that the total duct costs are allocated equally to the access and core networks.

Question 24:

Do you have any comments on the approach adopted for the fixed model?

17. Proposed Regulated Prices

17.1. Fixed Network Origination Service

This service covers the cost in the originating network of a call outgoing from fixed network to other national fixed and mobile networks. Since the previous Public Inquiry the MCMC amended the service to remove SMS/MMS messaging.

The cost is based on usage of network elements by the outgoing call, which is reflected in routing factors, and on call characteristics (including average call duration, average ring time and percentage of traffic in the busy hour). The resulting unit costs (sen per minute) of the origination service using a base case WACC of 8.61% are shown in the table below.

Table 31: Fixed Network Origination Service costs – base case

	2023	2024	2025
Outgoing national calls (sen/min)	1.65	1.35	1.18

[Source: MCMC]

The dominant factor in influencing the cost of network origination is the cost associated with licences of the IP multimedia services (**IMS**) and softswitch. As the call volumes decrease, the number of required licences also decreases with time. The declining cost of fixed termination follows the declining cost trend of licences and active equipment.

As a sensitivity analysis an alternative scenario was tested using a WACC of 9.61%, shown in the table below. As discussed in Section 9.3 this value represents a second WACC scenario – the high case – encompassing a higher cost of equity than the base case WACC.

Table 32: Fixed Network Origination Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
Outgoing national calls (sen/min)	1.67	1.37	1.20

[Source: MCMC]

The MCMC proposes new regulated prices for the fixed network origination service, based on the service costs, as shown in Table 33.

Table 33: Fixed Network Origination Service – proposed regulated prices

	2023	2024	2025
Outgoing national calls (sen/min)	1.65	1.35	1.18

[Source: MCMC]

17.2. Fixed Network Termination Service

This service covers the cost in the terminating network of a call incoming to fixed network from other national fixed and mobile networks.

The cost is based on usage of network elements by the incoming call, which is reflected in routing factors, and on call characteristics (including average call duration, average ring time and the percentage of traffic in the busy hour). The resulting unit costs (sen per minute) of the termination service, using a WACC of 8.61%, are shown in the table below.

Table 34: Fixed Network Termination Service costs – base case

	2023	2024	2025
Incoming national calls (sen/min)	1.65	1.35	1.18

[Source: MCMC]

The fixed network termination service uses the same resources as the fixed origination service. The dominant factor in influencing the cost of network termination is the cost of IMS and softswitch licences. As the call volumes decrease, the number of required licences also decreases with time. The declining cost of fixed termination follows the declining cost trend of licences and active equipment.

As a sensitivity analysis an alternative scenario was tested using the higher case WACC of 9.61%, shown in the table below.

Table 35: Fixed Network Termination Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
Incoming national calls (sen/min)	1.67	1.37	1.20

[Source: MCMC]

The MCMC proposes new regulated prices for the fixed network origination service, based on the service costs, as shown in Table 36.

Table 36: Fixed Network Termination Service – proposed regulated prices

	2023	2024	2025
Incoming national calls (sen/min)	1.65	1.35	1.18

[Source: MCMC]

17.3. Interconnect Link Service

Since the previous Public Inquiry, the Interconnect Link Service (**ILS**) has been modified to include IP-based interconnection. The Interconnect Link Service cost covers the cost for 1km of the interconnect link cable, the associated installation costs and cost of either a 1Gbit/s CPE or 10Gbit/s CPE, depending on the capacity of the link. The resulting costs, using a base WACC of 8.61%, are shown below.

Table 37: Interconnect Link Service costs – base case

	2023	2024	2025
ILS link (RM/km/month per fibre pair)	46	44	42
ILS installation	1,560	1,606	1,655
1Gbps CPE (RM/month)	100	95	91
10Gbps CPE (RM/month)	338	321	305

[Source: MCMC]

The installation costs increase over time due to the increase in labour cost, while the cost of cable and CPE decrease in time due to decreasing asset costs.

As a sensitivity analysis one alternative scenario was tested using the high case WACC of 9.61%. The result of this scenario is shown below.

Table 38: Interconnect Link Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
ILS link (RM/month per km of fibre pair)	48	45	43
ILS installation (RM)	1,560	1,606	1,655
1Gbps CPE for full-span link (RM/month)	101	96	91
10Gbps CPE for full-span link (RM/month)	341	324	308

[Source: MCMC]

The MCMC proposes to regulate the prices for this service, based on the service costs, as shown in Table 39 below.

Table 39: Interconnect Link Service costs – proposed regulated prices

	2023	2024	2025
ILS link (RM/km/month per fibre pair)	46	44	42
ILS installation	1,560	1,606	1,655
1Gbps CPE (RM/month)	100	95	91
10Gbps CPE (RM/month)	338	321	305

[Source: MCMC]

17.4. Wholesale Local Leased Circuit Service

The Wholesale Local Leased Circuit Service covers the access part of a leased line in addition to any switching and routing costs. Circuits up to 1Mbps use a copper access line, from 1 Mbps up to 1 Gbps use a fibre access line with CPE, from 1 Gbps up to 10 Gbps use fibre access lines with 10G CPE and from 1 Gbps and above use fibre access lines with DWDM terminals. The resulting monthly costs, based on a WACC of 8.61%, are shown below.

Table 40: Wholesale Local Leased Circuit Service costs – base case

	2023	2024	2025
Cost of the local circuit:			
Wholesale local leased circuit with copper access (RM/month)	17	15	-
Wholesale local leased circuit using 1Mbit/s to 1Gbit/s Ethernet (RM/month)	915	783	752
Wholesale local leased circuit using 1Gbit/s to 10Gbit/s Ethernet (RM/month)	1,144	1,008	989
Wholesale local leased circuit using DWDM (RM/month)	1,218	1,071	1,049
Cost of traffic over the Ethernet network:			
Wholesale local leased circuit with copper access (RM/Mbps/month)	3.66	3.14	-
Wholesale local leased circuit using 1Mbit/s to 10Gbit/s Ethernet (RM/Mbps/month)	1.67	1.42	1.34
Wholesale local leased circuit using DWDM (RM/Mbps/month)	0.45	0.38	0.37

[Source: MCMC]

The cost of installation increases due to increasing labour costs. Due to declining costs of cables and active electronics, the service cost declines with time. The costs for a copper based Wholesale Local Leased Circuit Service are only determined up to 2024 as it is assumed that the copper network will be phased out by 2025.

As a sensitivity analysis an alternative scenario was tested using the high case WACC of 9.61%, with the results shown in the table below.

Table 41: Wholesale Local Leased Circuit Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
Cost of the local circuit:			
Wholesale local leased circuit with copper access (RM/month)	17	16	-
Wholesale local leased circuit using 1Mbit/s to 1Gbit/s Ethernet (RM/month)	943	815	783
Wholesale local leased circuit using 1Gbit/s to 10Gbit/s Ethernet (RM/month)	1,174	1,041	1,022
Wholesale local leased circuit using DWDM (RM/month)	1,248	1,105	1,083
Cost of traffic over the Ethernet network:			
Wholesale local leased circuit with copper access (RM/Mbps/month)	3.67	3.17	-
Wholesale local leased circuit using 1Mbit/s to 10Gbit/s Ethernet (RM/Mbps/month)	1.68	1.44	1.36
Wholesale local leased circuit using DWDM (RM/Mbps/month)	0.45	0.39	0.37

[Source: MCMC]

The cost of installation of the wholesale local leased circuit service, shown below, increases due to increasing labour costs.

Table 42: Wholesale Local Leased Circuit Service – installation cost

	2023	2024	2025
Installation cost (RM/service)	2,437	2,510	2,585

[Source: MCMC]

The costs for installation are increasing over time due to the increasing labour costs.

The MCMC proposes to regulate the prices for Wholesale Local Leased Circuit Service based on the costs in Table 40 and Table 42. A linear glide path, starting from the most recent regulated price for wholesale local leased circuit is applied to ensure a smooth transition in the price.

Table 43: Wholesale Local Leased Circuit Service – proposed regulated prices

	2023	2024	2025
Cost of the local circuit:			
Wholesale local leased circuit with copper access (RM/month)	33	15	-
Wholesale local leased circuit using 1Mbit/s to 1Gbit/s Ethernet (RM/month)	646	699	752
Wholesale local leased circuit using 1Gbit/s to 10Gbit/s Ethernet (RM/month)	10,242	5,616	989
Wholesale local leased circuit using DWDM (RM/month)	942	995	1,049
Cost of traffic over the Ethernet network:			
Wholesale local leased circuit with copper access (RM/Mbps/month)	3.66	3.14	-
Wholesale local leased circuit using 1Mbit/s to 10Gbit/s Ethernet (RM/Mbps/month)	1.67	1.42	1.34
Wholesale local leased circuit using DWDM (RM/Mbps/month)	0.45	0.38	0.37

[Source: MCMC]

17.5. Domestic Connectivity to International Services

The Domestic Connectivity to International Services (**DCIS**) is used together with the Network Co-Location Service and the transmission service.

It includes the tie cable between TM's and the access seeker's equipment. The resulting costs are shown below.

Table 44: Domestic Connectivity to International Services cost – base case

	2023	2024	2025
DCIS link (RM/month per metre of fibre pair)	0.05	0.04	0.04
DCIS installation (RM/service)	97	100	103

[Source: MCMC]

The MCMC proposes to regulate the prices for this service, based on the service costs, as shown in

Table 45 below.

Table 45: Domestic Connectivity to International Services – proposed regulated prices

	2023	2024	2025
DCIS link (RM/month per metre of fibre pair)	0.05	0.04	0.04
DCIS installation (RM/service)	97	100	103

[Source: MCMC]

17.6. Trunk Transmission Service

The Trunk Transmission Service covers the transmission in the core network. Given the significant cost of the submarine cable, the Trunk Transmission Service is categorised based on whether or not it uses the domestic submarine cable between Peninsular Malaysia and Sabah and Sarawak. The resulting costs, based on a WACC of 8.61%, are shown below. The base case assumes that 82% of total duct costs are allocated to the access network.

Table 46: Trunk Transmission Service costs – base case

	2023	2024	2025
Trunk transmission service (RM/month):			
10 Mbps	29	25	24
100 Mbps	291	253	244
200 Mbps	583	505	489
500 Mbps	1,457	1,263	1,222
750 Mbps	2,186	1,894	1,833
1 Gbps	2,914	2,525	2,444
3 Gbps	8,743	7,576	7,333
5 Gbps	14,572	12,627	12,222
Trunk transmission service with submarine cable (RM/month):			
10 Mbps	40	35	34
100 Mbps	402	351	342
200 Mbps	805	702	684
500 Mbps	2,012	1,754	1,709
750 Mbps	3,018	2,631	2,564
1 Gbps	4,023	3,508	3,419
3 Gbps	12,070	10,524	10,256
5 Gbps	20,117	17,540	17,093

[Source: MCMC]

The cost of trunk transmission declines with time following the cost trend of active equipment and fibre cables. The costs fell considerably compared to the previous PI exercise. This is mainly due to revaluing the main cost components such as ducts and manholes.

As a sensitivity analysis two alternative scenarios were tested. The first scenario uses the high case WACC of 9.61%. The second scenario assumes that 50% of the duct costs are allocated to the aggregation and core network. The results of these two scenarios are shown below.

Table 47: Trunk Transmission Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
Trunk transmission service (RM/month):			
10 Mbps	30	26	25
100 Mbps	301	263	254
200 Mbps	602	525	509
500 Mbps	1,504	1,313	1,272
750 Mbps	2,257	1,970	1,909
1 Gbps	3,009	2,627	2,545
3 Gbps	9,027	7,881	7,635
5 Gbps	15,045	13,134	12,725
Trunk transmission service with submarine cable (RM/month):			
10 Mbps	42	36	36
100 Mbps	415	365	356
200 Mbps	831	730	712
500 Mbps	2,077	1,824	1,779
750 Mbps	3,116	2,736	2,668
1 Gbps	4,155	3,649	3,558
3 Gbps	12,464	10,946	10,674
5 Gbps	20,773	18,243	17,790

[Source: MCMC]

Table 48: Trunk Transmission Service costs, WACC = 8.61% and assuming 50% of duct costs are allocated to the aggregation and core network – sensitivity test

	2023	2024	2025
Trunk transmission service (RM/month):			
10 Mbps	41	36	36
100 Mbps	411	362	356
200 Mbps	823	725	713
500 Mbps	2,057	1,811	1,782
750 Mbps	3,085	2,717	2,673
1 Gbps	4,114	3,623	3,565
3 Gbps	12,342	10,868	10,694
5 Gbps	20,569	18,114	17,823
Trunk transmission service with submarine cable (RM/month):			
10 Mbps	52	46	45
100 Mbps	522	460	454
200 Mbps	1,044	921	908
500 Mbps	2,611	2,302	2,269
750 Mbps	3,916	3,453	3,404
1 Gbps	5,221	4,605	4,538
3 Gbps	15,664	13,814	13,614
5 Gbps	26,107	23,023	22,690

[Source: MCMC]

Allocating equal proportions of duct costs to access and core networks has a significant impact on the cost of transmission services, leading to a cost increase of up to 20%. While the allocation of duct costs on an equal basis seems intuitive, it is inconsistent with the provided top-down data which suggests that the access network comprises more than 80% of civil infrastructure costs.

The costs for installation of the Trunk Transmission Service, shown below, are increasing over time due to increasing labour costs.

Table 49: Trunk Transmission Service – installation cost

	2023	2024	2025
Trunk transmission installation (RM/service)	487	502	517

[Source: MCMC]

The MCMC proposes to regulate prices for Trunk Transmission Service based on the costs in Table 46 and Table 49, with the application of a linear glide path for Trunk Transmission Service, starting from the most recent regulated price, to ensure a smooth transition into the new rates (Table 50).

Table 50: Trunk Transmission Service – proposed regulated prices

	2023	2024	2025
Trunk transmission service (RM/month):			
10 Mbps	55	40	24
100 Mbps	555	399	244
200 Mbps	1,110	800	489
500 Mbps	2,775	1999	1,222
750 Mbps	4,162	2998	1,833
1 Gbps	5,663	4054	2,444
3 Gbps	16,991	12,162	7,333
5 Gbps	28,319	20,271	12,222
Trunk transmission service with submarine cable (RM/month):			
10 Mbps	221	128	34
100 Mbps	2,213	1,278	342
200 Mbps	4,427	2,555	684
500 Mbps	11,066	6,388	1,709
750 Mbps	16,599	9,582	2,564
1 Gbps	22,636	13,028	3,419
3 Gbps	67,908	39,082	10,256
5 Gbps	113,180	65,137	17,093

[Source: MCMC]

17.7. End-to-End Transmission Service

The End-to-End Transmission Service covers two Wholesale Local Leased Circuit Services and the transmission in the core network. Due to the significant cost of the submarine cable, the End-to-End Transmission Service is categorised based on whether or not it uses the domestic submarine cable between Peninsular Malaysia and Sabah and Sarawak. The resulting costs, based on a base WACC of 8.61%, are shown below. The base case assumes that 82% of total duct costs are allocated to the access network.

Table 51: End-to-End Transmission Service costs – base case

	2023	2024	2025
End-to-end transmission service (RM/month):			
Using copper access			
1 Mbps	32	30	-
Using fibre access			
10 Mbps	1,734	1,541	1,525
100 Mbps	2,114	1,868	1,839
200 Mbps	2,537	2,231	2,188
500 Mbps	3,805	3,322	3,235
750 Mbps	4,861	4,231	4,107
1 Gbps	5,918	5,140	4,980
3 Gbps	14,371	12,410	11,959
5 Gbps	22,824	19,681	18,938
End-to-end transmission service with submarine cable (RM/month):			
Using copper access			
1 Mbps	34	32	-
Using fibre access			
10 Mbps	1,756	1,560	1,545
100 Mbps	2,336	2,064	2,034
200 Mbps	2,980	2,624	2,578
500 Mbps	4,914	4,304	4,209
750 Mbps	6,525	5,705	5,569
1 Gbps	8,136	7,105	6,928
3 Gbps	21,025	18,305	17,804
5 Gbps	33,913	29,506	28,680

[Source: MCMC]

The costs of End-to-End Transmission decreases with time following the cost trend of active equipment and fibre cables.

As a sensitivity analysis two alternative scenarios were tested. The first scenario uses the high case WACC of 9.61%. The second scenario assumes that 50% of the duct costs are allocated to the aggregation and core network. The results of these two scenarios are shown below.

Table 52: End-to-End Transmission Service costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
End-to-end transmission service (RM/month):			
Using copper access			
1 Mbps	33	31	-
Using fibre access			
10 Mbps	1,792	1,603	1,587
100 Mbps	2,182	1,941	1,911
200 Mbps	2,615	2,316	2,272
500 Mbps	3,914	3,442	3,353
750 Mbps	4,997	4,380	4,255
1 Gbps	6,080	5,318	5,516
3 Gbps	14,743	12,825	12,367
5 Gbps	23,407	20,331	19,577
End-to-end transmission service with submarine cable (RM/month):			
1 Mbps using copper access	35	33	-
10 Mbps	1,815	1,623	1,607
100 Mbps	2,411	2,145	2,114
200 Mbps	3,073	2,725	2,677
500 Mbps	5,060	4,464	4,367
750 Mbps	6,716	5,913	5,774
1 Gbps	8,372	7,362	7,182
3 Gbps	21,618	18,955	18,445
5 Gbps	34,864	30,548	29,708

[Source: MCMC]

Table 53: End-to-End Transmission Service costs, WACC = 8.61% and assuming 50% of duct costs are allocated to the aggregation and core network – sensitivity test

	2023	2024	2025
End-to-end transmission service (RM/month):			
Using copper access			
1 Mbps	32	30	-
Using fibre access			
10 Mbps	1,741	1,548	1,532
100 Mbps	2,229	1,974	1,947
200 Mbps	2,771	2,447	2,408
500 Mbps	4,399	3,866	3,790
750 Mbps	5,755	5,049	4,942
1 Gbps	7,111	6,232	6,095
3 Gbps	17,959	15,696	15,312
5 Gbps	28,808	25,159	24,530
End-to-end transmission service with submarine cable (RM/month):			
Using copper access			
1 Mbps	35	32	-
Using fibre access			
10 Mbps	1,763	1,567	1,551
100 Mbps	2,451	2,170	2,141
200 Mbps	3,214	2,839	2,797
500 Mbps	5,506	4,848	4,764
750 Mbps	7,416	6,522	6,403
1 Gbps	9,326	8,196	8,042
3 Gbps	24,605	21,587	21,153
5 Gbps	39,884	34,978	34,265

[Source: MCMC]

As in the case of Trunk Transmission, allocating equal proportions of duct costs to access and core networks has a considerable impact on the cost of End-to-End Transmission services. The increase in cost becomes more significant with increasing service data rates.

The costs for installation of the End-to-End Transmission Service, shown below, are increasing over time due to increasing labour costs.

Table 54: End-to-End Transmission Service – installation costs

	2023	2024	2025
End-to-End transmission installation (RM/service)	4,874	5,020	5,171

[Source: MCMC]

The MCMC proposes to regulate prices for End-to-End Transmission Service based on the service costs in Table 51 and Table 54. A glide path has been applied for End-to-End Transmission Service, shown in Table 55, as there was a significant decline in modelled costs.

Table 55: End-to-End Transmission Service – proposed regulated prices

	2023	2024	2025
End-to-end transmission service (RM/month):			
1 Mbps	69	30	-
10 Mbps	1,346	1,435	1,525
100 Mbps	1,876	1,858	1,839
200 Mbps	2,467	2,327	2,188
500 Mbps	4,236	3,736	3,235
750 Mbps	5,710	4,909	4,107
1 Gbps	7,299	6,139	4,980
3 Gbps	19,718	15,838	11,959
5 Gbps	31,742	25,340	18,938
End-to-end transmission service with submarine cable (RM/month):			
1 Mbps	82	32	-
10 Mbps	1,515	1,530	1,545
100 Mbps	3,567	2,801	2,034
200 Mbps	5,848	4,213	2,578
500 Mbps	12,690	8,449	4,209
750 Mbps	18,391	11,980	5,569
1 Gbps	24,596	15,762	6,928
3 Gbps	71,609	44,706	17,804
5 Gbps	118,227	73,454	28,680

[Source: MCMC]

17.8. IP Transit Service

IP Transit is a service for the carriage of data in digital form using Border Gateway Protocol, between an access seeker Point of Presence (**POP**) at which peering is not available and a Point of Interconnection (**POI**) at which peering is available. The model assumes that both POP and POI are at the edge of the core network where the access seeker has access to 10Gbit/s and 100Gbit/s router ports. The base case for cost calculation assumes a WACC of 8.61% and that 82% of total duct costs are allocated to the access network.

Table 56: IP Transit Service costs – base case

	2023	**2024**	**2025**
IP Transit with a speed up to 10Gbit/s (RM/month)	19,708	17,333	17,054
IP Transit with a speed from 10Gbit/s to 100Gbit/s (RM/month)	197,081	173,333	170,543

[Source: MCMC]

The cost of IP Transit falls over time due to the declining cost of active equipment and cabling.

As a sensitivity analysis one alternative scenario was tested. The scenario assumes a WACC of 9.61%. The results of this scenario are shown below.

Table 57: IP Transit Service cost, WACC = 9.61% – sensitivity test

	2023	**2024**	**2025**
IP Transit with a speed up to 10Gbit/s (RM/month)	20,571	18,227	17,948
IP Transit with a speed from 10Gbit/s to 100Gbit/s (RM/month)	205,714	182,271	179,484

[Source: MCMC]

The MCMC proposes to regulate prices for IP Transit Service, based on the service costs, as shown in Table 58 below.

Table 58: IP Transit Service – proposed regulated prices

	2023	**2024**	**2025**
IP Transit with a speed up to 10Gbit/s (RM/month)	19,708	17,333	17,054
IP Transit with a speed from 10Gbit/s to 100Gbit/s (RM/month)	197,081	173,333	170,543

[Source: MCMC]

17.9. Layer 2 HSBB Network Service with QoS

The Layer 2 HSBB Network Service with QoS covers the optical line unit (**ONU**), fibre access line, optical distribution frame (**ODF**), optical line terminal (**OLT**), gigabit passive optical network (**GPON**) card and transmission in the aggregation network to the POI with the Access Seeker. The costs also include the cost of the port. The resulting costs, based on a WACC of 8.61%, are shown below.

Table 59: Layer 2 HSBB Network Service with QoS cost – base case

	2023	2024	2025
Termination unit port (RM/month)	32.93	29.59	29.84
Layer 2 service gateway costs (RM/month):			
30 Mbps	88.86	76.96	74.46
50 Mbps	148.09	128.26	124.09
100 Mbps	296.19	256.53	248.19
250 Mbps	740.46	641.32	620.47
500 Mbps	1,480.93	1,282.64	1,240.94
600 Mbps	1,777.11	1,539.16	1,489.12
700 Mbps	2,073.30	1,795.69	1,737.31
800 Mbps	2,369.48	2,052.22	1,985.50
1000 Mbps	2,961.86	2,565.27	2,481.87

[Source: MCMC]

The costs decrease with time due to the decline in active equipment and cabling costs.

As a sensitivity analysis two alternative scenarios were tested. The first scenario uses a high case WACC of 9.61%. The second scenario assumes that the demand for copper-based broadband services i.e. Asymmetric Digital Subscriber Line (**ADSL**) and Very-high-bit-rate Digital Subscriber Line (**VDSL**) declines at a slower rate and continues until 2025. The results of these two scenarios are shown below.

Table 60: Layer 2 HSBB Network Service with QoS cost, WACC = 9.61% – sensitivity test

	2023	2024	2025
Termination unit port (RM/month)	34.11	30.91	31.23
Layer 2 service gateway costs (RM/month):			
30 Mbps	91.69	80.01	77.48
50 Mbps	152.82	133.35	129.13
100 Mbps	305.64	266.70	258.27
250 Mbps	764.09	666.74	645.67
500 Mbps	1,528.18	1,333.48	1,291.34
600 Mbps	1,833.82	1,600.18	1,549.61
700 Mbps	2,139.45	1,866.87	1,807.88
800 Mbps	2,445.09	2,133.57	2,066.15
1000 Mbps	3,056.36	2,666.96	2,582.68

[Source: MCMC]

Table 61: Layer 2 HSBB Network Service with QoS cost, WACC = 8.61% and with continuation of ADSL and VDSL services up to 2025 – sensitivity test

	2023	2024	2025
Termination unit port (RM/month)	33.04	29.61	29.68
Layer 2 service gateway costs (RM/month):			
30 Mbps	88.91	76.91	74.33
50 Mbps	148.18	128.18	123.88
100 Mbps	296.35	256.37	247.77
250 Mbps	740.88	640.92	619.42
500 Mbps	1,481.77	1,281.84	1,238.85
600 Mbps	1,778.12	1,538.21	1,486.62
700 Mbps	2,074.48	1,794.58	1,734.39
800 Mbps	2,370.83	2,050.95	1,982.16
1000 Mbps	2,963.54	2,563.69	2,477.70

[Source: MCMC]

There is only a marginal effect on the cost of Layer 2 HSBB services if ADSL/VDSL services are continued, as the contribution of copper-based broadband to core traffic compared to FTTH and HSBB is very small.

The costs for installation of Layer 2 HSBB Network Service with QoS are shown in the table below.

Table 62: Layer 2 HSBB Network Service with QoS – installation cost

	2023	2024	2025
Layer 2 HSBB installation (RM)	609	627	646

[Source: MCMC]

The costs for installation are increasing over time due to increasing labour costs.

The MCMC proposes to regulate the prices for Layer 2 HSBB Network Service with QoS, based on service costs, as shown below.

Table 63: Layer 2 HSBB Network Service with QoS – proposed regulated prices

	2023	2024	2025
Termination unit port (RM/month)	32.93	29.59	29.84
Layer 2 service gateway costs (RM/month):			
30 Mbps	88.86	76.96	74.46
50 Mbps	148.09	128.26	124.09
100 Mbps	296.19	256.53	248.19
250 Mbps	740.46	641.32	620.47
500 Mbps	1,480.93	1,282.64	1,240.94
600 Mbps	1,777.11	1,539.16	1,489.12
700 Mbps	2,073.30	1,795.69	1,737.31
800 Mbps	2,369.48	2,052.22	1,985.50
1000 Mbps	2,961.86	2,565.27	2,481.87
Layer 2 HSBB installation (RM)	609	627	646

[Source: MCMC]

17.10. Layer 3 HSBB Network Service

The Layer 3 HSBB Network Service with network service covers the ONU, fibre access line, ODF, OLT GPON card and transmission in core network to the POI with the access seeker. The costs include also the cost of the port. The resulting costs, based on a WACC of 8.61%, are shown below.

Table 64: Layer 3 HSBB Network Service costs – base case

	2023	2024	2025
Termination unit port (RM/month)	32.93	29.59	29.84
Layer 3 service gateway costs (RM/month):			
30 Mbps	91.59	79.31	76.72
50 Mbps	152.65	132.18	127.86
100 Mbps	305.31	264.37	255.72
250 Mbps	763.27	660.92	639.31
500 Mbps	1,526.55	1,321.85	1,278.62
600 Mbps	1,831.86	1,586.21	1,534.34
700 Mbps	2,137.17	1,850.58	1,790.07
800 Mbps	2,442.48	2,114.95	2,045.79
1000 Mbps	3,053.10	2,643.69	2,557.24

[Source: MCMC]

The costs decrease with time due to the decline in active equipment and cabling costs.

As a sensitivity analysis two alternative scenarios were tested. The first scenario uses the high case WACC of 9.61%. The second scenario assumes that the copper based broadband services (ADSL and VDSL) continue to be provided up to 2025. The results of these two scenarios are shown below.

Table 65: Layer 3 HSBB Network Service cost, WACC = 9.61% – sensitivity test

	2023	2024	2025
Termination unit port (RM/month)	34.11	30.91	31.23
Layer 3 service gateway costs (RM/month):			
30 Mbps	94.44	82.38	79.76
50 Mbps	157.39	137.31	132.94
100 Mbps	314.79	274.62	265.88
250 Mbps	786.97	686.54	664.69
500 Mbps	1,573.95	1,373.08	1,329.39
600 Mbps	1,888.74	1,647.69	1,595.27
700 Mbps	2,203.53	1,922.31	1,861.15
800 Mbps	2,518.32	2,196.92	2,127.02
1000 Mbps	3,147.90	2,746.15	2,658.78

[Source: MCMC]

Table 66: Layer 3 HSBB Network Service cost, WACC = 8.61% and continuation of ADSL and VDSL services up to 2025 – sensitivity test

	2023	2024	2025
Termination unit port (RM/month)	33.04	29.61	29.68
Layer 3 service gateway costs (RM/month):			
30 Mbps	91.65	79.26	76.59
50 Mbps	152.74	132.10	127.64
100 Mbps	305.48	264.21	255.29
250 Mbps	763.71	660.51	638.22
500 Mbps	1,527.42	1,321.03	1,276.43
600 Mbps	1,832.91	1,585.23	1,531.72
700 Mbps	2,138.39	1,849.44	1,787.01
800 Mbps	2,443.88	2,113.65	2,042.29
1000 Mbps	3,054.85	2,642.06	2,552.87

[Source: MCMC]

Continuing ADSL/VDSL services until 2025 leads to a very small decline in Layer 3 HSBB costs due to improving economies of scale in the core network. However, the change is negligible due to the low traffic levels of copper-based broadband services compared to FTTH and HSBB.

Costs for installation of Layer 3 HSBB Network Service with network service are shown below.

Table 67: Layer 3 HSBB Network Service – installation costs

	2023	2024	2025
Layer 3 HSBB installation (RM)	609	627	646

[Source: MCMC]

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes to regulate the prices for Layer 3 HSBB Network Service, based on the service costs in Table 68, as shown below.

Table 68: Layer 3 HSBB Network Service – proposed regulated prices

	2023	2024	2025
Termination unit port (RM/month)	32.93	29.59	29.84
Layer 3 service gateway costs (RM/month):			
30 Mbps	91.59	79.31	76.72
50 Mbps	152.65	132.18	127.86
100 Mbps	305.31	264.37	255.72
250 Mbps	763.27	660.92	639.31
500 Mbps	1,526.55	1,321.85	1,278.62
600 Mbps	1,831.86	1,586.21	1,534.34
700 Mbps	2,137.17	1,850.58	1,790.07
800 Mbps	2,442.48	2,114.95	2,045.79
1000 Mbps	3,053.10	2,643.69	2,557.24
Layer 3 HSBB installation (RM)	609	627	646

[Source: MCMC]

17.11. Network Co-Location Service

The Network Co-Location Service includes physical co-location in the Access Provider's premises. Co-location includes the cost of one square metre of building space to account for the additional space needed for access to the space directly occupied by the co-located equipment. The resulting costs, in RM/month, are shown below (except for electricity consumption which is shown in RM/kWh).

Table 69: Network Co-Location Service costs – base case

	2023	2024	2025
Half copper cabinet (RM/month)	139	139	-
Half fibre distribution cabinet (RM/month)	225	222	220
Technical building (RM/month/m^2)	49	50	51
Submarine landing station (RM/month/m^2)	102	101	101
International submarine landing station (RM/month/m^2)	43	43	42
Satellite earth station (RM/month/m^2)	94	93	93
Electricity cost (RM/kWh)	0.59	0.60	0.62

[Source: MCMC]

As copper services are phased out after 2024, no cost is provided for the copper cabinet in 2025. For square metre costs in technical buildings, submarine landing stations and satellite stations, the costs follow the capital cost trend of the respective assets.

The MCMC proposes not to regulate the prices for Network Co-Location Service.

17.12. Duct and Manhole Access

The costs for Duct and Manhole Access are calculated based on a 25% share of duct and manhole costs. The resulting costs in RM/month are shown below.

Table 70: Duct and Manhole Access costs – base case

	2023	2024	2025
Lead-in ducts (RM/month)	124	126	129
Mainline ducts (RM/month)	155	158	161
Inter-exchange ducts (RM/month)	174	177	181
Lead-in manhole (RM/month)	3	3	3
Mainline manhole (RM/month)	4	4	4
Inter-exchange manhole (RM/month)	3	3	3

[Source: MCMC]

The cost increases with time due to increasing capital cost of civil infrastructure.

As a sensitivity analysis an alternative scenario was tested using the high case WACC of 9.61%, with the results shown below.

Table 71: Duct and Manhole Access costs, WACC = 9.61% – sensitivity test

	2023	2024	2025
Lead-in ducts (RM/month)	135	138	141
Mainline ducts (RM/month)	169	173	176
Inter-exchange ducts (RM/month)	191	195	199
Lead-in manhole (RM/month)	3	3	3
Mainline manhole (RM/month)	4	4	4
Inter-exchange manhole (RM/month)	3	3	3

[Source: MCMC]

The MCMC proposes to regulate the prices for duct and manhole access services, based on the service costs in Table 70above.

Question 25:

Do you have any comments on the proposed prices for the fixed services in the Access List?

PART E: MOBILE SERVICES

18. Mobile Services

18.1. Services

There are four mobile services in the Access List:

(a) Mobile Network Origination Service;
(b) Mobile Network Termination Service;
(c) MVNO Access; and
(d) Domestic Inter-Operator Roaming Service.

Consistent with the mobile model developed for the previous Public Inquiry, MCMC has adopted a total service LRIC methodology. This sets the whole network to be the increment, rather than estimating the difference in costs with and without mobile termination. It also included the costs of mobile coverage. The individual service costs include voice, SMS and MMS termination, as well as mobile data. For MVNO Access and the Domestic Inter-Operator Roaming Service, the costed services encompass on-net and off-net voice, on-net and off-net SMS, on-net and off-net MMS and data.

Following the sunset of 3G mobile technology in Malaysia, the mobile model is based on 4G technology only. This is in contrast to the previous Public Inquiry in which the modelling encompassed 2G/3G/4G technologies which were appropriate for the Malaysian market at that time.

In the current state of the market, the most critical price is for the mobile voice termination service. This price (Mobile Termination Rate (**MTR**)) is the amount a mobile network operator can charge another mobile network operator or a fixed network operator to terminate a voice call on its mobile network. Each mobile network operator has a monopoly on terminating calls to customers on its own network.

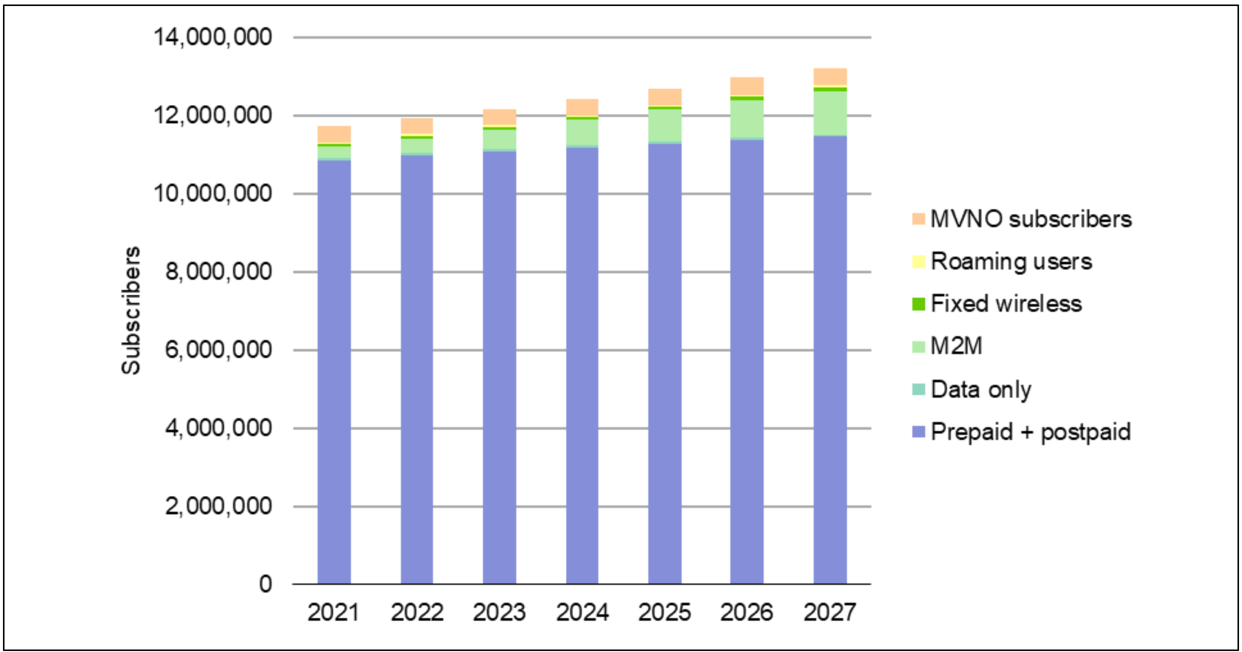
Due to the high level of termination traffic, small changes in the value of the MTR can have a large effect on the income and expenses of a mobile network operator. The MCMC has therefore developed a detailed model of mobile network operations based on extensive data from operators.

18.2. Service demands and traffic

The mobile model uses the number of active subscribers (customers) as the basic demand unit. Due to the high number of pre-paid subscribers in the mobile market, this number may be substantially less than the total number of SIMs in circulation, because subscribers often retain pre-paid SIMs after they have ceased using them.

Six mobile network operators – Celcom, Digi, Maxis, U Mobile, YTL and Webe – provided demand data for the mobile cost model. Some operators included forecasts of active subscribers. Using information from these operator forecasts, the MCMC developed its own view of the future evolution of the mobile market in Malaysia, with the notional modelled operator assumed to have a market share of 25% (including MVNO subscribers using the notional operator's network). This view is reflected in the demand forecasts for the model (Figure 3).

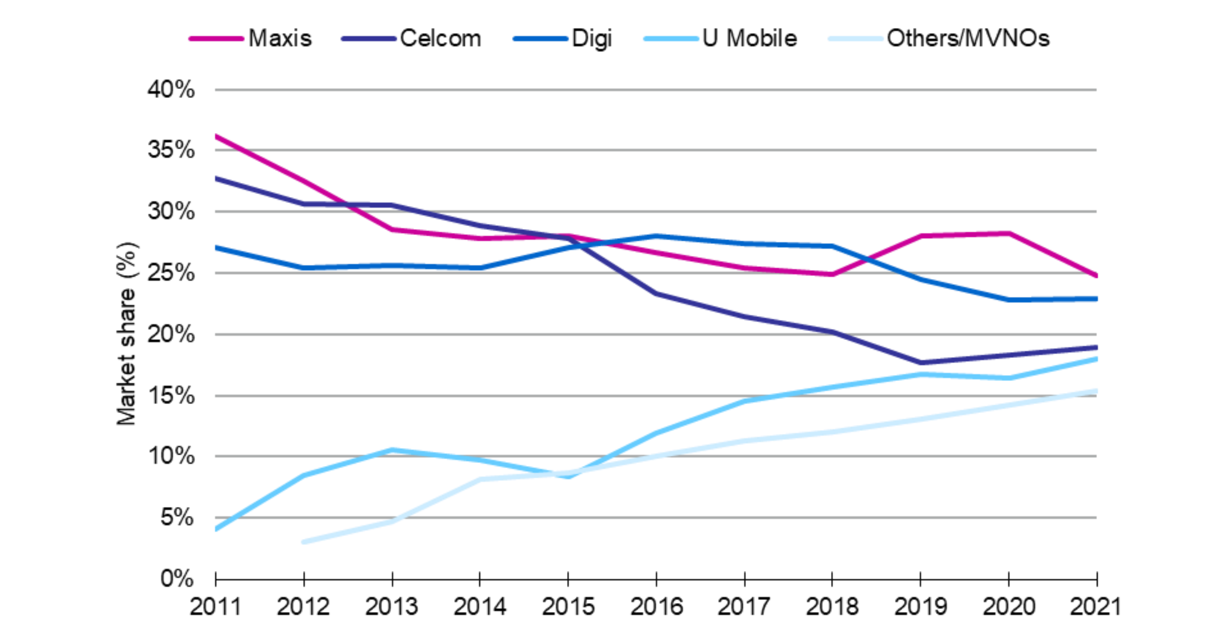
Figure 3: Mobile subscriber forecast



[Source: MCMC]

The model is for a hypothetical or "notional mobile operator", which has 25% market share. The MCMC notes that the merger of Digi and Celcom will reduce the number of players within the Malaysian market, with the merged entity likely to have market share in excess of 40%, based on 2021 subscriber volumes (Figure 4). However, the merger is expected to take place over a period of 3 years starting from 2023. As such, the 25% market share assumption represents an efficient level of demand in a market with four major operators.

Figure 4: Mobile operator market share



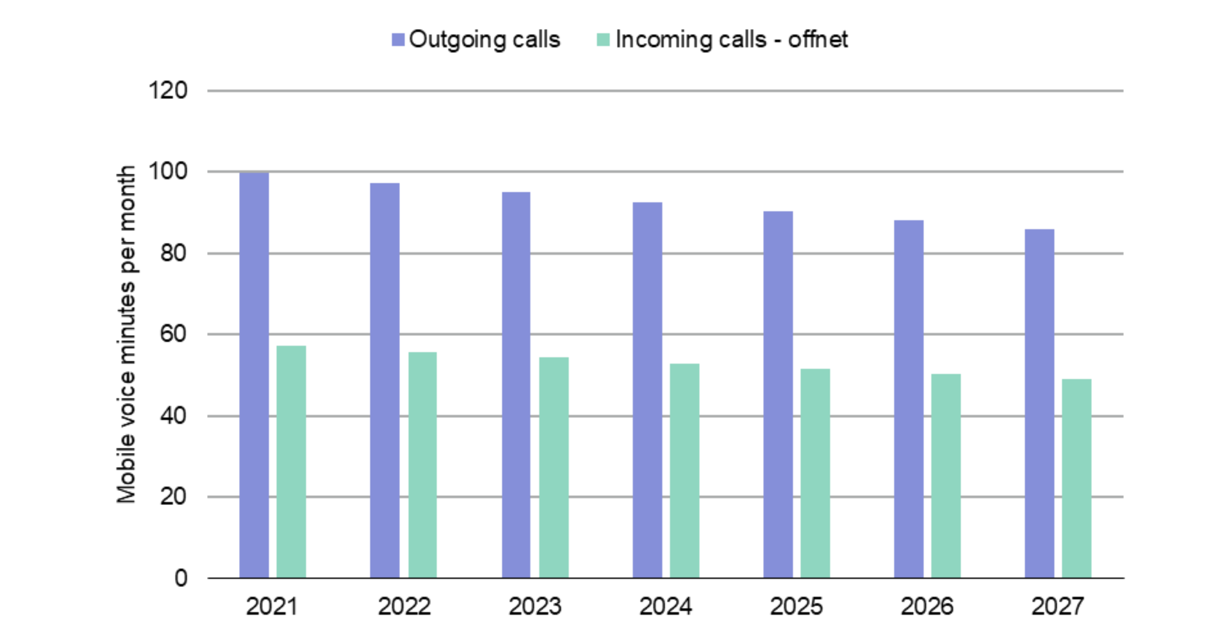
[Source: MCMC]

Question 26: Do you have any comments on the proposed market share assumption for the Notional Operator?

The operators also provided data on network demand – minutes of voice calls, numbers of messages for SMS and MMS, and megabytes of data for data services – generated by the mobile customers. This data was cross-checked with figures provided to the MCMC in past years and data provided by operators for traffic carried between them.

Operator data indicated that a declining trend is observable in both incoming and outgoing mobile voice minutes per subscriber per month. The MCMC has assumed that this trend will continue at the rate of -2.5% annually (Figure 5).

Figure 5: Forecast voice minutes per subscriber per month



[Source: MCMC]

Messaging traffic is exhibiting a declining trend over time. Informed by operator information the model assumptions for SMS and MMS traffic are shown in Table 72.

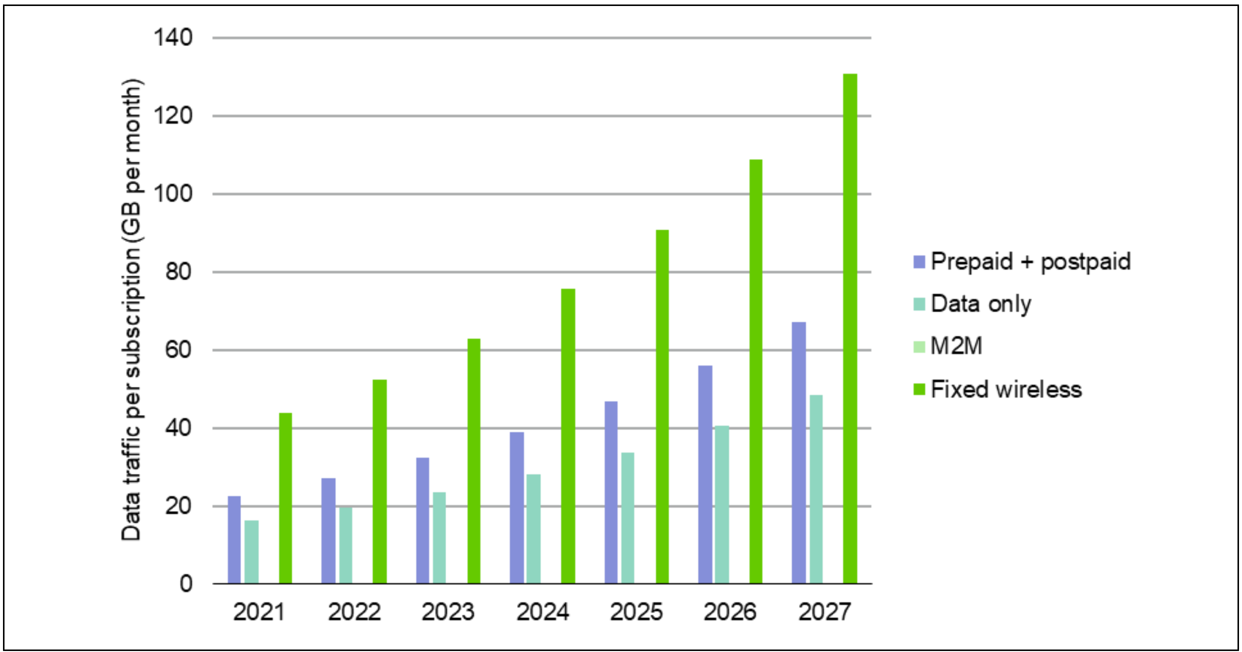
Table 72: Forecast average messages per subscriber per month

	2021	2022	2023	2024	2025	2026	2027
SMS – outgoing	7.7	6.1	4.9	3.9	3.1	2.5	2.0
SMS – incoming (off-net)	2.6	2.0	1.6	1.3	1.0	0.8	0.7
MMS – outgoing	0.032	0.026	0.020	0.016	0.013	0.010	0.008
MMS – incoming (off-net)	0.013	0.010	0.008	0.007	0.005	0.004	0.003

[Source: MCMC]

In contrast to mobile voice services, mobile data traffic has been increasing rapidly in recent years in Malaysia. The MCMC has assumed that this increase will continue at the rate of 20% annually (Figure 6).

Figure 6: Forecast data traffic per subscription per month by type of service



[Source: MCMC]

For the notional operator, the MCMC has calculated the average usage per subscriber for each service. These figures are inputs to the model and multiplied by the average number of subscribers in each year to derive the total service volume.

Demand on the notional operator's network is assumed to be only the 4G proportion of total traffic. A portion of the data traffic is assumed to use DNB's 5G standalone service (Table 73), while all voice and SMS traffic is carried by the 4G network.

Table 73: Assumed proportion of data traffic carried on 5G

	2022	2023	2024	2025	2026	2027
% of data traffic on 5G	5%	15%	30%	60%	70%	80%

[Source: MCMC]

The MCMC has assumed that the notional operator will carry MVNO traffic, with the MVNO subscribers being equivalent to 0.9% share of the national postpaid and prepaid market. Per subscriber voice, SMS and data traffic is assumed to be 20% lower than that for the notional operator's own subscribers.

With regard to roaming demand, the MCMC has assumed that 2% of the national market for postpaid and prepaid market would be potential roamers, with 5% of those subscribers roaming on the notional operator's network at any time. Per subscriber voice, SMS and data traffic for roamers is assumed to be the same as that for the notional operator's own subscribers.

Question 27:

Do you have any comments on the proposed assumptions for the Notional Operator's services and volumes?

18.3. Spectrum allocations and coverage

The availability of radio spectrum to each operator plays a key role in determining the costs of network rollout. Lower frequencies have superior propagation characteristics, leading to lower costs for providing coverage.

The current allocations of radio spectrum to the mobile operators are shown in Table 74 below. It will be seen that the Notional Operator in the model is assumed to have a spectrum allocation of:

(a) 2 × 10MHz of paired spectrum in the 900MHz band;
(b) 2 × 20MHz of paired spectrum in the 1800MHz band;
(c) 2 × 15MHz of paired spectrum in the 2.1GHz band; and
(d) 2 × 10MHz in the 2.6GHz band.

Table 74: Spectrum holdings (MHz) of the four largest mobile operators and for the notional operator

Operator	900 MHz	1800 MHz	2100 MHz	2600 MHz
Celcom	2x10MHz	2x20MHz	2x15MHz + 5MHz	2x10MHz
Digi	2x5MHz	2x20MHz	2x15MHz + 5MHz	2x10MHz
Maxis	2x10MHz	2x20MHz	2x15MHz + 5MHz	2x10MHz
U Mobile	2x5MHz	2x15MHz	2x15MHz + 5MHz	2x10MHz
Notional Operator	**2x10MHz**	**2x20MHz**	**2x15MHz**	**2x10MHz**

[Source: MCMC]

The geographical area coverage assumptions used in the model are shown in Table 75 and are assumed to remain constant for the model time-period.

Table 75: Coverage assumptions

Geographic area	Coverage	Total area with mobile coverage (sq km)
Urban	100%	848
Suburban	95%	6,688
Rural	85%	71,613
Remote	30%	71,693

[Source: MCMC]

Question 28:

Do you have any comments on the proposed approach to the radio spectrum and coverage assumptions?

18.4. Mobile network model

The model calculates the quantities of network elements (such as base stations) required by the radio access network (**RAN**) and core network to meet the notional operator's coverage targets and carry the forecast traffic. In urban and suburban areas, one would expect the network size to be driven by peak traffic requirements as well as coverage. The model determines the number of elements required to provide satisfactory service in the busy hour and dimensions the network to support the demand. For voice, 7% of busy day traffic is assumed to occur in the busy hour, while for SMS and data the assumptions are 10% and 6% respectively.

The most significant proportion of the cost is associated with the RAN and hence these cost elements have been modelled in some detail. However, most of the transport network is treated as a lump sum cost in the model rather than being demand-driven.

Question 29:

Do you have any comments on the busy hour traffic assumptions?

18.5. Radio network costs

In addition to the costs of network elements, mobile providers have costs associated with their radio access networks. Apparatus Assignment (**AA**) fees are incurred for each base station and microwave link. In addition, the model includes an annual spectrum charge, based on MNO information. These are assumed to be constant over the regulatory timeframe (Table 76).

Table 76: Annualised fees

Fees	Annual cost per network element (RM)
Base station – 4 band	660
Base station – 3 band	550
Base station – 2 band	420
Microwave link	2,120
Spectrum fee	182,534,414

[Source: MCMC]

18.6. Other cost inputs

In general, the input costs used in the model were derived by averaging the inputs provided by the operators, although in some cases it was necessary to exclude inputs from the averaging process. Typically, this occurred when there were significant outliers, or it was evident that the submitted costs were not directly comparable.

18.7. USP

The model incorporates the cost of the USP levy via a mark-up of 6% on the cost per unit demand. No USP compensation payments are included.

18.8. Cost mark-ups

The model includes a mark-up of 22.18% to account for fixed and common costs or overheads. The overheads exclude retail costs but include common business overheads such as non-operational buildings, corporate IT, vehicles and other corporate overhead. Excluded retail costs encompass handsets, subsidies, dealer payments, promotions, customer support, sales and marketing.

For the notional operator, the mark-up is derived by reference to the top-down costs provided by the four major mobile operators.

Table 77: Estimated overhead mark-ups

	2020	2021	Average
Range	19.41% - 28.42%	20.24% - 27.06%	19.82%- 27.74%
Notional operator	-	-	22.18%

[Source: MCMC]

A mark-up of 0.5% is also applied to the cost per unit demand for the network licence fee.

Question 30:
Do you have any comments on the design and cost assumptions for the 4G mobile model?

18.9. Access List service costs

The model produces estimates of the cost of a range of services, including, but not limited to those in the Access List. The inclusion of services not currently in the Access List does not imply any intention on the MCMC's part to add these to the Access List. Rather, inclusion is necessary to account for all the traffic carried by the notional operator and so the range of services is necessarily broad. The costs calculated by the model are presented in the table below. These costs are based on the base case assumptions, including a WACC of 9.04%.

Table 78: Mobile service costs – base case

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0532	0.0548	0.0590
SMS termination	sen per Message	0.0403	0.0509	0.0643
MMS termination	sen per Message	24.1749	30.5337	38.5913
Data	RM per GB	0.7065	0.7205	0.8786
Roaming				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3499	61.0675	77.1826
Data	RM per GB	0.7072	0.7212	0.8796
MVNO Access				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3499	61.0675	77.1826
Data	RM per GB	0.7071	0.7210	0.8794

[Source: MCMC]

Data traffic dominates network demand, with voice traffic being relatively insignificant. Thus, in the allocation of costs, only a small proportion is assigned to voice. Costs per unit demand increase over time – in the case of voice and SMS, this is due to declining levels of total traffic. Although the volume of data traffic steadily increases, that proportion which is carried over 4G also declines, as more and more data traffic will be shifting to 5G. These reductions in traffic volumes result in a lower level of utilisation of relatively fixed network assets, leading to increasing costs per unit demand.

These numbers provide the "base case" for the consideration of regulated mobile prices. Following the MCMC precedent, it was decided to use tilted annuities as the means of annualising capital costs over time.

Question 31: Do you have any comments on the service costs calculated by the 4G mobile model?

18.10. Sensitivity analysis

This section provides additional results from the model to demonstrate how the final calculated prices change with modifications to key parameters.

18.11. WACC value

The WACC value is a key parameter in that it determines the return on capital required for a suitable return to investors. It was estimated in Section 10 that the WACC for mobile fell within a range with lower and upper bounds of 8.38% and 9.95%, respectively.

The following tables show the effect on mobile interconnection rates for the standard notional operator inputs of WACC values at the upper and lower bound of the estimated range.

Table 79: Mobile service costs, WACC = 9.95% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0539	0.0555	0.0597
SMS termination	sen per Message	0.0412	0.0521	0.0658
MMS termination	sen per Message	24.7359	31.2423	39.4869
Data	RM per GB	0.7132	0.7272	0.8865
Roaming				
Voice on-net	sen per Minute	0.0999	0.1029	0.1105
Voice off-net	sen per Minute	0.1078	0.1110	0.1194
SMS on-net	sen per Message	0.0824	0.1041	0.1316
SMS off-net	sen per Message	0.0825	0.1041	0.1316
MMS on-net	sen per Message	49.4656	62.4782	78.9667
MMS off-net	sen per Message	49.4719	62.4847	78.9738
Data	RM per GB	0.7139	0.7279	0.8875
MVNO Access				
Voice on-net	sen per Minute	0.0999	0.1029	0.1105
Voice off-net	sen per Minute	0.1078	0.1110	0.1194
SMS on-net	sen per Message	0.0824	0.1041	0.1316
SMS off-net	sen per Message	0.0825	0.1041	0.1316
MMS on-net	sen per Message	49.4656	62.4782	78.9667
MMS off-net	sen per Message	49.4719	62.4847	78.9738
Data	RM per GB	0.7138	0.7278	0.8874

[Source: MCMC]

Table 80: Mobile service costs, WACC = 8.38% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0528	0.0544	0.0585
SMS termination	sen per Message	0.0396	0.0500	0.0633
MMS termination	sen per Message	23.7748	30.0283	37.9525
Data	RM per GB	0.7018	0.7156	0.8729
Roaming				
Voice on-net	sen per Minute	0.0978	0.1008	0.1083
Voice off-net	sen per Minute	0.1056	0.1087	0.1170
SMS on-net	sen per Message	0.0792	0.1001	0.1265
SMS off-net	sen per Message	0.0792	0.1001	0.1265
MMS on-net	sen per Message	47.5434	60.0503	75.8980
MMS off-net	sen per Message	47.5496	60.0566	75.9050
Data	RM per GB	0.7024	0.7163	0.8739
MVNO Access				
Voice on-net	sen per Minute	0.0978	0.1008	0.1083
Voice off-net	sen per Minute	0.1056	0.1087	0.1170
SMS on-net	sen per Message	0.0792	0.1001	0.1265
SMS off-net	sen per Message	0.0792	0.1001	0.1265
MMS on-net	sen per Message	47.5434	60.0503	75.8980
MMS off-net	sen per Message	47.5496	60.0566	75.9050
Data	RM per GB	0.7023	0.7162	0.8738

[Source: MCMC]

18.12. Subscribers

If the number of subscribers is increased or decreased, the traffic generated will also increase or decrease. The impact of varying the subscriber forecasts by 10% is shown in the tables below. As expected, the cost per unit demand decreases if subscriber numbers increase.

Table 81: Mobile services costs, subscribers increased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0492	0.0506	0.0544
SMS termination	sen per Message	0.0367	0.0464	0.0586
MMS termination	sen per Message	22.0381	27.8346	35.1798
Data	RM per GB	0.6799	0.6929	0.8372
Roaming				
Voice on-net	sen per Minute	0.0910	0.0937	0.1006
Voice off-net	sen per Minute	0.0983	0.1012	0.1088
SMS on-net	sen per Message	0.0735	0.0928	0.1173
SMS off-net	sen per Message	0.0735	0.0928	0.1173
MMS on-net	sen per Message	44.0702	55.6633	70.3530
MMS off-net	sen per Message	44.0761	55.6693	70.3596
Data	RM per GB	0.6805	0.6935	0.8381
MVNO Access				
Voice on-net	sen per Minute	0.0910	0.0937	0.1006
Voice off-net	sen per Minute	0.0983	0.1012	0.1088
SMS on-net	sen per Message	0.0735	0.0928	0.1173
SMS off-net	sen per Message	0.0735	0.0928	0.1173
MMS on-net	sen per Message	44.0702	55.6633	70.3530
MMS off-net	sen per Message	44.0761	55.6693	70.3596
Data	RM per GB	0.6804	0.6934	0.8380

[Source: MCMC]

Table 82: Mobile services costs, subscribers decreased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0582	0.0599	0.0645
SMS termination	sen per Message	0.0446	0.0564	0.0712
MMS termination	sen per Message	26.7709	33.8126	42.7356
Data	RM per GB	0.7392	0.7544	0.9288
Roaming				
Voice on-net	sen per Minute	0.1081	0.1114	0.1197
Voice off-net	sen per Minute	0.1164	0.1199	0.1291
SMS on-net	sen per Message	0.0892	0.1127	0.1424
SMS off-net	sen per Message	0.0892	0.1127	0.1425
MMS on-net	sen per Message	53.5350	67.6185	85.4637
MMS off-net	sen per Message	53.5417	67.6253	85.4712
Data	RM per GB	0.7399	0.7552	0.9300
MVNO Access				
Voice on-net	sen per Minute	0.1081	0.1114	0.1197
Voice off-net	sen per Minute	0.1164	0.1199	0.1291
SMS on-net	sen per Message	0.0892	0.1127	0.1424
SMS off-net	sen per Message	0.0892	0.1127	0.1425
MMS on-net	sen per Message	53.5350	67.6185	85.4637
MMS off-net	sen per Message	53.5417	67.6253	85.4712
Data	RM per GB	0.7398	0.7550	0.9298

[Source: MCMC]

18.13. Voice calls

Variation in the assumed voice traffic per subscriber has a significant impact on the resultant cost per unit demand for voice termination, as is shown in the tables below, as the largely fixed network costs are allocated across a greater or lower input demand. This also affects the cost per unit demand for the other services, due to changes in the shares of costs allocated across the different services.

Table 83: Mobile services costs, voice traffic per subscriber increased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0496	0.0511	0.0551
SMS termination	sen per Message	0.0403	0.0509	0.0643
MMS termination	sen per Message	24.1748	30.5336	38.5912
Data	RM per GB	0.7065	0.7209	0.8786
Roaming				
Voice on-net	sen per Minute	0.0918	0.0946	0.1018
Voice off-net	sen per Minute	0.0993	0.1022	0.1103
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3496	61.0672	77.1823
Data	RM per GB	0.7071	0.7216	0.8796
MVNO Access				
Voice on-net	sen per Minute	0.0918	0.0946	0.1018
Voice off-net	sen per Minute	0.0993	0.1022	0.1103
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3496	61.0672	77.1823
Data	RM per GB	0.7070	0.7215	0.8794

[Source: MCMC]

Table 84: Mobile services costs, voice traffic per subscriber decreased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0576	0.0593	0.0637
SMS termination	sen per Message	0.0403	0.0509	0.0643
MMS termination	sen per Message	24.1751	30.5339	38.5914
Data	RM per GB	0.7066	0.7205	0.8787
Roaming				
Voice on-net	sen per Minute	0.1071	0.1104	0.1182
Voice off-net	sen per Minute	0.1153	0.1187	0.1273
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3502	61.0678	77.1829
Data	RM per GB	0.7073	0.7212	0.8798
MVNO Access				
Voice on-net	sen per Minute	0.1071	0.1104	0.1182
Voice off-net	sen per Minute	0.1153	0.1187	0.1273
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3502	61.0678	77.1829
Data	RM per GB	0.7072	0.7211	0.8796

[Source: MCMC]

18.14. SMS and MMS

While variation in the volume of SMS and MMS messages per subscriber have an effect on the cost per message, there is little impact on the costs per unit demand for other services. As indicated by information provided by the mobile network operators, messaging traffic is in decline as users increasingly adopt other services, typically OTT messaging applications.

Table 85: Mobile services costs, messaging traffic per subscriber increased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0532	0.0548	0.0590
SMS termination	sen per Message	0.0367	0.0464	0.0586
MMS termination	sen per Message	22.0386	27.8352	35.1805
Data	RM per GB	0.7065	0.7205	0.8786
Roaming				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0735	0.0928	0.1173
SMS off-net	sen per Message	0.0735	0.0928	0.1173
MMS on-net	sen per Message	44.0709	55.6640	70.3540
MMS off-net	sen per Message	44.0771	55.6703	70.3610
Data	RM per GB	0.7072	0.7212	0.8796
MVNO Access				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0735	0.0928	0.1173
SMS off-net	sen per Message	0.0735	0.0928	0.1173
MMS on-net	sen per Message	44.0709	55.6640	70.3540
MMS off-net	sen per Message	44.0771	55.6703	70.3610
Data	RM per GB	0.7071	0.7210	0.8794

[Source: MCMC]

Table 86: Mobile services costs, messaging traffic per subscriber decreased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0532	0.0548	0.0590
SMS termination	sen per Message	0.0446	0.0564	0.0712
MMS termination	sen per Message	26.7702	33.8120	42.7348
Data	RM per GB	0.7065	0.7205	0.8786
Roaming				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0892	0.1127	0.1424
SMS off-net	sen per Message	0.0892	0.1127	0.1424
MMS on-net	sen per Message	53.5342	67.6177	85.4625
MMS off-net	sen per Message	53.5405	67.6240	85.4695
Data	RM per GB	0.7072	0.7212	0.8796
MVNO Access				
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0892	0.1127	0.1424
SMS off-net	sen per Message	0.0892	0.1127	0.1424
MMS on-net	sen per Message	53.5342	67.6177	85.4625
MMS off-net	sen per Message	53.5405	67.6240	85.4695
Data	RM per GB	0.7071	0.7210	0.8794

[Source: MCMC]

18.15. Mobile data

Mobile traffic is dominated by data, and thus variations in the data traffic per subscriber have a significant effect on the cost per GB. The impact on the other services is relatively low, as the relevant traffic volumes are relatively insignificant compared to those of data traffic. In general, greater volumes of data traffic result in lower costs per unit demand. The results are shown in the table below.

Table 87: Mobile services costs, data traffic per subscriber increased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0528	0.0543	0.0583
SMS termination	sen per Message	0.0403	0.0509	0.0643
MMS termination	sen per Message	24.1746	30.5334	38.5907
Data	RM per GB	0.6797	0.6928	0.8368
Roaming				
Voice on-net	sen per Minute	0.0979	0.1009	0.1079
Voice off-net	sen per Minute	0.1056	0.1087	0.1165
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3430	61.0605	77.1745
MMS off-net	sen per Message	48.3491	61.0667	77.1814
Data	RM per GB	0.6803	0.6935	0.8378
MVNO Access				
Voice on-net	sen per Minute	0.0979	0.1009	0.1079
Voice off-net	sen per Minute	0.1056	0.1087	0.1165
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3430	61.0605	77.1745
MMS off-net	sen per Message	48.3491	61.0667	77.1814
Data	RM per GB	0.6802	0.6934	0.8376

[Source: MCMC]

Table 88: Mobile services costs, data traffic per subscriber decreased by 10% – sensitivity test

Service	Unit	2023	2024	2025
Voice termination	sen per Minute	0.0538	0.0554	0.0599
SMS termination	sen per Message	0.0403	0.0509	0.0643
MMS termination	sen per Message	24.1754	30.5342	38.5920
Data	RM per GB	0.7392	0.7546	0.9291
Roaming				
Voice on-net	sen per Minute	0.0997	0.1027	0.1107
Voice off-net	sen per Minute	0.1076	0.1108	0.1197
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3444	61.0620	77.1768
MMS off-net	sen per Message	48.3508	61.0684	77.1840
Data	RM per GB	0.7400	0.7554	0.9302
MVNO Access				
Voice on-net	sen per Minute	0.0997	0.1027	0.1107
Voice off-net	sen per Minute	0.1076	0.1108	0.1197
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3444	61.0619	77.1768
MMS off-net	sen per Message	48.3508	61.0684	77.1840
Data	RM per GB	0.7398	0.7552	0.9300

[Source: MCMC]

18.16. Proposed regulated prices

The considerations of the previous sections suggest that regulated prices for mobile origination and termination should be set using the inputs for an operator with 25% market share. Prices at this level provide appropriate incentives for market competition, investment in new technologies and service innovation to promote greater usage of new technologies.

While the MCMC has powers to set regulated prices for messaging services, there is no clear need to do so. For SMS and MMS messaging services, the operators enter into agreements that may assume symmetry of traffic and involve no settlements; or may charge for interconnection at a low rate per message.

The MCMC proposes to set regulated prices for voice interconnection for Mobile Network Origination, Mobile Network Termination Services, MVNO Access and Domestic Inter-Operator Roaming Service. The proposed prices are based on those calculated for the notional operator inputs to the mobile model. It is necessary, however, to avoid abrupt changes that may prove disruptive to the industry. The MCMC has therefore used a glide path from the previous regulated rates for origination and termination to the calculated LRIC rates in 2025.

The proposed regulated prices are shown in the following tables.

Table 89: Mobile Network Origination Service Proposed Prices

Voice call origination	Units	2023	2024	2025
National	sen/min	0.680	0.369	0.059

[Source: MCMC]

Table 90: Mobile Network Termination Proposed Prices

Voice call termination	Units	2023	2024	2025
National	sen/min	0.680	0.369	0.059

[Source: MCMC]

Table 91: MVNO Access Proposed Prices

	Units	2023	2024	2025
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3499	61.0675	77.1826
Data	RM per GB	0.7071	0.7210	0.8794

[Source: MCMC]

Table 92: Domestic Inter-Operator Roaming Service Proposed Prices

	Units	2023	2024	2025
Voice on-net	sen per Minute	0.0987	0.1017	0.1092
Voice off-net	sen per Minute	0.1065	0.1096	0.1180
SMS on-net	sen per Message	0.0806	0.1018	0.1286
SMS off-net	sen per Message	0.0806	0.1018	0.1286
MMS on-net	sen per Message	48.3436	61.0611	77.1756
MMS off-net	sen per Message	48.3499	61.0675	77.1826
Data	RM per GB	0.7072	0.7212	0.8796

[Source: MCMC]

Question 32:

Do you have any comments on the proposed regulated prices for mobile services?

PART F: 5G SERVICES

19. 5G services

19.1. Services

The Access List includes two modes of 5G access:

- 4G Evolved Packet Core (**EPC**) with 5G Radio Access Network (**RAN**) Access (**NSA**); and
- 5G Standalone Access (**SA**).

As 5G spectrum has been allocated solely to wholesale access provider DNB, 5G deployment in Malaysia comprises a multi-operator core network (**MOCN**) so that mobile network operators may integrate their own 4G core networks with DNB's 5G RAN as well 5G SA where DNB deploys core network.

19.2. 5G network model

The MCMC has examined a number of alternative approaches for the 5G network model and in doing so carefully considered the characteristics of Malaysia's new wholesale 5G operation. Consistent with its regulatory responsibilities and duties, the MCMC seeks to ensure that the access network provider has appropriate incentives to continue investing in its network in the medium to long-term. In this respect, the costing approach must ensure that the access provider receives sufficient compensation for reasonable costs it incurs over time so that the required quality of service is maintained. At the same time, the modelling should promote appropriate incentives for efficiency to serve the LTBE.

The MCMC decided against replacing the LRIC methodology with the use of a FAC approach as the latter would not be in the LTBE. With no incentives to improve efficiency and direct passthrough to access seekers of all costs incurred (whether efficient or not), ultimately upward pressure on retail prices may occur.

The MCMC also considered whether a RAB or step-by-step approach would be appropriate. This approach involves using the actual asset base as the basis for wholesale price setting. However, many of the key reasons for adopting the regulated asset base approach do not apply in relation to DNB. In particular DNB is not operating a legacy network, but is constructing a new network. One of the main drivers for the adoption of RAB costing approach in some telecommunications regulatory regimes (for example, in Australia) was the need to reflect previous depreciation of actual assets in legacy networks to avoid over-recovery of cost when assets are revalued at optimised replacement cost under a LRIC approach. Clearly this is not an issue in the DNB context, given that new assets are being purchased at the present time.

The MCMC considers that from a techno-economic perspective, the cost modelling approach for 5G should be similar to developing a LRIC cost model for a 4G network, as the service definitions are similar, and the RAN differs mainly in the capacity. Bottom-up LRIC modelling of the 5G core is feasible and is typically based on approaches used to price cloud computing services. However, at the same time the MCMC notes that 5G core networks are in their infancy and their techno-economic characteristics are not yet well established. As such the MCMC has opted to develop a LRIC model encompassing transparent bottom-up costs where feasible, while the 5G core is costed top-down using actual DNB costs.

Thus, the model represents a hypothetical efficient Malaysian 5G wholesale operator and delivers a cost-based price with a reasonable return for each year of the model timeframe. The model has a base year of 2022 and extends to 2027. Following the LRIC approach, each year the network is constructed anew with sufficient capacity to carry the demand forecast for that year. Economic depreciation represented by a tilted annuity approach is applied, together with a mark-up for indirect (overhead) costs based on benchmark data.

The increment for the 5G model is the entire network. This means that it was not necessary to subtract a 'coverage network' from a 'capacity network'. The reason for this is that the entire network is being effectively driven by a single base product – if that product was used as the increment there is essentially no remaining demand on the network that could be used to recover costs.

The model uses information on DNB's coverage area to estimate the number of base stations required for geographic coverage. Additional base stations are installed as required to meet demand for capacity. The number of base stations drives other costs in the model, such as apparatus assignment fees and backhaul transmission.

Question 33:

Do you have any comments on the proposed modelling approach for 5G?

19.3. Data for the model

As DNB's 5G wholesale access services have been included in the Access List, the MCMC must have regard to established precedent in costing such services: namely, application of a "reasonably efficient" standard. As such, the MCMC has used all sources of information available to ensure that the model reflects a level of efficiency appropriate for the provision of wholesale 5G services in Malaysia. This includes information provided by DNB, other mobile network operators and respected international sources such as the GSM Association (**GSMA**).

DNB provided data for the model, in the form of a top-down business case with some bottom-up information. The MCMC also sent a 5G data request to the MNOs, given that many had conducted 5G trials and therefore were likely to have useful information. The data request included several questions regarding the MNOs' expectations for core, MOCN, network slicing and MVNO access, and most MNOs provided responses. Data provided by MNOs included: information on resource capacities, spectral efficiency, unit costs for RAN, sites and backhaul. Limited information was provided on core costs.

Question 34:

Do you have any comments on the MCMC's proposed use of data in the 5G model?

19.4. Service demand and traffic

The MCMC developed 5G demand forecasts for input to the cost model based on a model of the Malaysian mobile market as well as information provided by DNB and the MNOs. These forecasts are shown in Table 93. In general, the MCMC's forecast is lower than DNB's forecast in the earlier years and higher in the later years.

Demand is expressed in terms of bandwidth (Gbit/s) which is split across three geotypes (heavy, middle and light), which correspond to the geotypes used in DNB's own top-down cost model. This enabled the LRIC model to perform a similar selection of base station types as that performed by DNB's model. It is assumed that each year 90% of the demand will be for 4G EPC with 5G RAN, and 10% will be for the SA service (Table 93).

Table 93: 5G demand forecast, 2022 to 2027 (Gbit/s)

	2022	2023	2024	2025	2026	2027
Total peak traffic (Gbit/s)	330	1,200	2,908	7,047	9,957	13,778
4G EPC with 5G RAN	297	1,080	2,617	6,342	8.961	12,400
5G SA	33	120	291	705	996	1,378

[Source: MCMC]

The MCMC assumed that downlink traffic comprises 92% of demand, with uplink traffic the remaining 8%, based on information supplied by the MNOs.

Question 35: Do you have any comments on the proposed demand forecast?

19.5. Spectrum allocation and coverage

The hypothetical mobile operator is assumed to hold the following spectrum:

(a) 700MHz – 2 × 40MHz
(b) 3.5GHz – 200MHz unpaired.

Cell radius assumptions determine the number of base stations required to deliver service to the coverage area. These assumptions, shown in the table below by area type (dense urban, urban, suburban, rural), are based on 3.5GHz spectrum.

Table 94: Cell radius assumptions by area type

Area type	Cell radius (km)
Dense urban	0.37
Urban	0.51
Suburban	0.91
Rural	3.78

[Source: MCMC]

The assumptions used for network coverage by area type are shown in Table 95.

Table 95: Roll-out by area type (square km)

	2022	2023	2024	2025	2026	2027
Dense urban	200	200	200	200	200	200
Urban	1,500	1,900	1,900	1,900	1,900	1,900
Suburban	1,700	6,000	6,500	6,500	6,500	6,500
Rural	1,400	10,900	16,400	16,400	16,400	16,400
Total	4,800	19,000	25,000	25,000	25,000	25,000

[Source: MCMC]

Spectral efficiency assumptions were based on data from the GSMA (Table 96).

Table 96: Spectral efficiency assumptions for 5G model

	Spectral efficiency (bit/s/Hz)
700MHz	2.80
3.5GHz / 32T32R	4.20
3.5GHz / 64T64R	5.60

[Source: GSMA]

As noted in Section 19.2, the model uses information on DNB's coverage area to estimate the number of base stations required for geographic coverage. The estimated number of base stations from the model is shown in the table below.

Table 97: Estimated number of base stations required for coverage

	2022	2023	2024	2025	2026	2027
Dense urban	563	563	563	563	563	563
Urban	2,220	2,812	2,812	2,812	2,812	2,812
Suburban	791	2,789	3,022	3,022	3,022	3,022
Rural	38	294	442	442	442	442
Total	3,612	6,458	6,839	6,839	6,839	6,839

[Source: MCMC]

Question 36:

Do you have any comments on the assumptions for spectrum allocation and coverage?

19.6. Additional assumptions

The MCMC has made a number of additional assumptions in the model which have an impact on the estimated costs. These assumptions are as follows:

(a) 69% of sites are towers, with 31% rooftop;
(b) 40% of tower sites are assumed to be shared; and
(c) 100% of heavy sites, 75% of middle sites and 60% of light sites – largely those located in urban areas – use fibre for backhaul, with the remainder of the sites using microwave.

Question 37:
Do you have any comments on any of the other proposed assumptions applied in the 5G model?

19.7. Cost mark-ups

The MCMC has set the mark-up for overhead costs to be comparable with those of a Malaysian 4G operator, with an assumed value of 24.17%. Information provided by the two mobile network operators with the highest mark-ups was used as the basis for this assumption, on the grounds that there would be similarities between the overhead cost structure of such operators and a new mobile wholesale operation.

Following the same approach as for the 4G model, USP and network licence fees have been calculated as mark-ups – 6% and 0.5% respectively – to the cost per unit demand.

Question 38:
Do you have any comments on the proposed cost mark-ups?

19.8. Access List service costs

The costs calculated by the model are presented in the table below. These costs are based on the assumptions described above, including a WACC of 6.63%.

Table 98: Access List service costs, 2023 to 2025 (RM per Gbit/s per month)

	2023	2024	2025
4G EPC with 5G RAN	79,710	34,588	14,201
5G SA	111,932	49,264	20,332

[Source: MCMC]

Question 39:
Do you have any comments on the service costs calculated by the 5G model?

19.9. Sensitivity analysis

19.9.1. WACC

The WACC value is a key parameter in that it determines the return on capital required for a suitable return to investors. The following table shows the effect on modelled rates for the hypothetical operator for two alternative WACC values – one above and one below the proposed value.

Table 99: Impact of variation to the WACC assumption – sensitivity test (RM per Gbit/s per month)

	2023	2024	2025
WACC = 9.26%			
4G EPC with 5G RAN	83,480	36,196	14,851
5G SA	116,618	51,260	21,139
WACC = 4.49%			
4G EPC with 5G RAN	76,790	33,343	13,699
5G SA	108,302	47,719	19,707

[Source: MCMC]

19.9.2. Demand

Demand is a key input to the model. It drives costs, as the network needs to deploy sufficient capacity to carry the projected demand. In addition, it is an input to the determination of costs per unit demand. The following table illustrates the effect on the model results if the assumed demand is increased by 10% or decreased by 10%.

Table 100: Impact of variation to the forecast demand – sensitivity test (RM per Gbit/s per month)

	2023	2024	2025
Demand +10%			
4G EPC with 5G RAN	72,464	31,443	12,910
5G SA	101,756	44,785	18,483
Demand -10%			
4G EPC with 5G RAN	88,567	38,431	15,779
5G SA	124,369	54,738	22,591

[Source: MCMC]

19.9.3. Coverage

Model results are very sensitive to coverage assumptions as shown below. The model ensures that sufficient capacity is installed for the forecast demand. By contrast, if the hypothetical operator in the early years deployed sufficient base stations to achieve the 2025 coverage target the estimated costs for the regulatory period are higher.

Table 101: Impact of coverage target being achieved in 2023 – sensitivity test (RM per Gbit/s per month)

	2023	2024	2025
4G EPC with 5G RAN	84,345	34,588	14,201
5G SA	116,567	49,264	20,332

[Source: MCMC]

Increasing or decreasing the coverage area has a significant impact on the model results, as is shown in the following table.

Table 102: Impact of changes to the coverage area – sensitivity test (RM per Gbit/s per month)

	2023	2024	2025
Coverage area +10%			
4G EPC with 5G RAN	87,557	37,995	15,600
5G SA	119,778	52,671	21,730
Coverage area -10%			
4G EPC with 5G RAN	71,861	31,179	12,802
5G SA	104,082	45,855	18,932

[Source: MCMC]

19.9.4. Overheads

As stated in Section 19.7 the assumption for the overhead mark-up was based on information from the two mobile operators with the largest proportion of overhead costs. However, if an average mark-up is calculated using data from the four major mobile operators (the assumption used in the 4G model) then the result is reduced. This value has been used in the sensitivity test below.

Table 103: Impact of variation in the overhead mark-up – sensitivity test (RM per Gbit/s per month)

	2023	2024	2025
Mark-up = 22.18%			
4G EPC with 5G RAN	78,433	34,033	13,974
5G SA	110,138	48,474	20,006

[Source: MCMC]

Question 40:

Do you have any comments on the 5G sensitivity analysis?

19.10. Regulated prices

The proposed regulated prices are shown in Table 104: Proposed regulated prices for 5G access (RM per Gbit/s per month)

Table 104: Proposed regulated prices for 5G access (RM per Gbit/s per month)

	2023	2024	2025
4G EPC with 5G RAN	79,710	34,588	14,201
5G SA	111,932	49,264	20,332

[Source: MCMC]

Question 41:

Do you have any comments on the proposed regulated prices for 5G?

PART G: INFRASTRUCTURE SHARING

20. Mobile Infrastructure Sharing Service (Towers)

20.1. Background and Purpose

Since the previous PI, the infrastructure sharing service in the Access List has been modified. The revised service description is as follows:

(a) Infrastructure Sharing is a Facility and/or Service which comprises the following:

(i) provision of physical access, which refers to the provision of space (including rooftop space) at specified network facilities to enable an Access Seeker to install and maintain its own equipment; or
(ii) provision of access to in-building Common Antenna Systems and physical access to central equipment room.

(b) Specified network facilities include:

(i) towers and Associated Tower Sites; and
(ii) any other facility that supports, or has the capability to support, the installation of mobile or fixed network equipment in, along, or in close proximity to:
(A) a street;
(B) a road;
(C) a path;
(D) a railway corridor;
(E) a park; or
(F) such other outdoor area that may be accessed by members of the public, including but not limited to billboards, public transit shelters, poles, traffic light poles, bridges, and road gantries.

(c) Physical access includes power (including right-of-way for power installation by the Access Seeker), environmental services (such as heat, light, ventilation and air-conditioning), security, site maintenance and access for the personnel of the Access Seeker.
(d) Provision of space at Associated Tower Sites includes space where the Access Seeker may place its cabin or outdoor equipment and space required for cable gantry connecting to the tower and generator set.

To date, this service has not been subject to price regulation, with operators free to agree prices by negotiation. However, as this is a regulated service in the Access List, the MCMC has a duty to ensure that the price terms and conditions are reasonable.

The Infrastructure Sharing service is provided by a mix of nationwide operators and other providers whose footprint covers a single State, or a small number of States. A variety of structures of different designs and heights are offered.

The MCMC has analysed cost data provided by the following SBCs, other tower companies and mobile operators: Borneo Restu Sdn Bhd, Celcom Axiata Berhad, Common Tower Technologies Sdn Bhd, Desabina Industries Sdn Bhd, D'Harmoni Telco Infra Sdn Bhd, Digi, Edgepoint Towers Sdn Bhd, Edotco Malaysia Sdn Bhd, Globalcomm Solutions Sdn Bhd, Grass2route Sdn Bhd, InfraQuest Sdn Bhd, Karya Ehsan Sdn Bhd, Konsortium Jaringan Selangor Sdn Bhd, Maxis Broadband Sdn Bhd, Meba Holdings Sdn Bhd, Melaka ICT Holdings Sdn Bhd, Mutiara Smart Sdn Bhd, Ofisgate Sdn Bhd, PDC Telecommunication Services Sdn. Bhd, Perlis Comm Sdn Bhd, Perak Integrated Networks Services Sdn Bhd, Sacofa Sdn Bhd, TM, Touch Mindscape Sdn Bhd, U Mobile Sdn Bhd, XMT Technologies Sdn Bhd, and Yiked Bina Sdn Bhd.

Tower companies primarily build facilities (towers and poles) and then lease space on these facilities for antennas. The MCMC model calculates the annualised cost per site of different types of towers, which may also vary by height. This is then shared amongst several mobile operators. For example, for a standard situation in which an average of three mobile operators share a tower, the tower company divides the annual cost by three. The model does not account for mark-up in leasing with additional sharing parties nor tenure of the lease with longer durations that potentially could incur discounts. These are left to commercial negotiations.

The purpose of the MCMC cost model is to provide the MCMC with some insight into the efficient costs of providing such a service. It is therefore also necessary to consider what form of regulatory controls should be taken, including, but not limited to, the structure and level of prices that should be allowed.

20.2. Modelling approach

The MCMC proposes a simple, bottom-up model, using tilted annuities as the annualisation method and with assets valued at current cost. The prices paid by operators for assets are likely to change over time and, since the inputs are mainly a mix of property and civil engineering items, it seems likely that the cost trend will be upwards. Nevertheless, developments such as the experimental use of new materials (such as carbon fibre or bamboo) suggest that there is room for further innovation in the sector. This and the unusually large number of participants in the sector in Malaysia suggests that future structural change is possible, potentially including new entrants with more efficient technological solutions. In view of this, a costing approach using assets valued on a current cost basis and tilted annuities seems appropriate.

20.3. Modelling issues

20.3.1. Modelling precedents

A key issue for modelling this service is that there are limited sources of comparator data, in contrast to fixed and mobile models. Although tower costs are generally included in mobile models, the level of detail in terms of different options for tower structures tends to be very limited, encompassing just a small selection of structures from the range typically offered by tower companies. It is necessary therefore to apply general principles for cost modelling in a manner that is reasonably consistent with the approach adopted in the other models, but that addresses the particular characteristics of this sector.

20.3.2. Industry structure

The structure of the sector in Malaysia is unusual, if not unique, consisting of a number of localised operators, sometimes with direct ties to State government bodies, as well as nationwide networks of towers primarily composed of assets formerly belonging to mobile operators. In addition, the mobile operators themselves operate tower-sharing arrangements, often on a non-monetary exchange basis. With a plethora of different arrangements, it is challenging to identify an economically efficient configuration. Furthermore, there is little benchmark information on regulated prices available from published sources. The MCMC proposes, therefore, to model the costs of a notional tower operator on the basis of the costs provided by the operators, unless these can be shown to be clearly inefficient. This is consistent with the approach adopted by the MCMC in the previous Public Inquiry.

20.3.3. Characteristics of towers and other structures

The characteristics of towers vary considerably, including type of structure, height, and design. Such factors affect costs in different ways, making cost comparisons difficult. Furthermore, costs of individual operators may vary with the practical and economic considerations of operating in various locations, for example in dense urban areas compared to rural areas, or in Sabah and Sarawak compared to Peninsular Malaysia. In addition, with wide variation in the mix of structure and location types across operators, it is difficult to make unambiguous comparisons between one operator and the next.

As regards to other structures such as billboards, public transit shelters, poles, traffic light poles, bridges, and road gantries, the MCMC understands that tower companies consider these to be non-standard structures which are custom built. Many of the structures require unique designs to accommodate antenna with specifications differing according to the particular mobile technology and frequencies involved. As a result, installation, operation and maintenance costs vary widely. Given these considerations, it is impractical to construct a fully differentiated cost model that captures all of the possible variations in tower and other structures and geography, supported by sufficient data points for each permutation to be sure that it reflects costs of an efficient operator.

On the other hand, it is the MCMC's understanding that the pricing structures applied in the sector tend not to make detailed distinctions about tower structure by geo-types (for example urban and rural areas). Instead, towers are priced by location, i.e. Peninsular Malaysia and Sabah and Sarawak, height, number of sharing parties and tenure. In addition, the MCMC understands that property costs (such as site rental) are often treated on a "pass-through" basis. In other words, in addition to a standardised price per site for everything else, tenants are asked to pay a share of the site rental that varies from site to site to reflect local conditions and landlord demands. This is a way of offsetting the risk to the tower operator, or at least sharing it with tenants.

In conclusion, it is the MCMC's view that the cost model should primarily reflect the average level of costs for a small number of variants of a basic service, but with flexibility to substitute different elements of cost where required, or to exclude elements of cost where they are passed through.

Whilst the main objective is for the model to provide a view of the overall average cost, consistent with the previous Public Inquiry, the model should also offer some insight into the effect of different configurations on that central estimate. Tower companies have in place a wide variety of different tower types and sizes, with wide variation in unit costs. In many cases, there was only one reported instance of a specific size and type combination. This was very prevalent in relation to street furniture, where a wide variation in unit costs and structure types are deployed.

Based on tower company information, the most common standard configurations are listed in Table 105, together with the number of datapoints available from the submissions provided to the MCMC. It should be noted that available datapoints are defined as instances in which tower companies have provided sufficient information (capital and operating costs) for the purposes of cost modelling. If there was missing data in relation to a tower company's structures, it was not possible to include these in the cost model data-set. For lattice structures, heights of 45 metres, 60 metres, 75 metres and 90 metres were selected for modelling as these had the greatest number of usable datapoints. Other structures listed below were also modelled, including the two rooftop structures and the smart street pole, despite the relatively small number of datapoints.

Table 105: Structures – number of datapoints by structure and size

Structure type	Height (m)	Number of datapoints
Lattice	45	13
Lattice	60	14
Lattice	76	12
Lattice	90	5
Monopole	30	7
Monopole	45	9
Lampole	24	12
Lampole	30	16
Monopole tree	30	5
Monopole tree	45	8
Rooftop – boom	3	4
Rooftop – boom	6	3
Smart street pole	18	2

[Source: MCMC]

The annualised total tower site costs calculated by the model using tilted annuities from 2023 to 2025 with WACC of 8.77% is shown in the Table 106: Annualised Infrastructure Sharing costs – base case

Table 106: Annualised Infrastructure Sharing costs – base case

Structure	2023	2024	2025
Lattice - 45m	102,368	109,746	117,696
Lattice - 60m	108,456	116,382	124,929
Lattice - 76m	114,950	123,461	132,645
Lattice - 90m	134,128	144,365	155,430
Monopole - 30m	89,417	94,309	99,471
Monopole - 45m	104,334	110,121	116,231
Lampole - 24m	68,984	74,166	79,831
Lampole - 30m	70,392	75,756	81,628
Monopole tree - 30m	74,731	81,064	88,078
Monopole tree - 45m	85,401	93,228	101,944
Boom - 3m	83,980	88,963	94,321
Boom - 6m	85,280	90,471	96,069
Smart street pole	64,279	68,339	72,688

[Source: MCMC]

20.3.4. Per-tenant pricing

An essential part of the business model for tower companies is the possibility of sharing tower facilities with more than one tenant. This raises the issue of how such costs should be shared. The MCMC understands that the general approach is to reduce the charges to existing tenants with the addition of new tenants. However, it is not necessarily the case that costs are shared equally amongst all tenants, or that an additional tenant would reduce charges proportionately. There may be valid economic reasons for this. For example, if the risks borne by a tower operator are highest when a site is first established, then it may be in its and the initial "anchor" tenant's interests to share this risk and for the anchor tenant to benefit from some preferential treatment in return.

An alternative pricing strategy would be for the tower operator to take a risk on the number of tenants it could attract to a new tower by charging a standard price, that might be slightly higher than the average under the sliding-scale approach described above. This approach would give tenants increased certainty about their costs but might be less efficient at rewarding differential risk.

It was the MCMC's initial assumption that adding additional tenants would not add greatly to the costs borne by the tower operator. However, the MCMC is aware that commercial landlords sometimes increase the rent charged to the tower operator as new tenants are added. The prevalence of this practice is unclear, as is the magnitude of any such rental increases.

It will be evident from the above discussion that a cost model is not a tool that is very well suited to determining an appropriate scheme for sharing site costs amongst tenants. In view of this, the MCMC proposes to model the costs per site and not per tenant. The SBCs have a common price list which discounts the single-tenant price by around 43% on average for two tenants and by approximately 55% where there are three tenants. The MCMC is minded to apply these rates in relating modelled total site costs with multi-tenant prices.

20.3.5. USP costs and subsidies

The USP operates by collecting a levy from operators and distributing funds to operators who are willing to make otherwise uneconomic investments that contribute to the objectives of the programme, particularly in extending the coverage of communications services to consumers who would otherwise not be served. Tower companies have been significant beneficiaries as well as contributors to the scheme. It is appropriate to consider, therefore, how these payments into and out of the scheme should be reflected in costs.

It is intended that the costs calculated by the model should convey a view of the average costs, including an appropriate return on capital, that should be passed on to tenants through prices. To this extent, it seems clear that subsidies should be reflected in the prices paid by tenants, because the tenants also need to be incentivised to take up the space created by the tower company in order for the objective of extending coverage to be met.

On the other hand, subsidies of this kind are, by their nature, specific to certain (generally, but not exclusively, rural) areas and different operators may have a widely different balance between contributions and receipts from the fund, depending on their participation in schemes operated by the USP. It may well be relevant for the MCMC to consider the position absent the USP or considering contributions only. In this case, the model is designed with the flexibility to exclude this element, or to substitute a different value.

It is standard practice for tower operators to include in contracts a mark-up for USP of 6%. As such, this has been incorporated in the model.

Question 42:

Do you have any comments on the approach to the modelling of tower costs?

20.4. Sensitivity analysis

In addition to the point estimate assumption of a WACC at 8.77%, it was estimated in Section 12 that the WACC for towers fell within a range with lower and upper bounds of 8.25% and 8.83%, respectively. Model results on the effect of different annualised methods on these upper and lower WACC values for towers cost are shown in Table 107: Annualised Infrastructure Sharing costs, WACC = 8.83% – sensitivity test and Table 108: Annualised Infrastructure Sharing costs, WACC = 8.25% – sensitivity test below. As expected, a higher WACC results in increased costs.

Table 107: Annualised Infrastructure Sharing costs, WACC = 8.83% – sensitivity test

Structure	2023	2024	2025
Lattice - 45m	102,737	110,146	118,131
Lattice - 60m	108,860	116,821	125,406
Lattice - 76m	115,393	123,941	133,167
Lattice - 90m	134,683	144,967	156,085
Monopole - 30m	89,635	94,539	99,714
Monopole - 45m	104,614	110,417	116,544
Lampole - 24m	69,131	74,328	80,012
Lampole - 30m	70,545	75,926	81,817
Monopole tree - 30m	74,912	81,266	88,304
Monopole tree - 45m	85,634	93,490	102,239
Boom - 3m	84,048	89,037	94,402
Boom - 6m	85,352	90,551	96,158
Smart street pole	64,387	68,457	72,816

[Source: MCMC]

Table 108: Annualised Infrastructure Sharing costs, WACC = 8.25% – sensitivity test

Structure	2023	2024	2025
Lattice - 45m	99,224	106,332	113,989
Lattice - 60m	105,009	112,638	120,862
Lattice - 76m	111,180	119,364	128,194
Lattice - 90m	129,404	139,228	149,846
Monopole - 30m	87,549	92,333	97,380
Monopole - 45m	101,935	107,582	113,543
Lampole - 24m	67,725	72,772	78,288
Lampole - 30m	69,075	74,297	80,011
Monopole tree - 30m	73,191	79,339	86,142
Monopole tree - 45m	83,415	90,994	99,429
Boom - 3m	83,402	88,329	93,624
Boom - 6m	84,657	89,785	95,312
Smart street pole	63,347	67,328	71,590

[Source: MCMC]

Question 43:

Do you have any comments on the sensitivities and outputs from the towers cost model?

20.5. Proposed approach to price regulation for the Mobile Infrastructure Sharing Service

It is clear from the discussion of the modelling results that the pricing structure for the mobile towers service is more complex than that of many other regulated access services due to the wide variety of structures on offer. It would not be feasible to set prices for every possible combination of tower structure, height and ancillary services. The evidence also suggests that there are likely to be local variations where an operator incurs substantially higher costs because of such factors as the inaccessibility of the site. The MCMC recognises that some operators may face issues of this type more frequently than others.

In recognition of this, the MCMC proposes to publish a set of prices for frequently-used tower configurations, based on the costing provided by the model. Tower operators would be free to offer different configurations, or to add or subtract elements of the service, for example by including backhaul services, and to reflect this in the price charged, provided that the variation is reasonably cost-effective in reference to the model. For example, an operator might offer a special structure of some kind to deal with the demands of a specific location. The reasonableness of any resulting special price would be assessed by the MCMC by substituting the relevant structure-related CAPEX and OPEX associated with this structure into the model.

Tower companies would be free to offer or agree prices below the reference price, although, for the avoidance of doubt, this would not affect the MCMC's duties and powers to take action in case it identifies that such prices were exclusionary in intention or effect. Where such concerns arose, the MCMC would be likely to seek further cost justification from the tower company concerned.

Per-tenant prices would be derived by applying suitable discounts to the single-tenant price, based on the levels of discount currently applied in the SBC price list, as discussed above. Thus, the discount on the single-tenant price would be 43% for two tenants and 55% where there are three tenants.

In instances where an operator faces exceptionally high costs for reasons beyond their reasonable control for a particular site, as discussed above, prices above the reference cost would be permitted, subject to the provision of appropriate evidence by the operator.

20.6. Proposed prices

The MCMC proposes to publish indicative prices for lattice type towers for 45, 60, 75 and 90 metres in height. The proposed prices are based on those calculated in the tower model based on tilted annuities and WACC value of 8.77%.

Table 109: Infrastructure Sharing – proposed indicative prices

Structure	2023	2024	2025
Lattice - 45m	102,368	109,746	117,696
Lattice - 60m	108,456	116,382	124,929
Lattice - 76m	114,950	123,461	132,645
Lattice - 90m	134,128	144,365	155,430

[Source: MCMC]

Question 44:

Do you have any comments on the proposed indicative prices for infrastructure sharing?

20.7. In-Building Common Antenna Systems

A related form of infrastructure sharing occurs when an operator installs an antenna system within a large public indoor space, for example a shopping centre, and this local antenna network is shared by two, or more, operators. In general, the model for this in Malaysia is that such systems are installed by the mobile operators, who then allow access to other mobile operators on the basis of reciprocal access to their own sites. There are also other providers that offer In-building Common Antenna (**IBCA**) systems facilities to mobile operators.

IBCA facilities are not widely provided by tower companies, and so little information was supplied. IBCA facilities are, however, included in the 4G mobile model as part of the mix of site types represented there and the degree of sharing that takes place is reflected. This information was included within the Infrastructure Sharing model, to derive average costs per site – for owned sites and leased sites – of an IBCA system.

The access to IBCA systems and central equipment rooms depends on the specific arrangements in a building and may involve access charges by a building owner or non-price terms and conditions.

IBCA can vary considerably in size and scale and the MCMC is minded to consider any disputes where it is asked to intervene on a case-by-case basis. The information provided by the mobile operators as part of the current costing exercise would form a part of the initial information base and would be supplemented by data gathered during the dispute to enable the MCMC to reach a conclusion.

The outputs of the model for 2023 to 2025, given base case assumptions are shown below. The "reference" costs are the average cost per site per year on an annualised basis, using a WACC of 8.77%.

Table 110: IBCA – annualised costs

Annualised total cost per site (RM/year)	2023	2024	2025
IBCA - owned	136,238	137,544	138,877
IBCA - leased	97,737	99,399	101,095

[Source: MCMC]

Question 45:

Do you have any comments on the approach to modelling in-building common antenna system?

PART H: DTTB MULTIPLEXING SERVICES

21. DTTB Multiplexing Service

21.1. Background and Purpose

The DTTB model is used to calculate costs and prices for the Digital Terrestrial Broadcasting Multiplexing Service on the Access List.

There is only one licensed operator, MYTV, consistent with the concept of a Common Integrated Infrastructure Provider (**CIIP**). The CIIP's role is to provide a single, national service to broadcasters using digital broadcast television technology. It provides a range of services, including radio as well as both standard definition (**SD**) and high definition (**HD**) television. It is committed to offer three multiplexes with an initial 30-channel capacity, with the possibility of further multiplexes, as sufficient demand emerges.

Since the Digital Terrestrial Broadcasting Multiplexing Service is included in the Access List, the MCMC is responsible for ensuring that the terms and conditions, including the prices offered to the broadcasters are reasonable. As a result, it is desirable for the MCMC to have some basis for understanding the likely economics of the business, including an estimate of efficient service costs.

21.2. Modelling approach

A bottom-up approach has been used for the model, however some costs included are largely fixed and determined by the existing number of broadcasting sites and distribution links. The model is based on local data provided by MYTV as well as suitable benchmark information of equipment capacities and costs. The calculated network costs are allocated to the radio and TV channels based on usage. A mark-up is applied to the final results to account for indirect costs.

21.3. Modelling issues

21.3.1. Economic characteristics of the DTTB sector

A key issue for modelling this service is that there is no existing body of established best practice, as there are for fixed and mobile models. It is necessary therefore to apply general principles for cost modelling in a way that is reasonably consistent with the approach taken in the other models, but that addresses the particular characteristics of this sector.

One key difference with the fixed and 4G mobile models is that MYTV is a wholesale-only operator with essentially one output: broadcast channels. The different types of channels are produced jointly within a given multiplex. Whilst it is possible to carry different mixes of, for example, HD and SD channels within the multiplex, the number of channels is limited by the traffic-carrying capacity of the multiplex.

21.3.2. Other services

It is possible to add services such as videotext and interactive content with a relatively small incremental cost when such services are broadcast within the channel bandwidth occupied by a television channel. In the absence of information about the likely nature and take-up of these incremental services, however, they have not been included within the model. If questions arise about the cost of such services in the future, it is a reasonable assumption that the avoidable costs of such services would equate to their direct costs. In other words, although they would occupy some bandwidth within that allocated to their host channel, none of the costs of providing that bandwidth would be avoidable and so it would be reasonable to assign to the incremental services only the costs of additional equipment and activity required to support them. The MCMC would therefore be minded to review such matters on a case-by-case basis as and when required.

21.3.2.1. SD, HD and UHD

A second characteristic of the technology being used by MYTV is that there is no hard-and-fast definition of SD, HD and Ultra High Definition (**UHD**) channels. Assumptions have been made concerning the average bandwidth of SD, HD and UHD channels based on industry data (Table 111). For the purposes of calculating overall costs, the model allows for channel-related and bandwidth-related costs to be calculated separately, so that the costs of a channel of any arbitrary bandwidth can be calculated. Channel-related costs relate to cost categories not driven by the bandwidth of the channels, while bandwidth-related costs include costs of equipment that are dimensioned based on bandwidth.

Table 111: Channel bandwidths assumed in the DTTB model

Channel type	Bandwidth (Mbit/s)
SD	2
HD	5
UHD	25
Radio	0.11

In practice, there would be limits imposed by the technology and by the broadcast spectrum available to MYTV on the total amount of bandwidth available and for any one channel. However, the model assumes that such issues are resolved exogenously (for example that only channels of a bandwidth that is feasible with the technology are considered). This simplifying assumption might have its limitations in situations where conflicting demands make the bandwidth available within a multiplex, in effect, a scarce resource. In such cases, it would be desirable to take a view of the opportunity costs of different options for the mix of channels (for example, adding an additional share of cost to a bandwidth-hungry channel, if it prevents several narrower-bandwidth channels from being broadcast). Such issues might be explored by a combination of different scenario inputs within the model and assessments of opportunity cost externally to the model.

21.3.3. Channel take-up

In the MCMC's view, a more likely challenge is likely to be filling the available capacity in line with MYTV's business plan, given that demand beyond the replacement of existing analogue channels is uncertain. Similarly, it is envisaged that additional multiplexes might be added once sufficient demand emerges. Given the substantial fixed costs associated with this, the timing of such a move in relation to the evolution of channel demand is likely to have a significant bearing on costs per channel taken by MYTV's broadcaster customers. These issues can be explored using different scenario inputs to the model, as shown in Table 112.

Table 112: Demand scenarios for TV and radio channels

	2022	2023	2025
High demand scenario			
SD	5	5	6
HD	18	22	22
Radio	11	13	15
Medium demand scenario			
SD	4	4	4
HD	14	14	14
Radio	10	10	10
Low demand scenario			
SD	3	3	2
HD	13	13	12
Radio	9	9	8

[Source: MCMC. Note: UHD channels were not included as no channel take-up is expected until 2026.]

21.3.4. Costing and pricing

It should be noted that the appropriate charge per channel cannot simply be decided by calculating the average costs per channel, or per channel and for bandwidth separately. This is a separate question that can be informed by the model calculations, but which will depend also on some additional policy considerations.

For example, it may be appropriate from an economic point of view to allow some degree of price discrimination – charging different prices for channels that otherwise make identical technical demands on the system. Such discrimination exists in other industries and in other sectors of the telecommunications industry, for example between "anchor" and other tenants in shopping malls, or between prepaid and post-paid mobile subscribers.

It is a well-established challenge for regulators to distinguish between instances where such discrimination is appropriate and beneficial, for example leading to optimum utilisation of the multiplex, or multiplexes, and hence to lower costs for broadcasters and their customers, and those cases where the discrimination is unfair and damaging to consumer welfare. Again, such matters will need to be addressed outside the model, though the model may be helpful in evaluating the cost implications of different options.

Another issue to be taken into account is that public subsidies have been provided to MYTV. The costs that have been produced by the model do not reflect any subsidy arrangements.

Taking the above issues into consideration, the MCMC is minded to use average cost per channel as a starting point and would expect prices to be set with reference to this and without discrimination, unless a case can be made by MYTV or by broadcasters that a different approach is more likely to maximise consumer welfare.

Question 46:

Do you have any comments on the approach to the modelling of the DTTB multiplex costs?

21.4. Model results

The model calculation delivers an annualised cost of providing the broadcasting services using the network assets. For each network resource or group of resources, a direct cost per unit demand is calculated by dividing the resource cost by the total demand on this network resource (RM per Mbit/s per year). The total cost per unit of demand for using the network is calculated and allocated to the service based on its usage. The annualised costs are broken down into two categories, a cost directly attributed to traffic-driven elements such as routers and transmitters, and common costs attributed to all broadcast channels. The first cost is used to calculate the cost per Mbit/s while the latter is used to calculate the cost per channel. The total cost per service is sum of these two components.

The model results are presented in Table 113: DTTB Multiplexing service costs – base case using the base case WACC of 7.88%.

Table 113: DTTB Multiplexing service costs – base case

	2023	2024	2025
SD	1,764,966	1,749,366	1,735,674
HD	2,966,144	2,930,575	2,898,742
UHD	10,973,996	10,805,303	10,652,522
Radio	1,008,224	1,005,204	1,002,942
1 Mbit/s	400,393	393,736	387,689

[Source: MCMC]

Table 113 presents the results for a medium channel take-up forecast, which assumes the demand will remain constant over the modelling period. The costs fall slightly in time due to the declining cost of equipment and traffic distribution.

21.5. Sensitivities

In Section 13, a point estimate of 7.88% was provided for the DTTB WACC. This was used for the calculation, the results of which were set out in the table above. Section 13 also provided an estimate of a lower WACC, at 7.15%. The results of applying the lower WACC is set out in Table 114: DTTB Multiplexing service costs, WACC = 7.15% WACC – sensitivity test below.

Table 114: DTTB Multiplexing service costs, WACC = 7.15% WACC – sensitivity test

	2023	2024	2025
SD	1,756,097	1,740,754	1,727,313
HD	2,957,935	2,922,590	2,890,975
UHD	10,970,186	10,801,498	10,648,727
Radio	998,939	996,197	994,205
1 Mbit/s	400,613	393,945	387,888

[Source: MCMC]

Note that due to the common infrastructure costs, the model results are sensitive to the channel demand. The higher the channel demand, the lower are the costs. Table 115 and Table 116 show two scenarios: the first being a high demand scenario, while the second is a low demand scenario, compared with the base case.

Table 115: DTTB Multiplexing service costs, WACC = 7.88% and high demand scenario

	2023	2024	2025
SD	1,456,250	1,386,690	1,317,923
HD	2,449,578	2,368,400	2,272,204
UHD	9,071,764	8,913,128	8,634,075
Radio	830,453	768,213	716,727
1 Mbit/s	331,109	327,236	318,094

[Source: MCMC]

Table 116: DTTB Multiplexing service costs, WACC = 7.88% and low demand scenario

	2023	2024	2025
SD	1,943,313	1,926,442	1,864,932
HD	3,238,459	3,200,125	2,994,470
UHD	11,872,768	11,691,345	10,524,726
Radio	1,127,371	1,124,022	1,153,322
1 Mbit/s	431,715	424,561	376,513

[Source: MCMC]

21.6. Proposed regulated prices

The MCMC proposes to regulate the prices of DTTB Multiplexing Services, based on the service costs, as shown in Table 117: DTTB Multiplexing service – proposed regulated prices below.

Table 117: DTTB Multiplexing service – proposed regulated prices

	2023	2024	2025
SD	1,764,966	1,749,366	1,735,674
HD	2,966,144	2,930,575	2,898,742
UHD	10,973,996	10,805,303	10,652,522
Radio	1,008,224	1,005,204	1,002,942
1 Mbit/s	400,393	393,736	387,689

[Source: MCMC]

Question 47:

Do you have any comments on the proposed DTTB regulated services and prices?