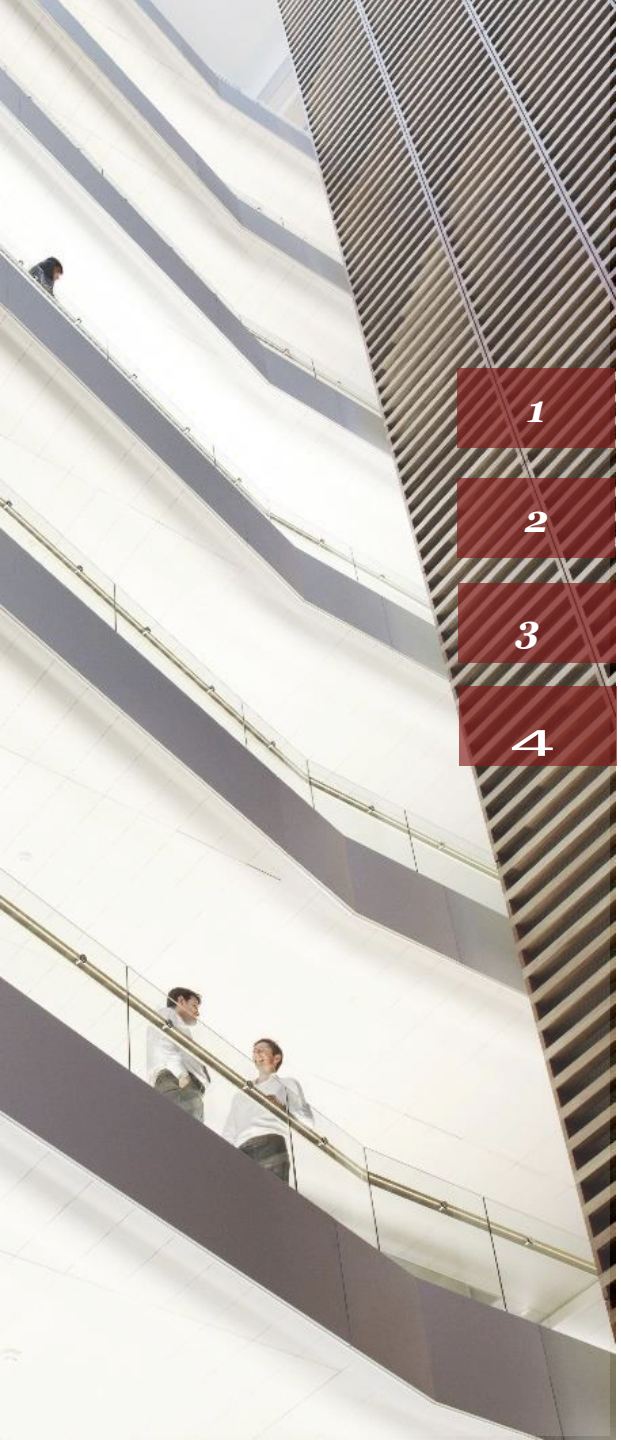
Consultation and development of Long Run Incremental Cost (LRIC) model for NGA and NGN based wholesale services and WACC methodology

Workshop

30th of July, 2018

pwc



Agenda

1. *Organization of project*
2. *Methodology of BU LRIC+ model*
3. *Methodology of WACC*
4. *Next Steps*

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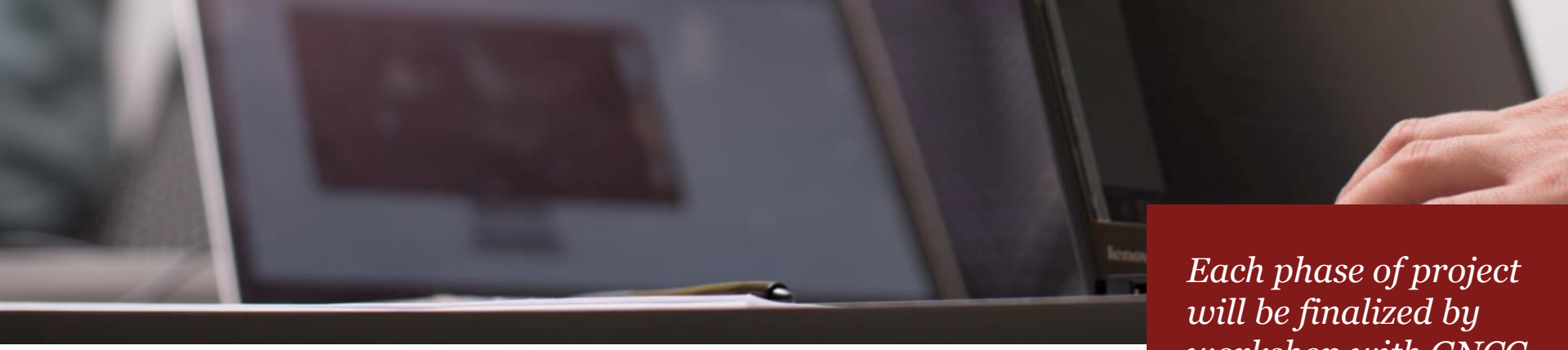
Organization of project

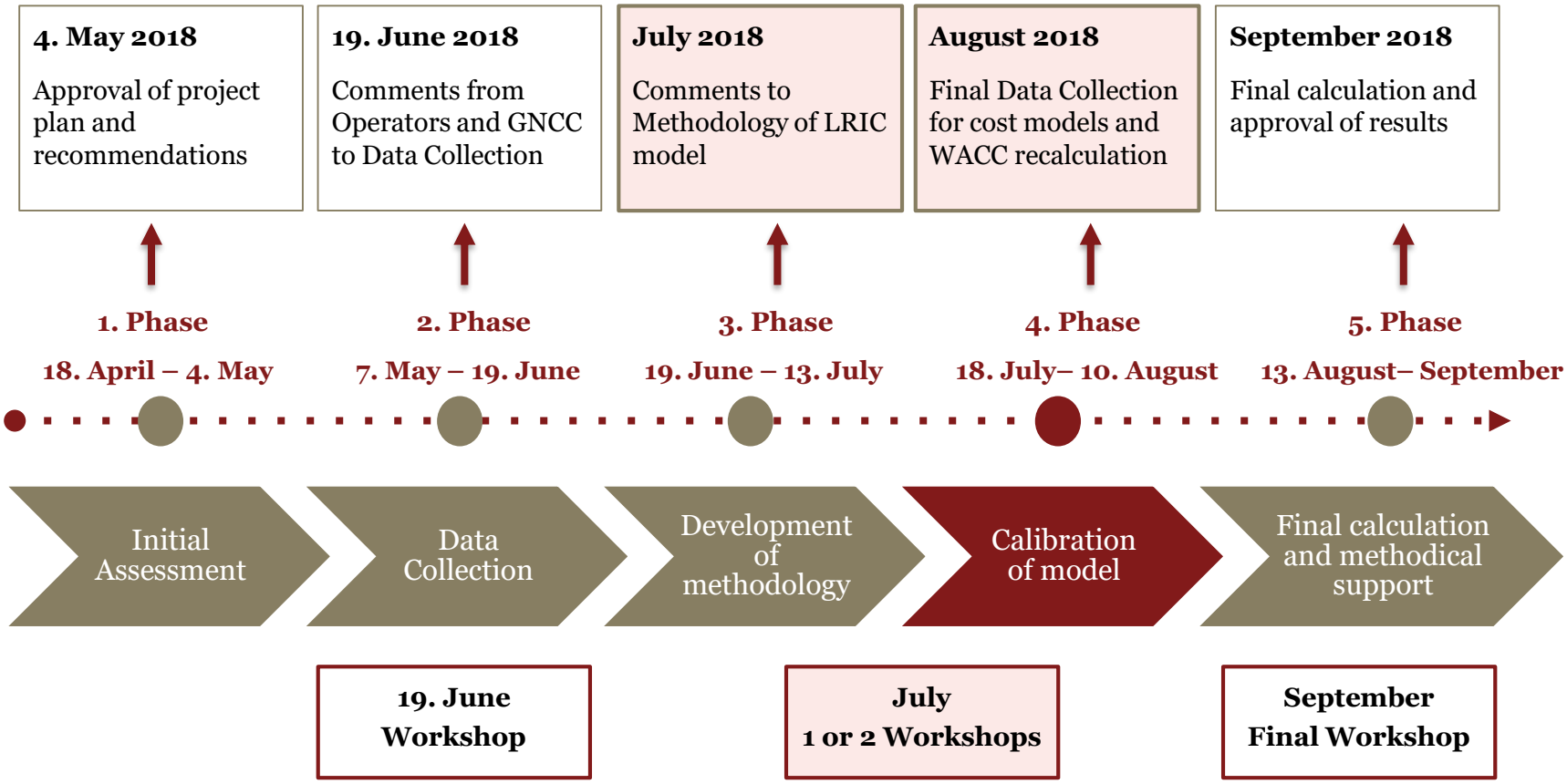


Each phase of project will be finalized by workshop with GNCC representatives and interested stakeholders

Timeline of development of LRIC model for wholesale services and broadband rates

1. Phase	2. Phase	3. Phase	4. Phase	5. Phase
18. April – 4. May	7. May – 19. June	19. June – 13. July	18. July– 10. August	13. August – September
Initial Assessment	Data Collection	Development of methodology	Calibration of model	Final calculation and methodical support
Recommendation to Methodology Preparation of Data request	Preparation of technical and economic data collection worksheets Consultation on additional input data	Finalization of methodology for wholesale services and Internet retail prices	Final Data Collection Calibration of models Recalculation of WACC	Presentation of calculated results

Necessary cooperation from GNCC and operators during model development



*Indicative dates are subject to the provision of required input data by operators

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Methodology of BU LRIC+ model

BU LRIC+ provides motivation for efficient investment as well as efficient use of existing infrastructure

Bottom-up modelling approach' means an approach that develops a **cost model starting from the expected demand in terms of subscribers and traffic**. It then models the efficient network required to meet the expected demand, and assesses the related costs using a theoretical network-engineering model

- **BU LRIC+ methodology:**
  - **Models the incremental capital** and **operating costs**
  - **borne by a theoretical efficient operator** in providing all access services
  - **adds a mark-up for strict recovery of common costs**

- The BU LRIC+ methodology allows for recovery of the total efficiently incurred costs

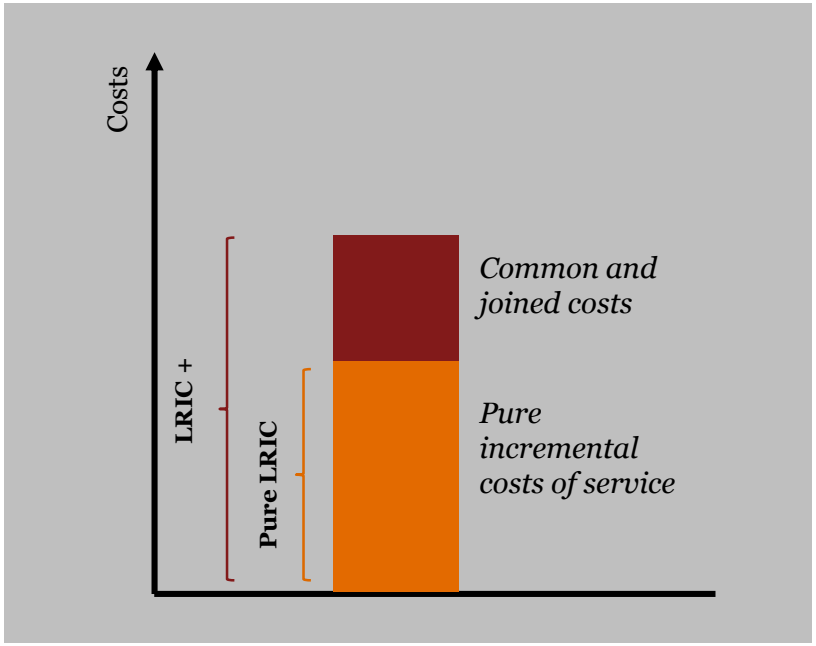
The bottom-up long-run incremental costs plus (BU LRIC+) costing methodology best meets the objectives of the EC and the NRAs for setting prices of the regulated wholesale access and transmission services

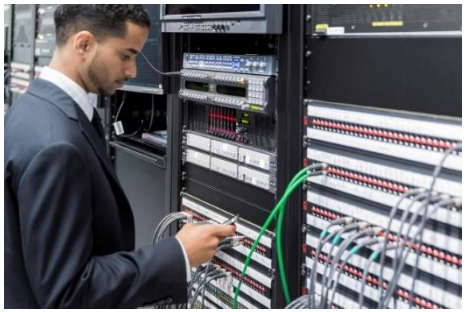
LRIC principles

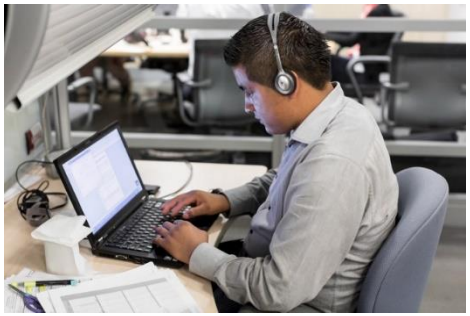
General principles of LRIC are:

- **Long-term horizon** - assumes that all inputs are considered as variable costs and at the same time they cover whole period including all relevant investments
- **Incremental** - represents additional output, which can be an additional unit of quantity of the service, or adding completely new services to the product portfolio of operator, while all other conditions stay unchanged
- **Common costs** - the costs of inputs that serve for provision of one or more services and cannot be allocated directly to an individual service. The costs are included in the calculation of the regulated prices by the mark-up method.
- **Mark-up** – value in %, by which LRIC costs will be increased to include Common and Joint costs

BU LRIC+ model reflects costs based on prices of modern equivalent assets, thereby is contributing to the optimization of telecommunications infrastructure







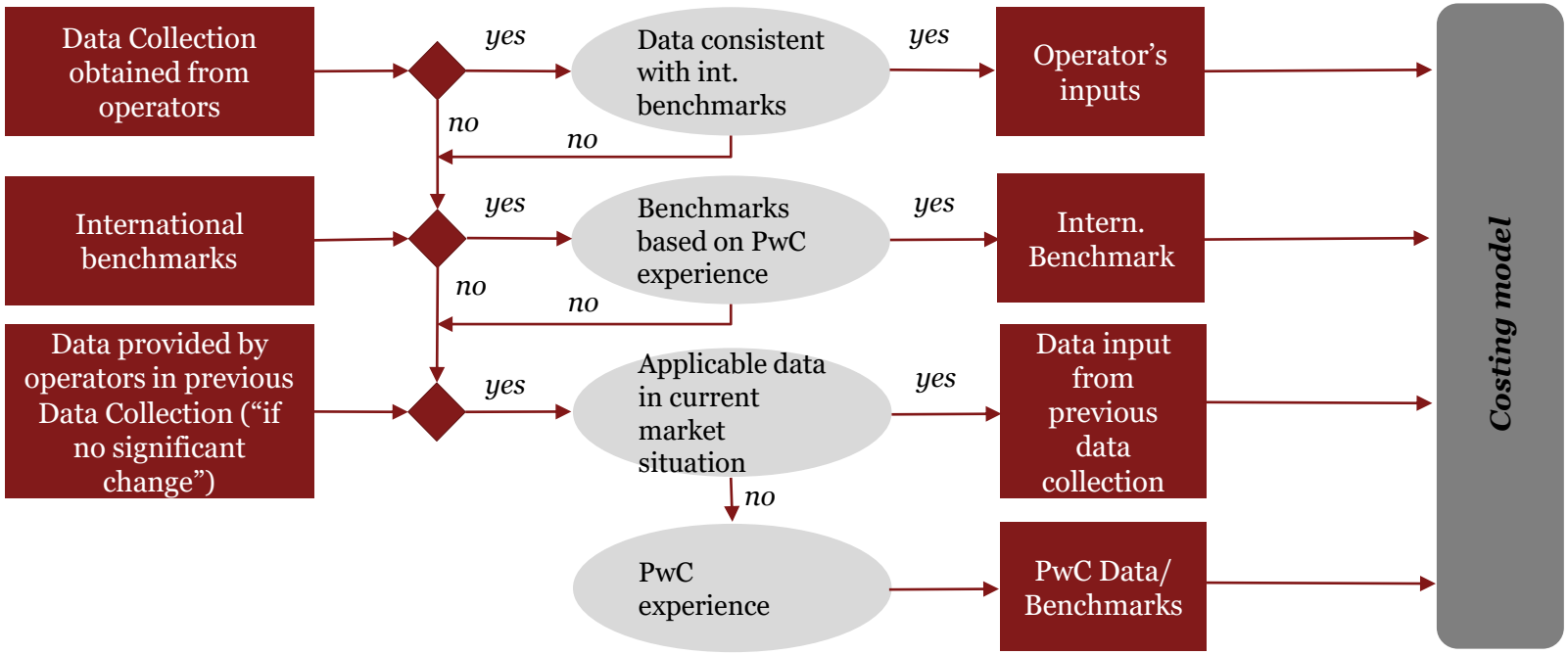
LRIC + cost modeling methodology for the regulated price calculation in the wholesale broadband market is based on the theoretical efficient operator ("TEO") principle that simulates the behavior of an efficient operator in a fully competitive market.

Definition of theoretical efficient operator

TEO is the operator, whose **transmission and access network covers all parts of Georgia as in reality,** with capacity able to serve defined required demand in country and, who **is using the most efficient technologies and the most effective network equipment**. TEO can be determined in four ways:

- TEO with the most cost effective inputs at the highest possible coverage, that means use of inputs provided from individual operator;
- TEO based on the average prices and demand calculated from operators inputs;
- TEO based on the average prices and demand calculated from operators that offer national coverage that is equivalent to principles of TEO;
- TEO set manually.

Process of input data validation for LRIC model



Topology of modelled network

There are 2 commonly known approaches to model the network of the theoretical effective operator:

- **Scorched earth** – the network is modelled "from the scratch" or as "greenfield"
- **Scorched node** – the network reflects current topology and only the network elements are optimized

The recommended approach to be used in the broadband model is ***Scorched node***, because :

- It is economically unrealistic to continually change the node infrastructure of the network
- It is based on statistics from the current network topology which makes it closer to reality
- Acknowledges the fact that it is very difficult to model network topology as there are complex process behind

Scorched earth

Scorched node

Annualization of investments

The model allows the application of 4 types of annuities:

Standard annuity	$C = I_{t=0} \cdot \frac{r}{1-(1+r)^{-n}}$
Modified standard annuity	$C_{t=1} = I_{t=0} \cdot \frac{(r-i)}{1-\left(\frac{1+i}{1+r}\right)^{n}}$
Tilted annuity	$C = I_{t=0} \cdot \left(\frac{1+r}{1+i}\right)^{u} \frac{r}{1-(1+r)^{-n}}$
Modified tilted annuity	$C_{t=1} = I_{t=0} \left(\frac{1+r}{1+i}\right)^{u} \frac{(r-i)}{1-\left(\frac{1+i}{1+r}\right)^{n}}$

Where:

C - constant annual capital charge

It=0 - replacement value of the asset at the start of the period

r - cost of capital-WACC

n - useful life of the asset

Ct - annual capital charge in period t

i - annual change in the price of the asset

I`t=0 - adjusted value of the asset to reflect the time taken in building the asset

U -average time taken to build the asset

We recommend the use of modified tilted annuity, because it best reflects reality of the telecommu-nication world

We recommend selecting one depreciation method and do not change it during the calculation in individual years

Valuation methodologies

The two most widely used asset valuation methods are:

Historical Cost Accounting (HCA)

- historical accounting information from accounting systems
- provides reliable and objective information on the cost of individual assets used in the network
- do not reflect material changes in asset prices

Current Cost Accounting (CCA)

- determines the price of an asset at which the asset could be replaced at present
- Current cost are calculated by adjusting the historical costs by inflation and by changes caused by technological and market development

During the development of LRIC+ costing model, we recommend the use of the Current Cost Accounting method, where possible, in accordance with the EC Recommendation.

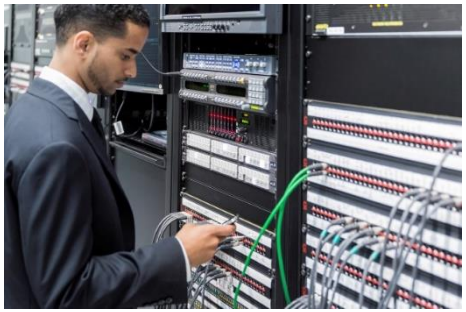
- **For all assets** with the exception of long-live reusable civil engineering assets – **Current cost accounting method, based on Modern Equivalent Asset (MEA)**, is used
- **For long-live reusable civil engineering assets (cable ducts, trenches, poles)** – indexation method is used based on EC Recommendation
  - Assets from this category are valued based on Regulated Asset Base – RAB - which consists of the **civil engineering assets valued at current costs reduced by elapsed economic life** (and hence costs already recovered)
  - **Once an asset is fully depreciated it is no longer part of the RAB** and no longer represents a cost

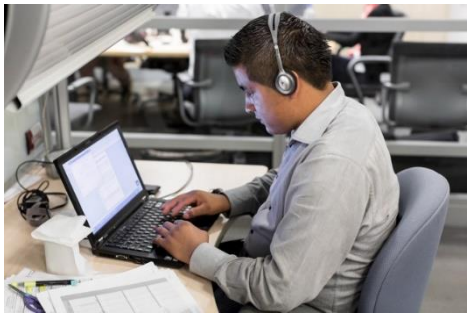
Definition of services

The model covers all services provided over the fixed network. Following services are included in the model:

- Telephony access lines (POTS, ISDN BRA, ISDN PRA, CDMA)
- Internet Access Services (ADSL, VDSL, SHDSL, GPON, P2P, CDMA internet access)
- DTV services
- Leased Lines (TDM national, TDM international)
- Data Transmission (Local, Backhaul, Trunk, National end-to-end, International end-to-end)
- Voice services
- Infrastructure sharing
    - Dark fibre rental – rental of one dark fibre, which represents the share of costs of fibre cable, ducts, and trenches where the fibre cable is laid.
    - Duct rental – rental of one hole in a duct, which represents the share of costs of the duct, and trenches, where the duct is laid.

Although the model covers all above listed services**, the underlying cost calculation does not serve for regulation of all services**. All the above listed services were included in the model in order to be able to model a complex network of theoretical efficient operator in Georgia and consequently to be able to allocate appropriate part of common and joint costs to wholesale broadband regulated services only.

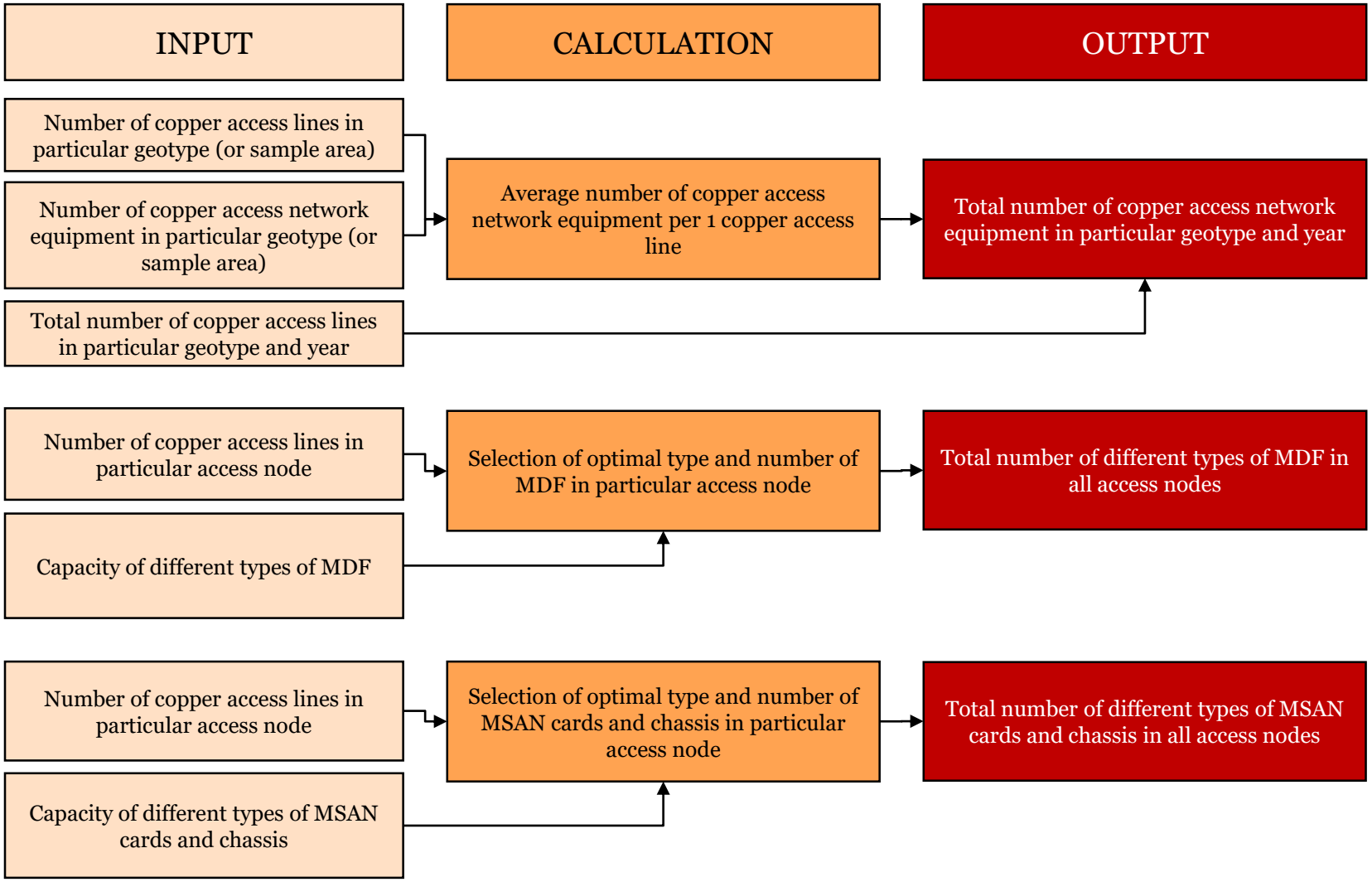




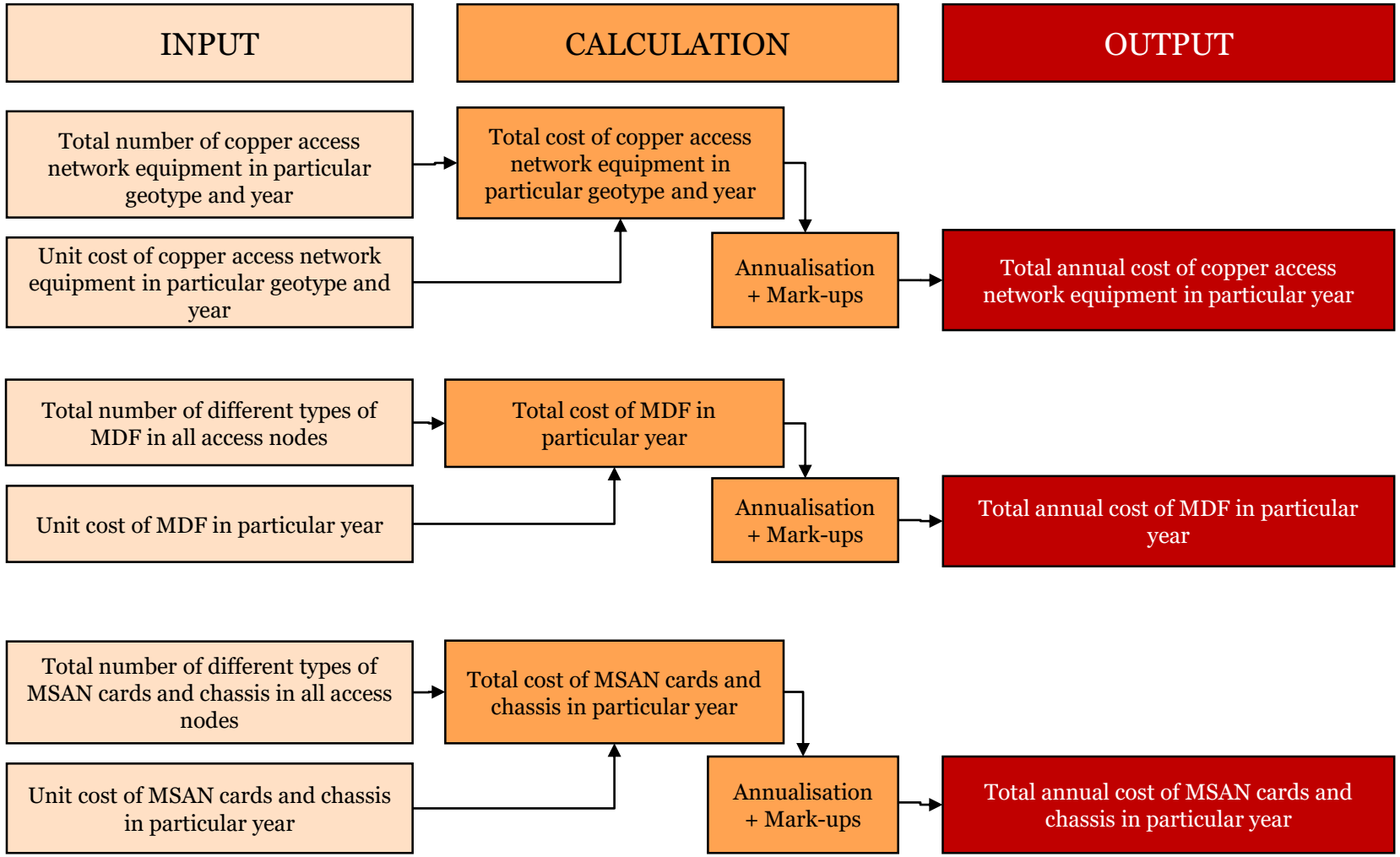
General structure of LRIC+ cost model

Model menu	Input worksheets	Technical modelling	Economical modelling	Calculation Results
Main menu of the model where the basic modelling parameters are selected: • Model of the TEO • Calculation timeline • Methods of annualization	Fields for data inputs where all the required data has to be collected: • Network topology • Network statistics • Service demand and statistics • Economic data	Core part of the model where the TEO's network is modelled: • Access network • Local Network • Core Network • Transport Network • Other network elements	Core part of the model where the TEO's network is transferred to economic terms: • Valuation • Useful life • Mark-ups • Annualization of costs	Final worksheet of the model where results of the modelling are summarised and the final LRIC+ is calculated

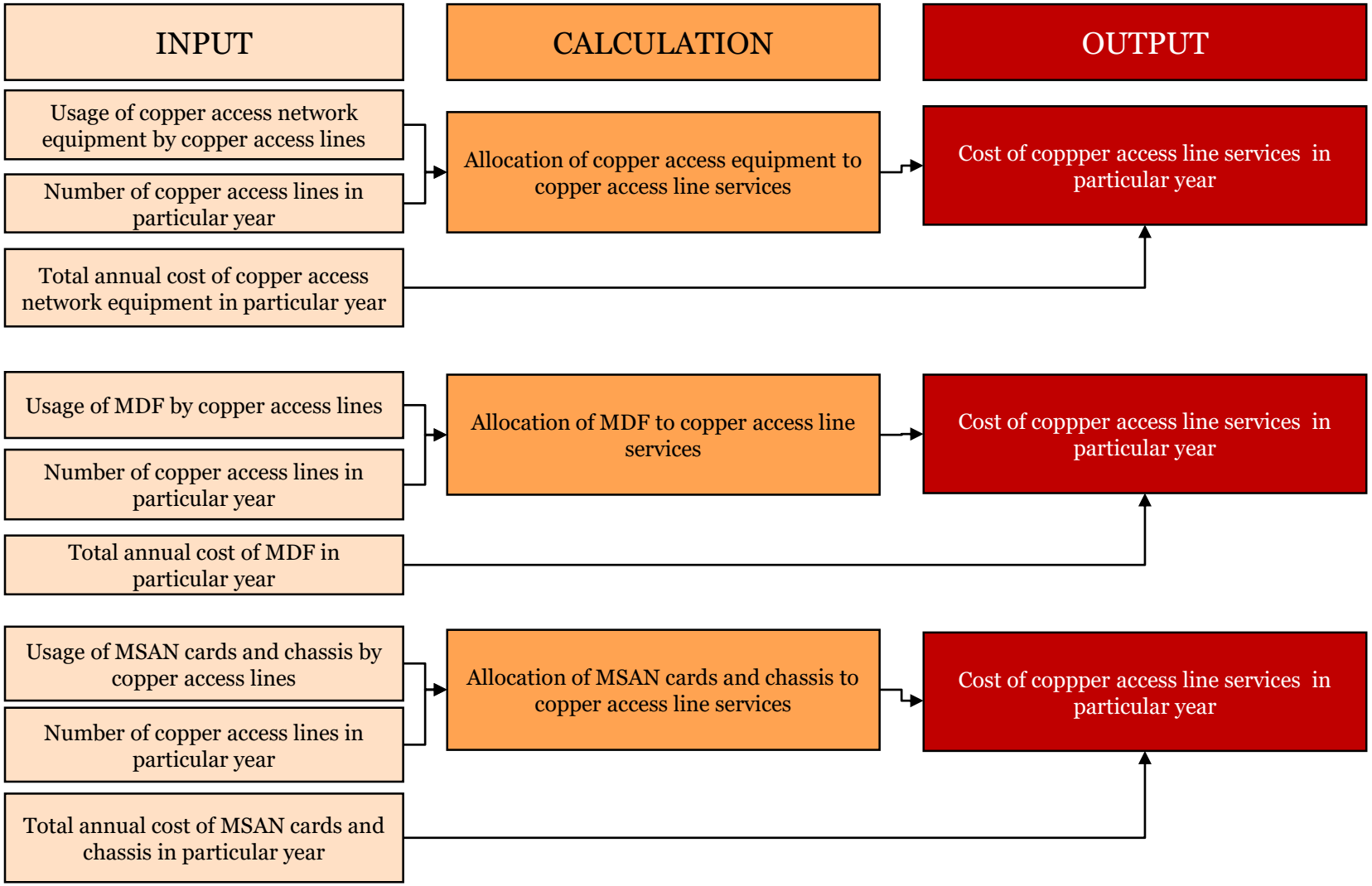
Model workflow – Technical modelling copper access



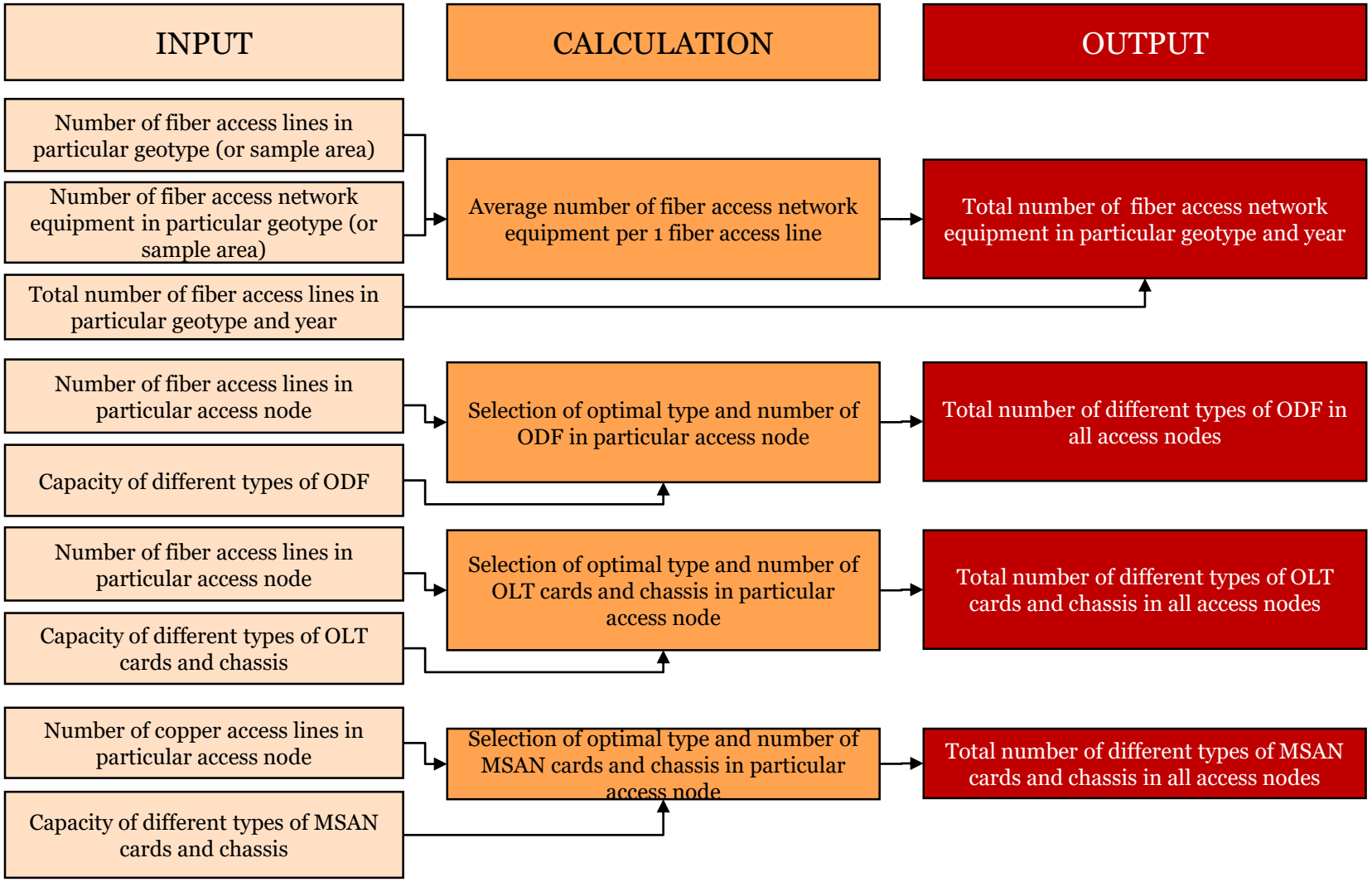
Model workflow – Economical modelling copper access (1/2)



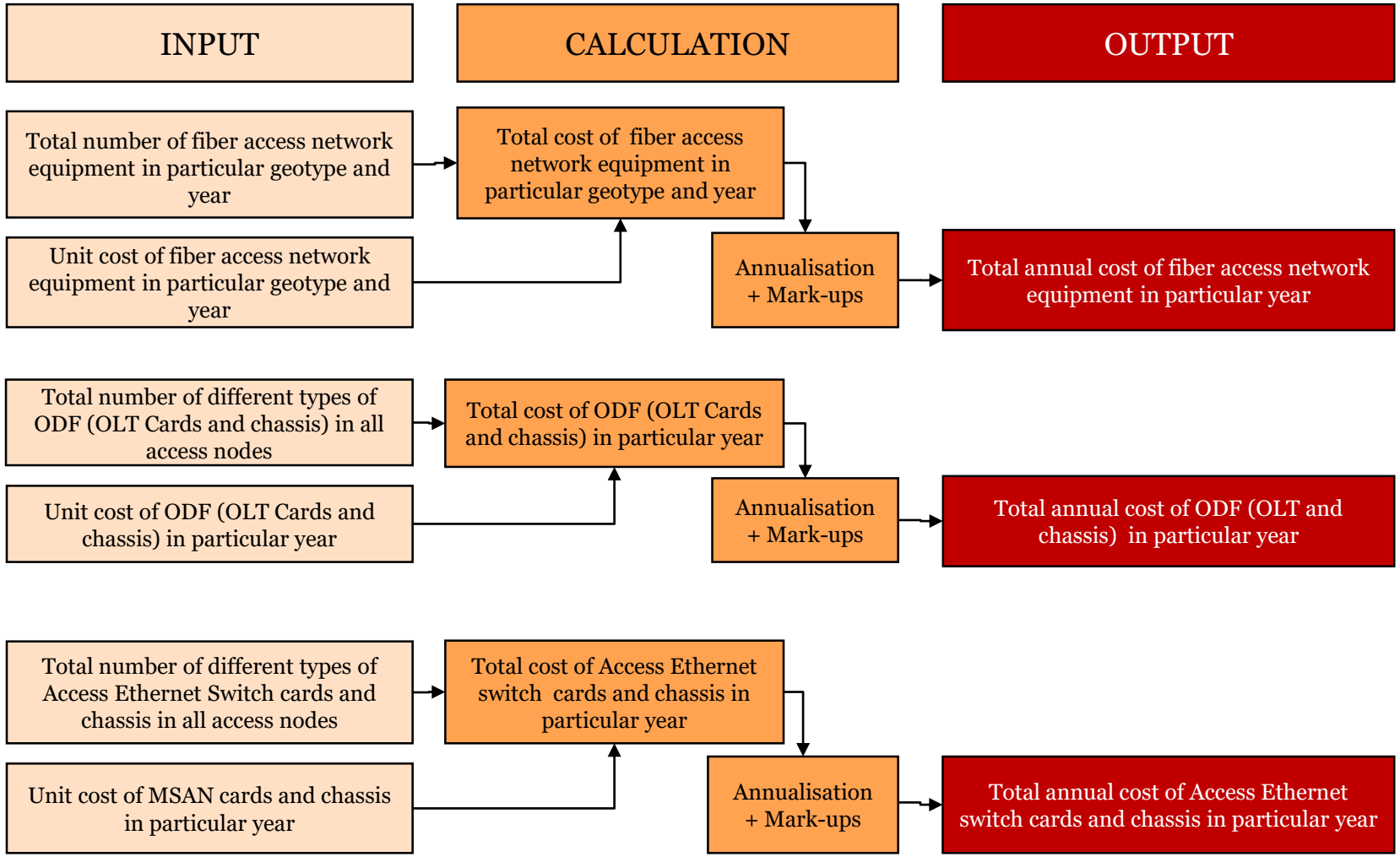
Model workflow – Economical modelling copper access (2/2)



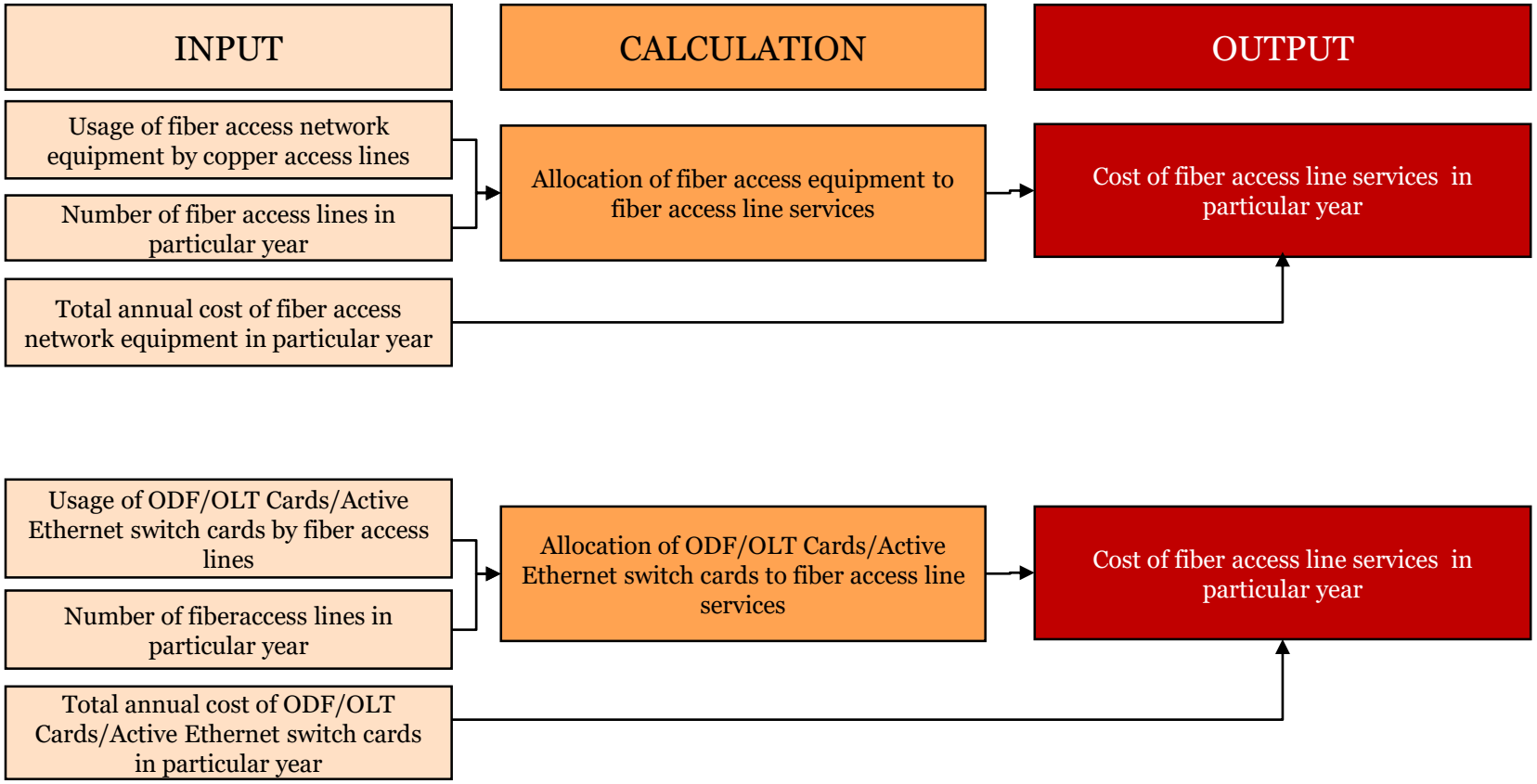
Model workflow – Technical modelling fiber access



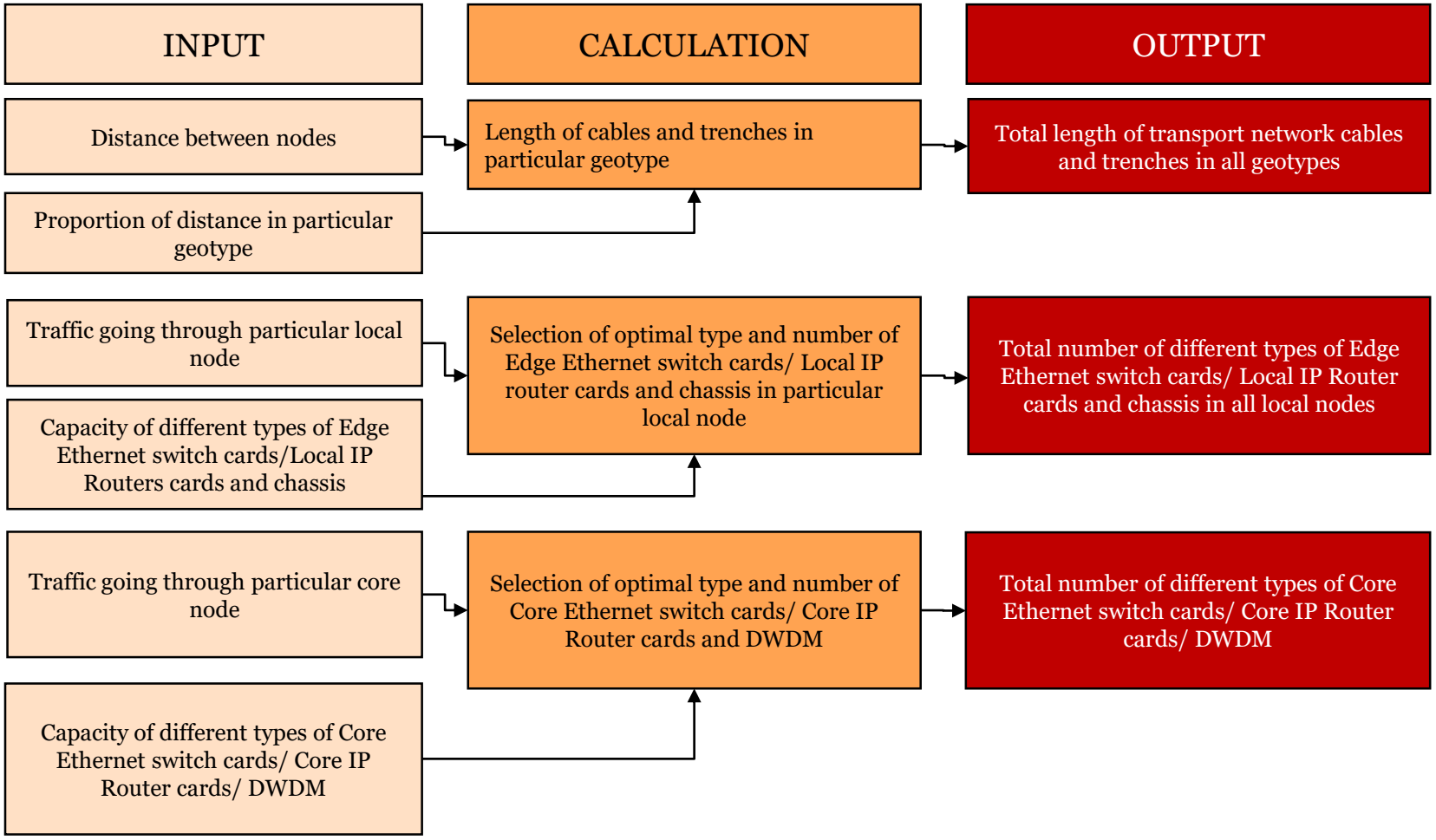
Model workflow – Economical modelling fiber access (1/2)



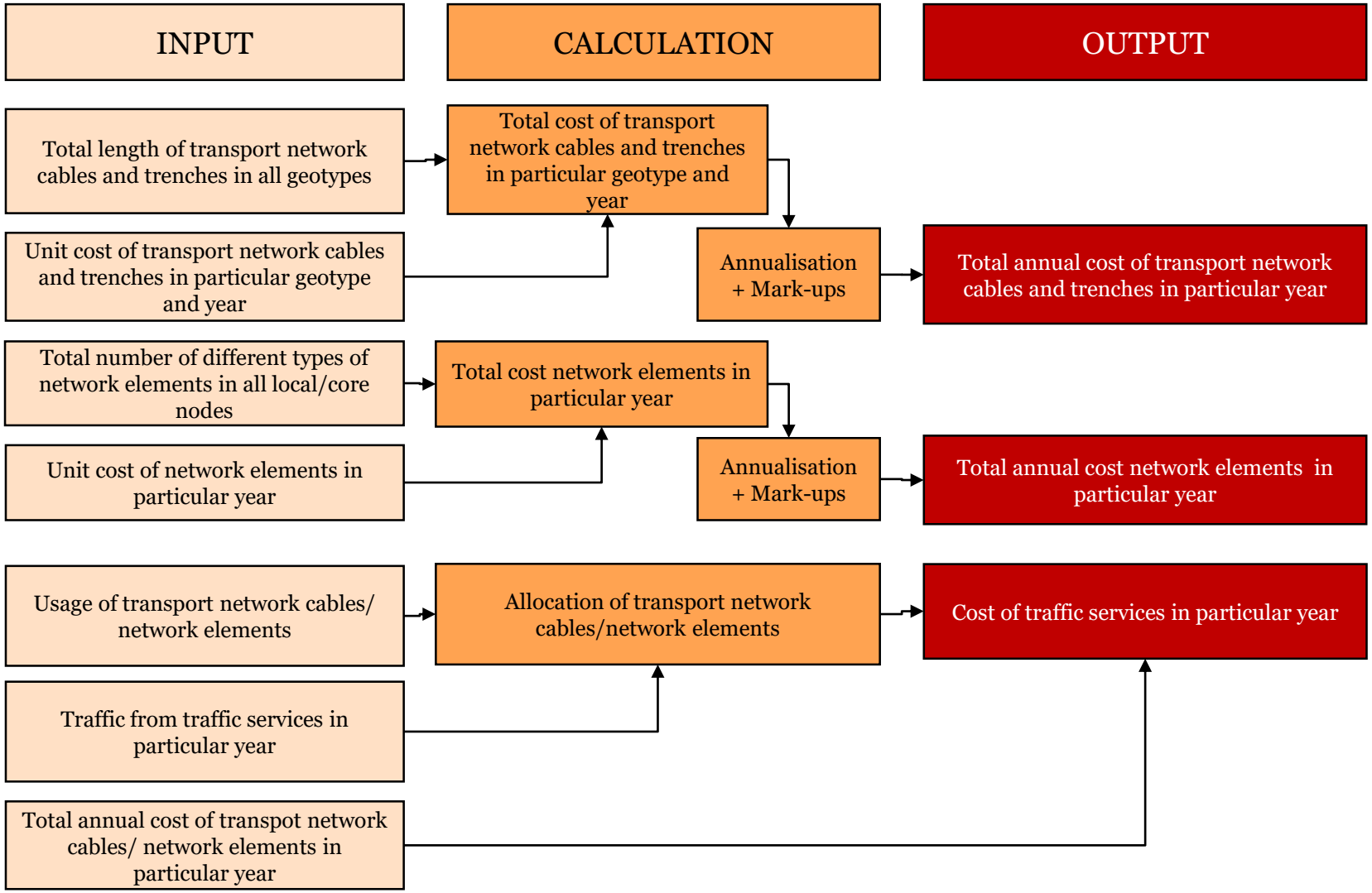
Model workflow – Economical modelling fiber access (2/2)



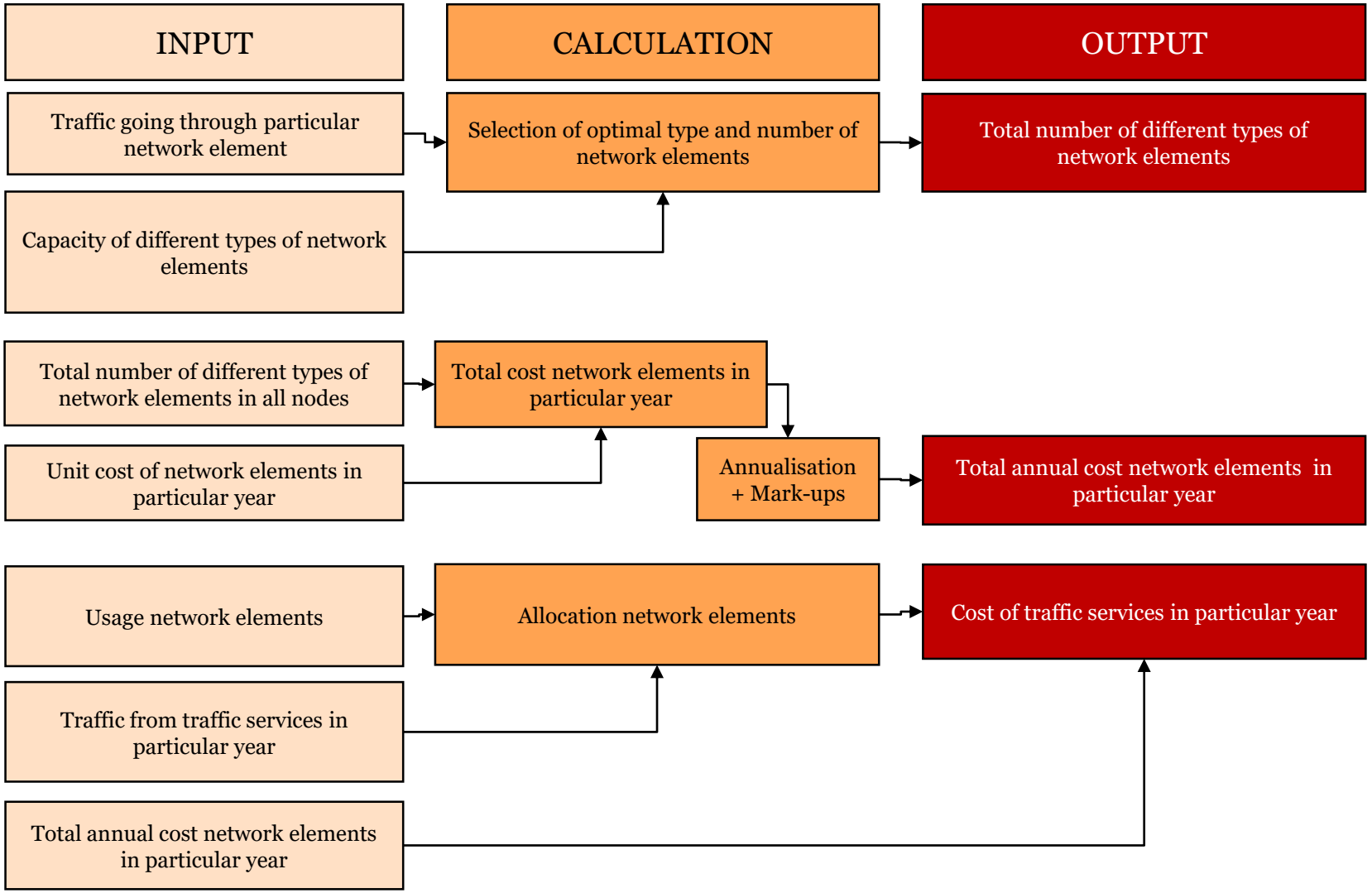
Model workflow – Technical modelling transport network



Model workflow – Economical modelling transport network



Model workflow – Other network elements (MGW, Softswith, IMS, AAA Server, BRAS, Ethernet Radiolink, MSC, HLR)



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Methodology of WACC

WACC calculation

- Weighted Average Cost of Capital ("WACC") represents the returns required by both debt and equity investors operating in the area of providing telecommunication services in Georgia, weighted by their respective contributions of capital. The conventional formula for deriving the WACC and the associated definitions are presented below:

After-tax WACC = Kd * (1-t) * (Percent Debt) + Ke * (Percent Equity)

Where:

Kd = Pre-tax cost of debt

t = Effective tax rate

Percent Debt = Debt capital as a percentage of capital

Ke = Cost of equity

Percent Equity = Equity capital as a percentage of capital

- In the regulatory context, proceeds acquired from the regulatory pricing, which includes WACC compensation, will be later subject to taxation. In order to reflect this, post-tax WACC needs to be adjusted for pre-tax WACC as follows:

Pre-tax WACC = After-tax WACC / (1-t)

Gearing

- Gearing level represents the ratio of net debt (D) to the value of the firm, including equity (D+E). Consequently, gearing determines the relative weight of debt and equity in the WACC. Debt financing provides higher tax shield to the company, although increases the risk of bankruptcy. The common practice for defining Gearing level to be used for calculation provides various options:
  - Gearing level at the level of Peer group used to estimate Beta
  - Gearing level at the level of regulated company (SMP or Theoretical efficient operator), whereby the market value of equity to be used is preferred to the use of book value of equity. In addition, the EU regulatory practice stipulates the gearing of regulated company should not exceed (or be below) the Peer group gearing by 10 percentage points, and overall should not be above 50%-55%

- As GNCC recognizes multiple SMPs at the relevant market, the Gearing level at the level of regulated company would cause multiple levels of WACC, which is not a common practice. Moreover, the market value of assets of regulated company is often not available, similarly as the gearing level of Theoretical efficient operator. As a result, **GNCC will use the Median of Gearing levels of Peer Group companies considered when estimating Beta**.
- The Peer Group can be further adjusted to reflect target situation Peer Group companies' specifics

Cost of Debt – Georgian approach

- In estimating the cost of debt for use in a WACC the objective is to arrive at an overall estimate of the weighted average cost of debt finance for the company as if it was refinancing all of its debt. The pre-tax cost of debt is multiplied by the interest-tax shield (1-t) to determine the after-tax cost of debt.

After-tax cost of debt = Kd * (1-t)

- Based on current best practice, it is recommended to use 12-months average interest rate to avoid seasonality of corporate bonds with 10-years maturity provided in national currency to industry producers, published by the National Bank of Georgia.
- Kd is composed of Risk-free rate and Market premium (ie. Kd=Rf+M), we may assume the Market premium is a difference between the yield on 10-year Risk-free government bonds and corporate bonds with 10-years maturity.
- The above described approach assumes that the risk profile (credit rating) of a telecommunication operator in Georgia is the same as the risk profile (credit rating) of average industry producer in Georgia. Although no data are available to support this assumption, we can compare telecommunication and industry producers in other countries and as the difference is usually negligible, the approach is considered acceptable.

Cost of Debt – EU approach

- In estimating the cost of debt for use in an WACC the objective is to arrive at an overall estimate of the weighted average cost of debt finance for the company as if it was refinancing all of its debt. The pre-tax cost of debt is multiplied by the interest-tax shield (1-t) to determine the after-tax cost of debt.

After-tax cost of debt = (Rf+M) * (1-t)

Where:

Rf – risk-free rate

M – risk premium

Cost of debt can be calculated by determining the yield to maturity on corporate bonds. The yield curves for corporate bonds according to their credit rating are published for example by Bloomberg.

In the circumstances of Georgian telecommunications market, cost of debt would be determined by analysis of yield of 10-year EUR bonds issued by telecommunication operators with BBB credit rating (published on, e.g., Bloomberg). Margin over risk-free rate will be calculated as the difference between this yield and the EUR risk-free government bonds.

The margin of risk-free EUR rate will be added up with Georgian risk-free rate to suggest a cost of debt for Georgian market.

The last thing to consider is the application of tax shield on calculated cost of debt (since interest expense is a tax-deductible item). In case of Georgia, income tax equals 15%.

Cost of Equity

- Cost of equity is calculated using the Capital Asset Pricing Model (CAPM). The model is based on two components – the risk-free interest rate and a risk premium that represents a systematic risk of the market and asset's exposure to this risk. The formula goes as follows:

$$\mathbf{Ke = Rf + \beta * (Rm - Rf)}$$

where:

Ke	Cost of equity
Rf	Risk-free rate
β	Beta
Rm	Return on market portfolio

Note: Size premium is not considered due to alignment with methodology prepared for European Commission by Brattle

Risk-free rate

Risk-free rate is the starting point of assessing the cost of equity. To consider an asset to be risk free, its cash flows should be considered as having no risk of default. Moreover, actual return on investment should be equal to its expected return, therefore there should be no reinvestment risk of not knowing what the rate of return will be in the future.

Risk-free rate should in this case be a default-free long-term - 10-year Georgian government bonds issued in relevant period. Risk-free rate is the **arithmetical average of market value of yield on Georgian governmental bonds** issued in year, in which the data collection exercise has been performed.

Risk premium

The difference between the return on the market portfolio and the risk free interest rate is termed the market risk premium in long-term period, e.g. 1926-2017. This premium reflects investor's required rate of return (in addition to risk-free rate) in order to invest in equities rather then risk-free government bonds.

There can be many uncertainties and judgement surrounding the elaboration and exact specification of market risk premium. Market risk premia can be determined on the basis of historical researches of stock market data performed in various countries over various time periods. These researches suggest a certain interval of values for risk premium, such as:

- German regulator ((Institut der Wirtschaftsprüfer in Deutschland e.V.) issued recommendation defining the value between 5,5%-7%, while the data from German market indicate the value approx. 6% and above
- Damodaran study analyzing sample of companies S&P 500 at the level of 5,8%
- Standard approach used by PwC is 6%

European Commission in its report related to WACC methodology avoids prescribing exact methodology, but caps the ERP in the range between 5% - 5,5%

As most of the above defined approaches tend to be above the value defined by Brattle and EC, we recommend to use the upper level of scale indicated by Brattle, at the **level of 5,5%**

Beta

The beta coefficient is a measure of contribution of an individual asset to the risk of a well-diversified portfolio. It is a measure of systematic risk. It **describes how the expected return of given stock of portfolio is correlated to the return of the financial market as a whole**.

A beta of one indicates that the price of the stock moves in line with the market. A beta less than one indicates that the price of stock is less volatile then the market (or, over time, the security's change in value is less dramatic that market's in both directions), while EC and Brattle suggest the asset Beta range of **0,50 to 0,67**. Although EC and Brattle suggest using 2-years beta estimates, we recommend assessing the statistical reasonability of **2-years Betas, and in case of lower significance, we recommend using longer periods, such as 3 or more years Betas**.

Beta coefficient can be determined by analysing stock market data of a comparable group of companies, including analysis of monthly movements of stock prices, analysis of market index on which the companies are quoted, regression analysis of the above movements to determine correlation coefficient (beta) between movement of stock price and its respective market index, followed by adjustment of beta toward one. However, the EC and Brattle study allows usage of **"off-the-shelf" estimates** from data providers, such as **Bloomberg** or others.

Beta coefficients calculated in this way reflect capital structure of individually analyzed companies. In order to finalize beta coefficient calculation for a specific company (or industry sector), individual beta coefficients of peer group companies (equity betas) need to be "ungeared" (or, in other words, "cleaned" of debt), by **unlevering equity betas to obtain asset betas by Gearing** calculated individually for each of the company selected in the Peer group.

Using the **median of the calculated asset betas**, rather than the arithmetic average, will tend to produce a beta estimate that is less dependent on the chosen comparators. As a final step in calculation, **median of these asset betas is "regeared" with a target expected capital structure** of assessed company, based on methodology defined in section related to Gearing.

Peer-group selection

Peer group selection is subject to multiple criteria defined by Brattle, such as:

- The firms must obviously be active in the telecoms industry,
- Shares of the firms must be liquidly traded
- Should not make up a large share (e.g. not more than 10%) of the relevant index against which beta is being calculated.
- The comparator firms should have an investment grade credit rating.
- The firms should not be involved in any substantial mergers and acquisitions
- The comparators should have shares trading at the time of the price control

However, Brattle considers only EU markets, we suggest to use also comparators from non-EU contries, such as China, Russia and Turkey. Similarly, Brattle does not recognize some peer group companies considered by GNCC previously, which were added into the analysis.

Company	Country	GNCC	Brattle
Hellenic Telecommunications Organization SA	Greece	x	
Magyar Telekom Telecommunications Public Limited Company	Hungary	x	
O2 Czech Republic AS	Czech Republic	x	
Telekom Austria AG	Austria	x	x
Swisscom AG	Switzerland	x	x
Vodafone Group Plc	United Kingdom	x	
Orange Polska Spolka Akcyjna	Poland	x	
Chinese Telecom	China	x	
Proximus PLC	Belgium	x	x
Orange (France Telecom)	France	x	x
Public Joint Stock Company Long-Distance and International Telecommunications Rostelecom	Russia	x	x
Public Joint Stock Company Tattelecom	Russia	x	
TeliaSonera Aktiebolag (publ)	Sweden	x	x
BT Group plc	United Kingdom	x	x
Türk Telekomünikasyon A.S.	Turkey	x	
Telecom Italia S.p.A.	Italy	x	x
Telefónica, S.A.	Spain	x	x
KPN	Netherlands		x
Deutsche Telekom	Germany		x
Telenet	Belgium		x
TDC	Denmark		x
Elisa	Finland		x
Kabel Deutschland	Germany		x
Telenor	Noway		x
NOS	Portugal		x
Tele 2	Sweden		x
Pharol	Portugal		x

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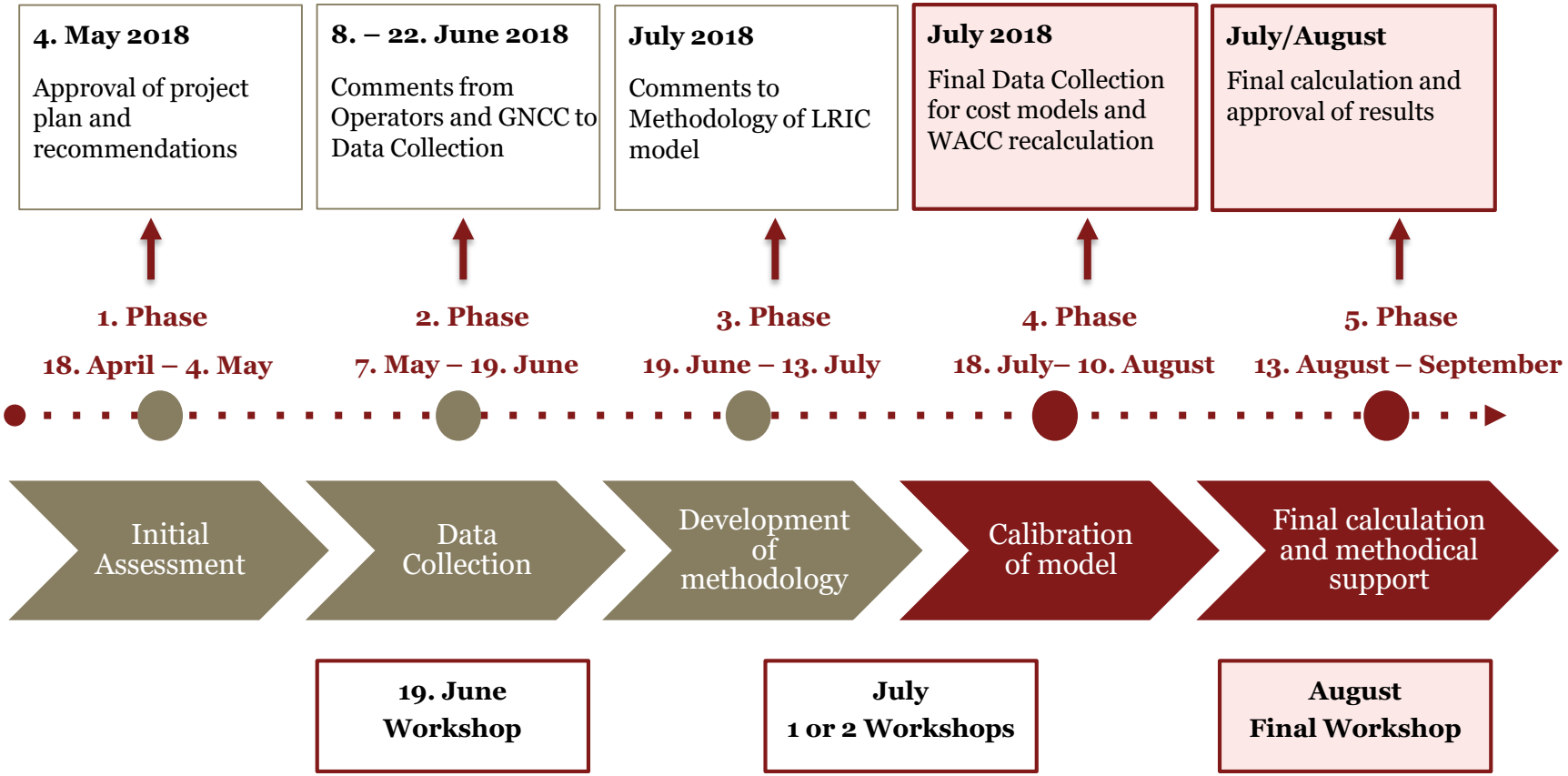
Next Steps

Next steps


4. May 2018
Approval of project plan and recommendations
8. – 22. June 2018
Comments from Operators and GNCC to Data Collection
July 2018
Comments to Methodology of LRIC model
July 2018
Final Data Collection for cost models and WACC recalculation
July/August
Final calculation and approval of results
1. Phase
18. April – 4. May
2. Phase
7. May – 19. June
3. Phase
19. June – 13. July
4. Phase
18. July– 10. August
5. Phase
13. August – September
Initial Assessment
Data Collection
Development of methodology
Calibration of model
Final calculation and methodical support
19. June Workshop
July 1 or 2 Workshops
August Final Workshop

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