# BULRIC Model for FTTH networks

*User Manual*

December 2018


# Contents

# 1. Introduction

This report describes how to use the BULRIC Model ('the model') for FTTH networks commissioned by the Belgian Institute for Postal services and Telecommunications (hereinafter, BIPT).

The present document contains the following sections:

- **General overview of the model**, describing the structure of the BULRIC Model Excel file.
- **Getting started**, detailing the main considerations and specifications to run the model.
- **Understanding the control panel**, describing the Control Panel of the model, which is the main user interface where the main options and scenarios are selected. Additionally, this worksheet contains a 'RUN' button to execute the model.
- **Reporting module**, presenting the reporting module which illustrates the last execution's results.
- **Definition of new parameters**, describing the guidelines needed for the introduction of new services or resources into the model.
- **Description of checks**, explaining the meaning of the checks introduced in the model.

# 2. General overview of the model

The model file is comprised of worksheets grouped in the following blocks or calculation steps:

- Support and control worksheets
- Step 0: Parameters
- Step 1: Main inputs
- Step 2: Advanced inputs
- Step 3: Drivers and Routing Factors mappings
- Step 4: Resources unit costs calculation
- Step 5: Drivers calculations
- Step 6: Access Network dimensioning
- Step 7: Transmission and Core Network dimensioning
- Step 8: Consolidation of network dimensioning results
- Step 9: Resource Costing
- Step 10: LRIC calculation
- Step 11: Common and G&A costs calculation
- Step 12: Outputs

The model has been developed based on a linear architecture in order to improve the execution performance and to reproduce the calculation flow logic.

The exhibit below shows the model calculation flow:

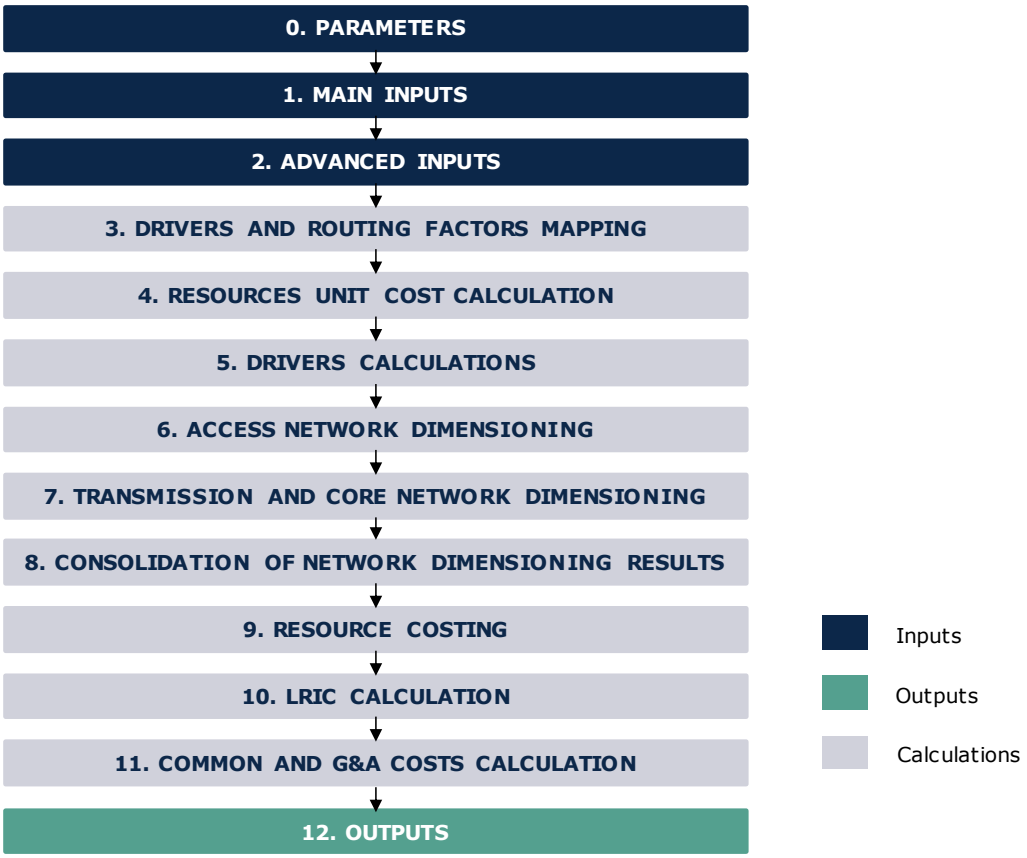



**Exhibit 2.1: Calculation flow of the model [Source: Axon Consulting]**

The block "Support and Control Worksheets" has not been represented in the previous exhibit for clarity purposes. Each block, or calculation step, is introduced in the section 2.1.

The worksheets contained in the blocks or calculation steps have been labelled according to the following structure (except "Support and Control Worksheets" block):

- Step number and ordinal: It is composed of the number of the step (i.e. 0, 1, 2…) and the order in letter format (i.e. A, B …)
- Type of worksheet indicators:
  - PAR: Definition of parameters
  - INP: Input worksheet
  - MAT: Matrix obtaining the relationship between two dimensions
  - MAP: Mapping between two dimensions
  - CALC: Other Calculations
  - OUT: Results worksheet
- Name of the worksheet

As an example, the worksheet '1A INP DEMAND' is the first (A) worksheet of the Step 1. It represents an input (INP) related with the demand (DEMAND).

## 2.1. Relationship between model calculation flow and worksheets

This section describes the calculation blocks, including a detailed description of the worksheets contained in each block. It should be pointed out that sub-section 2.1.1 does not strictly describe a block of the calculation flow, but the supporting and control worksheets used within the model.

### 2.1.1. Support and control worksheets

In the model there are seven (7) worksheets providing general information, supporting the calculation process and checking that execution has been performed correctly.

| Sheet name | Description |
|---|---|
| **CONTENTS** | ▶ Shows overall information about the model file (i.e. version, status and contacts)<br>▶ Provides a list and a brief description of the model worksheets |
| **CONTROL** | ▶ This worksheet includes main model options that may be adjusted to execute the model (for instance the WACC). At the same time, it includes the controls for the execution of the model. |
| **MAP** | ▶ Map that represents the relationship between worksheet blocks and the calculation flow followed.<br>▶ Colours have no meaning and have been selected to ease the identification of the blocks through the model labels. |
| **QUICK LINKS** | ▶ This worksheet contains several useful links to navigate through the main input & output sheets of the model. |
| **COLOUR CODE** | ▶ It contains the colour code used throughout the model. |
| **DISPLAY OPTIONS** | ▶ It enables to display only the inputs/outputs worksheets. |
| **CHECKS** | ▶ Diverse check calculations are contained in this worksheet to ensure that the model is working properly. Further details on these are provided in section 7 of this document. |

**Exhibit 2.2: Support and control worksheets. [Source: Axon Consulting]**

### 2.1.2. **Step 0: Parameters**

The five (5) worksheets concerning the parameterisations taken into consideration in the model are defined in the table below:

| Sheet name | Description |
|---|---|
| **0A PAR SERVICES** | ▶ The list of services considered in the model is introduced in this worksheet.<br>▶ In case that the user wants to define a new service, the following parameters must be filled:<br>-Category: This displays the main category of the service, for instance Access or Broadband. In the case that the service cannot be defined within one of the categories employed, the user can create a new one for the service.<br>-Subcategory: This allows for a more specific differentiation of the services within the same category.<br>-Segment: 'Retail' or 'Wholesale'.<br>-Description: Name of the service.<br>-Unit: Units used to measure the service, for instance lines or Mbps.<br>-Increment: Increment used to calculate the incremental cost of the service.<br>-Allocation to Geotypes Rule: Defines the allocation rule used for the defined geotypes.<br>-Monetary unit display: Subunits (EURCents) may be used as alternative to main units (EUR).<br>-To display the cost: 'Yes' or 'No' may be selected to display or not the cost of the service in the results block (final block of the model).<br>-Time period for costing: Used typically for subscription services that are billed monthly |

| Sheet name | Description |
|---|---|
| **0B PAR RESOURCES** | ▶ Network resources are listed in this worksheet. Other parameters related to the resources are also defined here.<br>▶ In case that the user wants to define a new resource, the categories that need to be defined for each resource are as follows:<br>-Category: Main classification of the resource, typically one of the already defined categories should be used for any new resource.<br>-Name: Complete name of the resource.<br>-Short Name: Shorter version of the name for abbreviation purposes throughout the model.<br>-Cost Component: Separates costs for different types of resources, such as ones that are costed based on the length and others that are costed based on the number of elements.<br>-Unit: Unit in which the resource is measured.<br>-Equivalent Equipment: used to group resources whose costs are allocated to services using the same Routing Factors. |
| **0C PAR DRIVERS** | ▶ The drivers are the variables used for the dimensioning of the network (e.g. Connections, Mbps). The list of drivers considered are listed in this worksheet.<br>▶ The rationale of the dimensioning drivers is to express traffic and demand (at service level) in a way that facilitates the dimensioning of network resources. |
| **0D PAR OTHER** | ▶ Other parameters needed in the model are defined in this worksheet. |

| Sheet name | Description |
|---|---|
| **0E PAR TX TECH** | ▶ The definition and characterisation of the technologies used for transmission is performed in this worksheet. Among the parameters defined, there is the first year that a technology will start to be available, the last year of provision, as well as the maximum number of units that a given technology may be installed. |

**Exhibit 2.3: Parameters worksheets. [Source: Axon Consulting]**

### 2.1.3. Step 1: Main inputs

The main inputs are those that need to be regularly updated to better represent the current characteristics of the operator under study. A total of seven (7) worksheets have been defined in this calculation block and are defined in the following table.

| Sheet name | Description |
|---|---|
| **1A INP DEMAND** | ▶ The demand (subscribers and traffic) that is needed to be supported by the network is input in this worksheet.<br>▶ This demand needs to be defined for each of the services defined in sheet "0A PAR SERVICES". |
| **1B INP DEMAND DISTRIBUTION** | ▶ The distribution of lines per geotype and year is introduced in this worksheet.<br>▶ The sum for each technology must add up to 100%. |
| **1C INP BUILDINGS DATA** | ▶ This worksheet includes the information related to buildings in the country with regards to the different geotypes defined in the model. |
| **1D INP COVERAGE** | ▶ The percentage of buildings covered in each geotype (by year) is introduced in this worksheet. |
| **1E INP UNITARY COSTS** | ▶ Unitary costs (differentiating CAPEX and OPEX) are defined in this worksheet for each resource introduced in sheet "0B PAR RESOURCES". |

| Sheet name | Description |
|---|---|
| **1F INP COST TRENDS** | ▶ Cost trends of the unitary costs by resource are input in this worksheet.<br>▶ They are employed to forecast unitary cost in the future period. |
| **1G G&A AND IT COSTS** | ▶ G&A and IT costs considered in the model are defined in this worksheet by means of mark-ups. |

**Exhibit 2.4: Main inputs worksheets. [Source: Axon Consulting]**

### 2.1.4. Step 2: Advanced inputs

The second type of inputs, named as Advanced Inputs, is not expected to be updated regularly by the user, as it is expected that the parameters they contain will usually remain unchanged. They are related to geographical information, technical parameters, etc. Six (6) worksheets have been defined in this step, and they are detailed in the table below:

| Sheet name | Description |
|---|---|
| **2A INP NW** | ▶ Network parameters needed for the dimensioning of the network (for instance, equipment's capacity, standard constants) are introduced in this worksheet. |
| **2B INP GEO DISTANCES** | ▶ This worksheet contains the information required to properly characterise the access network in terms of distances between network elements.<br>▶ The use of these inputs in the dimensioning is introduced in further detail in the descriptive manual, when describing the access network dimensioning. |
| **2C INP GEO NW CHARAC** | ▶ Data required for the definition of the geotypes is input in this worksheet<br>▶ These data include % of buried/aerial routes and parameters for the dimensioning of the access network equipment. |

| Sheet name | Description |
|---|---|
| **2D INP TX LINKS** | ▶ The information related to the transmission links is introduced in this worksheet for each transmission segment (Local Nodes - Core Nodes and Core Nodes - Core Nodes) |
| **2E INP RESOURCES LIVES** | ▶ Useful lives for the annualization of resources costs are introduced in this worksheet. |
| **2F INP HORIZON** | ▶ The planning horizon represents the years in advance that are considered for the dimensioning of the network.<br>▶ Overcapacity is the security margin between maximum expected traffic and the capacity installed. |

**Exhibit 2.5: Advanced inputs worksheets. [Source: Axon Consulting]**

### 2.1.5. **Step 3: Drivers and Routing Factors mappings**

The four (4) worksheets contained in this step are used to map the services with the drivers used for dimensioning and the definition of the routing factors. These worksheets are defined in the table below:

| Sheet name | Description |
|---|---|
| **3A MAP SERV2DRIV** | ▶ Relationships between services and dimensioning drivers based on the conversion factors and the use of the drivers by each service is defined in this worksheet.<br>▶ It must be noted that to obtain the drivers, it is necessary to indicate which services are related to them.<br>▶ It should also be noted that a service is generally assigned to more than one driver as drivers represent traffic in a particular point of the network. |
| **3B MAT SERV TO DRIV** | ▶ This worksheet calculates a relationship matrix between services and drivers based on the definitions established in worksheet "3A MAP SERV TO DRIV". |

| Sheet name | Description |
|---|---|
| **3C MAP ROUTING FACTORS** | ▶ In this worksheet, the cost allocation of resources to services is defined through Routing Factors. The Routing Factors are calculated considering network statistics.<br>▶ The Routing Factor is a measure of how many times a resource is used by a specific service during its provision. Hence, the more traffic a service generates, the higher the cost will be charged from the asset considered; and the higher utilisation of the asset, the higher cost taken. |
| **3D MAT ROUTING FACTORS** | ▶ This worksheet calculates a relationship matrix between services and resources based on the definitions established in worksheet "3C MAP ROUTING FACTORS". |

**Exhibit 2.6: Drivers and routing factors mappings worksheets. [Source: Axon Consulting]**

### 2.1.6. **Step 4: Resources unit costs calculation**

The three (3) worksheets introduced in this section are responsible for calculating the unitary OPEX and CAPEX costs of the resources for the years the model is being simulated. These worksheets are defined in the table below:

| Sheet name | Description |
|---|---|
| **4A CALC UNIT CAPEX CONSOL** | ▶ In this worksheet, CAPEX unitary costs are consolidated in a table with the format that needs to be used in the model.<br>▶ This calculation is performed taking into consideration the historic cost (from worksheet "1E INP UNITARY COSTS") and the future trends (from worksheet "1F INP COST TRENDS"). |
| **4B CALC UNIT OPEX CONSOL** | ▶ In this worksheet, OPEX unitary costs are consolidated in a table with the format that needs to be used in the model.<br>▶ This calculation is performed taking into consideration the historic cost (from sheet "1E INP UNITARY COSTS") and the future trends (from sheet "1F INP COST TRENDS"). |
| **4C CALC UNIT TX COSTS** | ▶ In this worksheet, unitary costs per transmission link (including all the needed resources) are estimated.<br>▶ This table is subsequently used for the selection of the optimum technology when dimensioning transmission links. |

**Exhibit 2.7: Resources unit costs calculation worksheets. [Source: Axon Consulting]**

### 2.1.7. Step 5: Drivers calculations

The following three (3) worksheets are related to the calculation of the dimensioning drivers. These worksheets are detailed in the table below:

| Sheet name | Description |
|---|---|
| **5A CALC ADJUSTED DEMAND** | ▶ The adjusted demand is calculated in this worksheet, considering the average consumption in the busy hour of the broadband users.<br>▶ The rationale of the adjusted demand is to express broadband traffic in a way that facilitates the dimensioning of network resources. |

| Sheet name | Description |
|---|---|
| **5B CALC TOTAL DRIVERS CONSOL** | ▶ Total volume of dimensioning drivers (considering all geotypes) is calculated in this worksheet, by considering the demand (worksheet "1A INP DEMAND") and the unit conversions defined (sheet "3B MAT SERV TO DRIV").<br>▶ The rationale of the dimensioning drivers is to express traffic and demand (at service level) in a way that facilitates the dimensioning of network resources. |
| **5C CALC GEO DRIVERS CONSOL** | ▶ The volume of dimensioning drivers per geotype is calculated in this worksheet.<br>▶ It must be noted that this step is necessary since the dimensioning of the access network is performed independently for the defined geotypes. |

**Exhibit 2.8: Drivers calculation worksheets. [Source: Axon Consulting]**

### 2.1.8. Step 6: Access Network dimensioning

These worksheets are responsible for dimensioning the access network. The two (2) worksheets defined in this step are described in the following table:

| Sheet name | Description |
|---|---|
| **6A CALC DIM ACCESS** | ▶ This worksheet dimensions the access network following the algorithms defined in the descriptive manual. |
| **6B MAC RES ACCESS** | ▶ The resources calculated in worksheet "6A CALC DIM ACCESS" are stored in this worksheet for the different geotypes and increments. |

**Exhibit 2.9: Access Network dimensioning worksheets. [Source: Axon Consulting]**

### 2.1.9. Step 7: Transmission and Core Network dimensioning

These worksheets are responsible for dimensioning the transmission and core Network. The two (2) worksheets defined in this step are described in the following table:

| Sheet name | Description |
|---|---|
| **7A CALC DIM CORE** | ▶ This worksheet dimensions the transmission and the core network following the algorithms defined in the descriptive manual. |
| **7B MAC RES CORE** | ▶ The resources calculated in worksheet "7A CALC DIM CORE" are stored in this worksheet for the different increments. |

**Exhibit 2.10: Transmission and Core Network dimensioning worksheets. [Source: Axon Consulting]**

### 2.1.10. Step 8: Consolidation of network dimensioning results

The results of the previous step are consolidated in one (1) worksheet included in this block. The description of this worksheet is provided in the table below:

| Sheet name | Description |
|---|---|
| **8A CONSOL RES** | ▶ This worksheet consolidates the resources obtained in all the previous dimensioning worksheets. |

**Exhibit 2.11: Consolidation of network dimensioning results worksheets. [Source: Axon Consulting]**

### 2.1.11. Step 9: Resource Costing

This step contains three (3) worksheets related with the costing of resources. A detailed explanation about these worksheets is provided in the following table:

| Sheet name | Description |
|---|---|
| **9A CALC RES COST OPEX** | ▶ The OPEX of the resources is calculated in this worksheet.<br>▶ The calculation takes into account the number of resources (from sheet "8A CONSOL RES") and the operational unitary cost (from sheet "4B CALC UNIT OPEX CONSOL"). |

| Sheet name | Description |
|---|---|
| **9B CALC RES COST CAPEX** | ▶ Resources' CAPEX is annualised in this worksheet using Economic Depreciation.<br>▶ For the calculation of investment costs, the number of resources is extracted from sheet "8A CONSOL RES" and the unitary costs from sheet "4A CALC UNIT CAPEX CONSOL". Cost are annualised by employing the useful lives from sheet "2E INP RESOURCES LIVES". |
| **9C CALC RES COST CONSOL** | ▶ OPEX and CAPEX of resources are consolidated in this worksheet for each increment. |

**Exhibit 2.12: Resource costing worksheets. [Source: Axon Consulting]**

### 2.1.12. Step 10: LRIC calculation

This step contains three (3) worksheets related with the allocation of incremental costs to services. A detailed explanation about these worksheets is provided in the following table:

| Sheet name | Description |
|---|---|
| **10A CALC ALLOC DEMAND** | ▶ The demand employed for the allocation of incremental costs is calculated in this worksheet. |
| **10B CALC SERV INCR COST** | ▶ This worksheet allocates resources' costs (from sheet "9C CALC RES COST CONSOL") to services through the use of Routing Factors (extracted from sheet "3D MAT ROUTING FACTORS"). |
| **10C CONSOL SERV INCR COST** | ▶ Incremental costs of each service are calculated in this worksheet as the sum of the cost associated to each increment, extracted from the previous sheet "10B CALC SERV INCR COST". |

**Exhibit 2.13: LRIC calculation worksheets. [Source: Axon Consulting]**

### 2.1.13. Step 11: Common and G&A costs calculation

This step is the responsible of obtaining the LRIC+ costs of services. The five (5) worksheets contained in this step are detailed below:

| Sheet name | Description |
|---|---|
| **11A CALC RES COMMON COST** | ▶ Resources common network costs are calculated in this worksheet.<br>▶ Common costs by resource are obtained as the difference between the total cost base obtained under FAC standard (considering all the demand) and the total incremental costs. |
| **11B CALC SERV COMMON COST** | ▶ This worksheet attributes the common costs, calculated in the previous worksheet 11A, to services through the Effective Capacity method. |
| **11C CALC SERV G&A AND IT COST** | ▶ This worksheet calculates the G&A and IT costs, based on the mark-ups defined in worksheet "1G G&A AND IT COSTS" |
| **11D OUT SERV RES COST** | ▶ This worksheet provides a disaggregation of services' unit cost for each network resource included in the model.<br>▶ The results presented in this worksheet correspond to the year and service selected in the cells reserved for this, located at the top of the worksheet. |
| **11E OUT KPI** | ▶ This worksheet has been reserved for the calculation of KPIs. |

**Exhibit 2.14: Common and G&A costs calculation worksheets. [Source: Axon Consulting]**

### 2.1.14. **Step 12: Outputs**

The two (2) worksheets contained in this step offer concise information about the results of the model. Further detail of these worksheets' content is provided in the table below:

| Sheet name | Description |
|---|---|
| **12A OUT SERV LRIC+ TOT COST** | ▶ This worksheet consolidates the total costs per service.<br>▶ Costs are disaggregated for incremental and common costs as well as for OPEX and CAPEX categories. |
| **12B OUT SERV LRIC+ UNIT COST** | ▶ This worksheet consolidates the unitary LRIC+ costs per service.<br>▶ Costs are disaggregated for incremental and common costs as well as for OPEX and CAPEX categories. |

**Exhibit 2.15: Outputs worksheets. [Source: Axon Consulting]**

# 3. Getting started

### Computer requirements

The BULRIC model is an Excel file. To run the model, a computer with at least 1 GB of RAM memory and with Microsoft Excel version 2007 (or a newer version) is required. For enhanced performance, it is recommended to run the model on computers with 2 GB of RAM Memory.

### Opening the model

The execution of the model makes use of Macros (embedded programs in Visual Basic). Therefore, they need to be enabled to run the model. If Macros are not enabled when opening the model, the following warning will appear[1]:

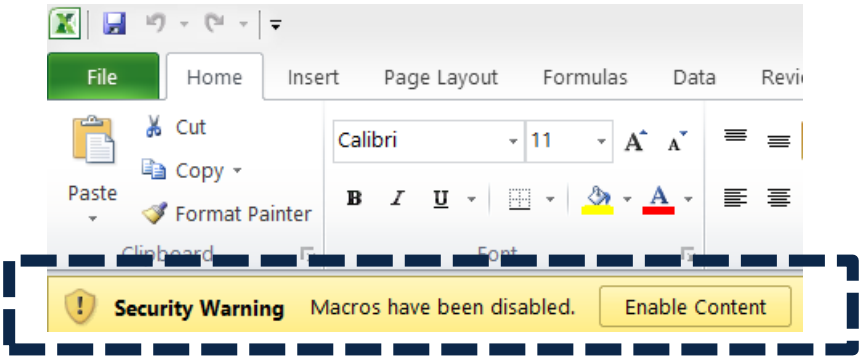



**Exhibit 3.1: Warning appearing in Microsoft Excel 2010 when model is open and Macros are not enabled. [Source: Axon Consulting]**

In case the warning shown above appears, clicking the "Enable Content" button will enable Macros and will allow the user to execute the model.

[1] In case the warning shown in Exhibit 3.1 does not appear, disregard further steps described in this section.

# 4. Understanding the control panel

The control panel represents the main interface user-model. It is used to select the model's main available options, configure the execution mode and run the model. The following figure shows a snapshot of the control panel.

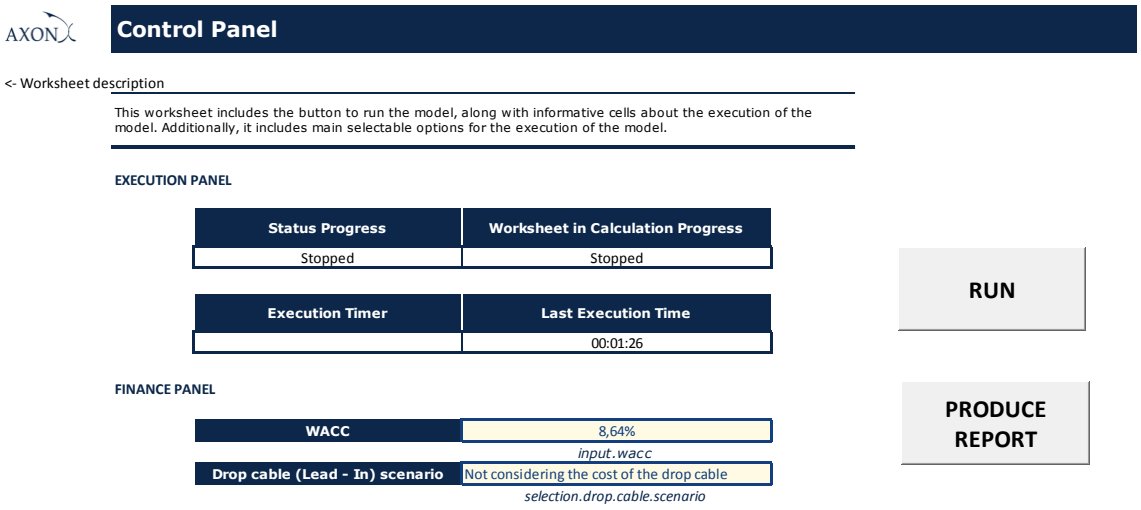



**Exhibit 4.1: Snapshot of the control panel [Source: Axon Consulting]**

The control panel is divided into the following blocks:

- Execution Panel
- Finance Panel

The two blocks are covered in the following paragraphs.

**Important warning: the model needs to be run to see the impact on the results of any change made in the control panel.**

## 4.1. Execution Panel

The Execution Panel displays information regarding the status and progress of the execution of the model. The following information is shown in this Panel:

- **Status Progress:** It displays the increment and geotype that is being run during the execution of the model. If a general calculation is being performed, this cell will show the indication `General´.
- **Worksheet in Calculation Progress**: It displays the worksheet that is running during the execution of the model.
- **Execution Timer**: It displays the duration of the current model execution.

- **Last Execution Time:** It displays the duration of the last execution of the model.

## 4.2. Finance Panel

The Finance Panel includes options affecting the way in which costs are calculated and presented:

- **WACC (Weighted Average Cost of Capital):** This parameter represents the average minimum remuneration required for the capital employed. The WACC is employed for the calculation of the cost of capital associated to fixed investments. A percentage must be introduced here by the user.
- **Drop cable (Lead – In) scenario:** This parameter represents the different options available for the consideration of the drop cable (cable connecting the customer's premise with the first point of connection in the operator's network):
  - *Not considering the cost of the drop cable*: the cost of the drop cable is excluded from the model's results.
  - *Considering the cost of the drop cable of all terminated dwellings*: the cost of all drop cables associated to household/dwellings that have been terminated is considered in the model's results. By the term "terminated", the model refers to all household/dwellings for which the connection between the customer's premise and the first point of connection in the operator's network has been carried out, even if the customer has not subscribed to FTTH services yet, but the necessary connection would already be ready in case he decides to subscribe in the future.

# 5. Reporting module

The BULRIC model is designed to produce outputs in separated files. This enables the user to analyse results without having to open the entire model.

## 5.1. How to produce the report

In order to produce the report, once the model has been executed ("RUN" button), the user should click on the "PRODUCE REPORT" button of the control panel (worksheet "CONTROL"). A window will then pop up asking the user to select a template where the results will be saved. The following snapshot shows this window.

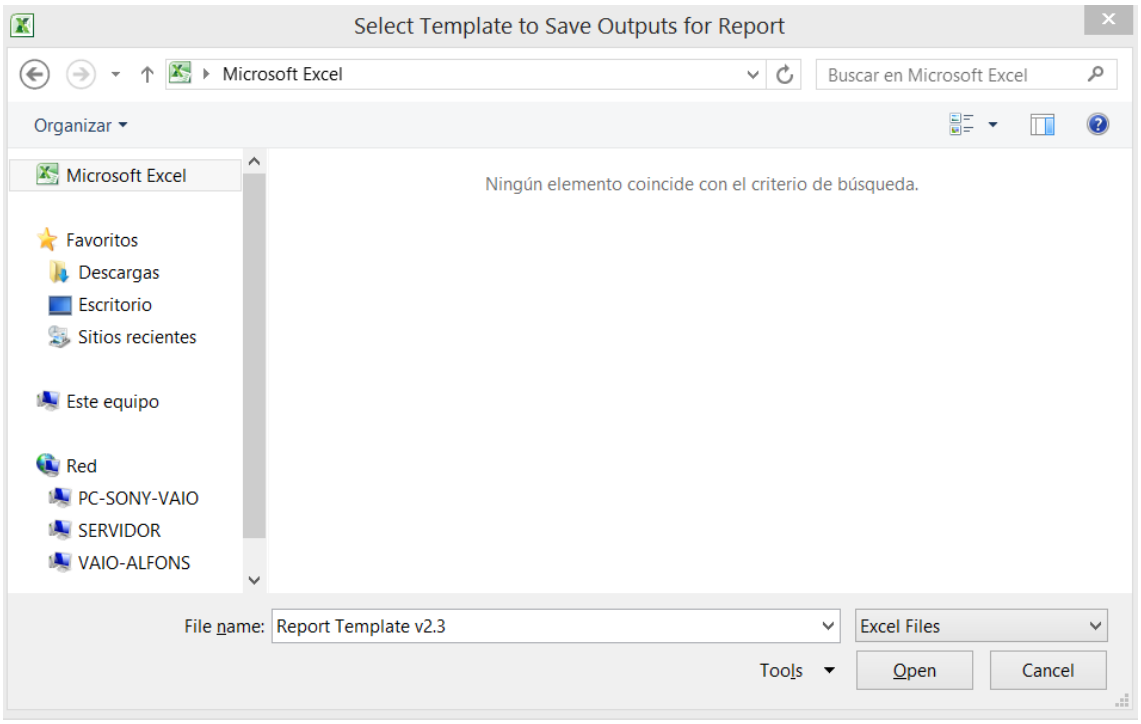



**Exhibit 5.1: Snapshot of the window that appears to select the template for the report [Source: Axon Consulting]**

After selecting the template, the model will ask for a destination folder and a name for the file in which the results will be saved. The following snapshot displays the window that will appear:

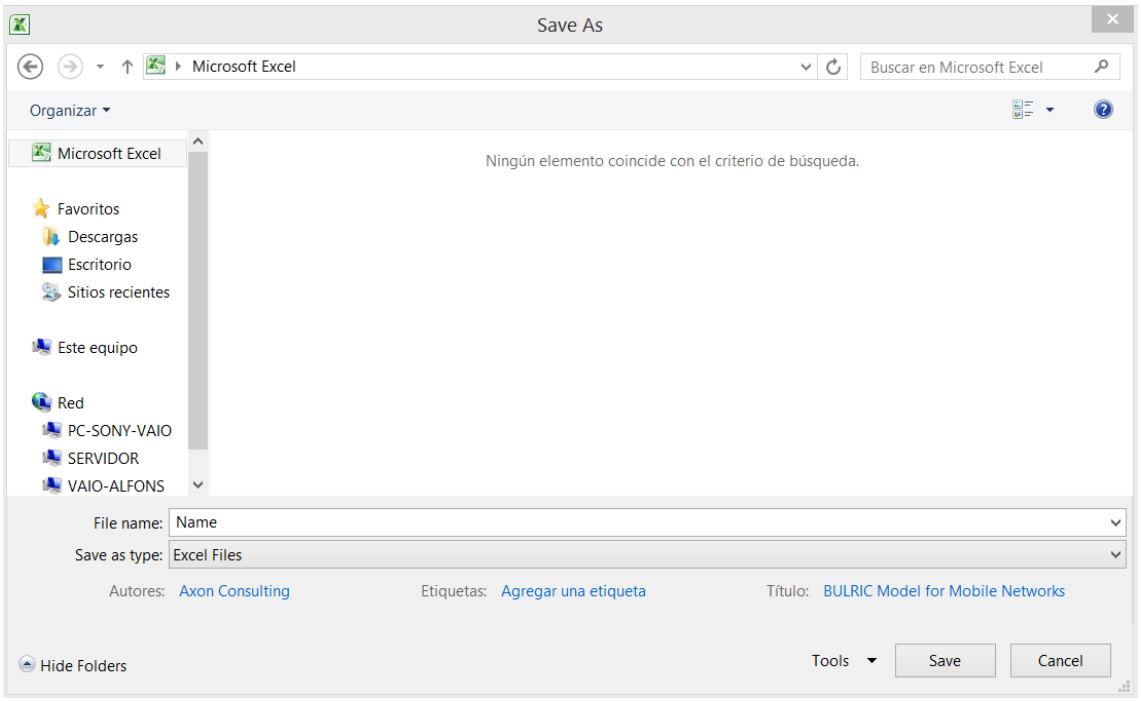



**Exhibit 5.2: Snapshot of the window that appears to save the Report [Source: Axon Consulting]**

## 5.2. **Structure of the report**

The report template has the following structure:

- **Presentation worksheets**:
  - **Pivot tables:** these tables can be easily configured to display results in the format or level of detail required. For example, a pivot table with total costs by resource can be changed to show costs by resource category (i.e. network level, transmission, core, etc.).
  - **Pivot charts:** these charts can be easily configured to represent the results in the format or detail level required.
- **Raw data worksheets:** the latest worksheets of the reporting template contain raw data saved from the model. These worksheets are located after the "Support" worksheet.


**Exhibit 5.3: Illustrative snapshot of the separation between presentation worksheet labels and raw data [Source: Axon Consulting]**

## 5.3. **Description of the report**

The Report is the main output of the model. It has been designed to provide full detail of the results obtained. This report contains the following items:

- **0A OUT PIVOT SERVICES DEMAND:** Pivot table with demand by service
- **0B OUT PIVOT SERV TOTAL COST:** Pivot table with total costs by service
- **0C OUT PIVOT SERVICE UNIT COST:** Pivot table with unitary costs by service
- **0D OUT PIVOT RESOURCES UNITS:** Pivot table with resources units obtained in dimensioning modules
- **0E OUT PIVOT RES TOTAL COST:** Pivot table with total annualised costs by resource
- **0F CHAR PT SERVICE UNIT COST:** Pivot chart showing the unitary cost of the selected service.

The following subsections describe each worksheet in detail.

### *0A OUT PIVOT SERVICES DEMAND*

This worksheet shows the demand input for which the network has been modelled (traffic and number of subscribers). Demand is shown on a highly configurable pivot table. The following figure shows an illustrative example of the demand pivot table.

| Increment name | FAC | | | | | |
|---|---|---|---|---|---|---|
| | | | SERVICES TRAFFIC | | | |
| Service Segment | Service Category | Units | 2016 | 2017 | 2018 | 2019 |
| Retail | Access | | | | | |
| | Access.FTTH.Retail.Access | Lines | - | - | - | - |
| | Broadband | | | | | |
| | Broadband.FTTH.Retail.25 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.50 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.75 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.100 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.125 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.150 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.200 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.300 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.500 Mbps | Lines | - | - | - | - |
| | Broadband.FTTH.Retail.1 Gbps | Lines | - | - | - | - |
| | Broadband.Copper.Retail.Broadband Traffic (Core Traffic) | Mbps | - | - | - | - |

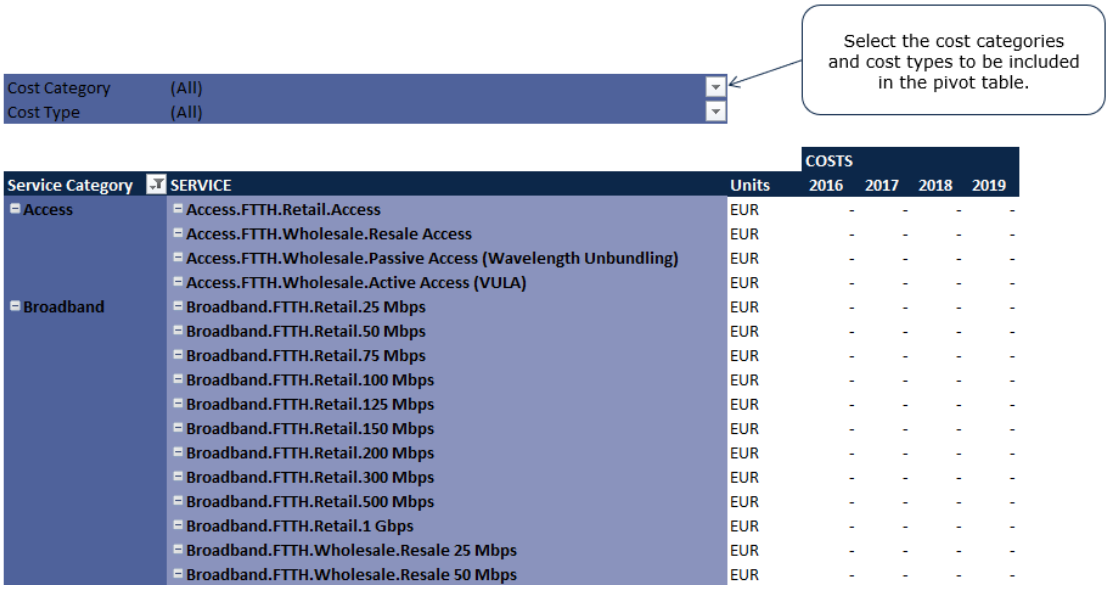
**Exhibit 5.4: Illustrative example of demand pivot table [Source: Axon Consulting]**

The previous table shows the demand broken down by service category (e.g. Access, Broadband, TV) and subcategory.

Although the table is predefined, it can be configured through the "PivotTable Field List" panel (see section 5.3.1).

### *0B OUT PIVOT SERV TOTAL COST*

This worksheet shows total costs per service. The following figure shows an illustrative example.




| Service Category | SERVICE | Units | COSTS 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| Access | Access.FTTH.Retail.Access | EUR | - | - | - | - |
| | Access.FTTH.Wholesale.Resale Access | EUR | - | - | - | - |
| | Access.FTTH.Wholesale.Passive Access (Wavelength Unbundling) | EUR | - | - | - | - |
| | Access.FTTH.Wholesale.Active Access (VULA) | EUR | - | - | - | - |
| Broadband | Broadband.FTTH.Retail.25 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.50 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.75 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.100 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.125 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.150 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.200 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.300 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.500 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Retail.1 Gbps | EUR | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 25 Mbps | EUR | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 50 Mbps | EUR | - | - | - | - |

**Exhibit 5.5: Illustrative example of costs by service Pivot Table [Source: Axon Consulting]**

The previous table also includes a filter to select the desired cost categories and cost types to be displayed from the options presented below:

- Cost category (one or more can be selected):
  - OPEX
  - CAPEX
- Cost type (one or more can be selected):
  - INCREMENTAL COST
  - COMMON COSTS

The unit in which the data is shown is EUR.

### 0C OUT PIVOT SERVICE UNIT COST

This sheet shows unitary costs by service. The following table shows an illustrative example.


| | | | UNIT COSTS | | | |
|---|---|---|---|---|---|---|
| Service Category | SERVICE | Units | 2016 | 2017 | 2018 | 2019 |
| Access | Access.FTTH.Retail.Access | EUR / Month / Lines | - | - | - | - |
| | Access.FTTH.Wholesale.Resale Access | EUR / Month / Lines | - | - | - | - |
| | Access.FTTH.Wholesale.Passive Access (Wavelength Unbundling) | EUR / Month / Lines | - | - | - | - |
| | Access.FTTH.Wholesale.Active Access (VULA) | EUR / Month / Lines | - | - | - | - |
| Broadband | Broadband.FTTH.Retail.25 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.50 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.75 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.100 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.125 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.150 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.200 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.300 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.500 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Retail.1 Gbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 25 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 50 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 75 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 100 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 125 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 150 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 200 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 300 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 500 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Resale 1 Gbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Bitstream 25 Mbps | EUR / Month / Lines | - | - | - | - |
| | Broadband.FTTH.Wholesale.Bitstream 50 Mbps | EUR / Month / Lines | - | - | - | - |

**Exhibit 5.6: Illustrative extract of unitary costs by service Pivot Table [Source: Axon Consulting]**

As in the previous worksheet, Cost Categories and Cost Types to be displayed can be selected by the user.

It is important to note that aggregating the costs of different services will not have any relevant meaning (it will not produce the blended unit costs of a given category of services).

### 0D OUT PIVOT RESOURCES UNITS

This worksheet shows the number of equipment elements obtained in the model to satisfy the demand. The following figure shows an illustrative extract of resource units.

| Increment name | FAC |
|---|---|

| | RESOURCES UNITS | | | |
|---|---|---|---|---|
| Service Category | 2016 | 2017 | 2018 | 2019 |
| **# of DTP-F** | | | | |
| DTP-F for SDU | - | - | - | - |
| DTP-F for MDU | - | - | - | - |
| **# of DTP-U** | | | | |
| DTP-U for SDU | - | - | - | - |
| DTP-U for MDU | - | - | - | - |
| **# of drops** | | | | |
| Drop Cable (Lead - In) - Single Dwelling | - | - | - | - |
| Drop Cable (Lead - In) - Multi Dwelling | - | - | - | - |
| **km** | | | | |
| Buried - 1 strand | - | - | - | - |
| Buried - 2 strand | - | - | - | - |
| Buried - 4 strand | - | - | - | - |
| Buried - 6 strand | - | - | - | - |
| Buried - 8 strand | - | - | - | - |
| Buried - 10 strand | - | - | - | - |
| Buried - 12 strand | - | - | - | - |
| Buried - 20 strand | - | - | - | - |
| Buried - 24 strand | - | - | - | - |
| Buried - 48 strand | - | - | - | - |

**Exhibit 5.7: Illustrative extract of Resources' units Pivot Table [Source: Axon Consulting]**

### *0E OUT PIVOT RES TOTAL COST*

This worksheet shows annualised costs broken down by resource. The following figure shows an illustrative example of costs by resource category:

| Cost category | (All) |
|---|---|

| | | COSTS | | | |
|---|---|---|---|---|---|
| Resource Category | Currency | 2016 | 2017 | 2018 | 2019 |
| Access Network | | | | | |
| DTP-F for SDU | EUR | - | - | - | - |
| DTP-U for SDU | EUR | - | - | - | - |
| DTP-F for MDU | EUR | - | - | - | - |
| DTP-U for MDU | EUR | - | - | - | - |
| # of OFPs | EUR | - | - | - | - |
| # of OMDFs | EUR | - | - | - | - |
| Access Fibre | | | | | |
| # of drops | EUR | - | - | - | - |
| length | EUR | - | - | - | - |
| # of joints | EUR | - | - | - | - |
| Access infrastructure | | | | | |
| length | EUR | - | - | - | - |
| # of manholes | EUR | - | - | - | - |
| # of poles | EUR | - | - | - | - |
| Local Exchange | | | | | |
| # of LEXs | EUR | - | - | - | - |

**Exhibit 5.8: Illustrative example of resources' cost by resources category [Source: Axon Consulting]**

As in previous tables, the cost category can be selected (i.e. OPEX, CAPEX or both).

### *0F CHAR PT SERVICE UNIT COST*

This worksheet contains a dynamic chart showing the unitary costs of the selected services. The following exhibit shows an illustrative example of the chart obtained in this worksheet.

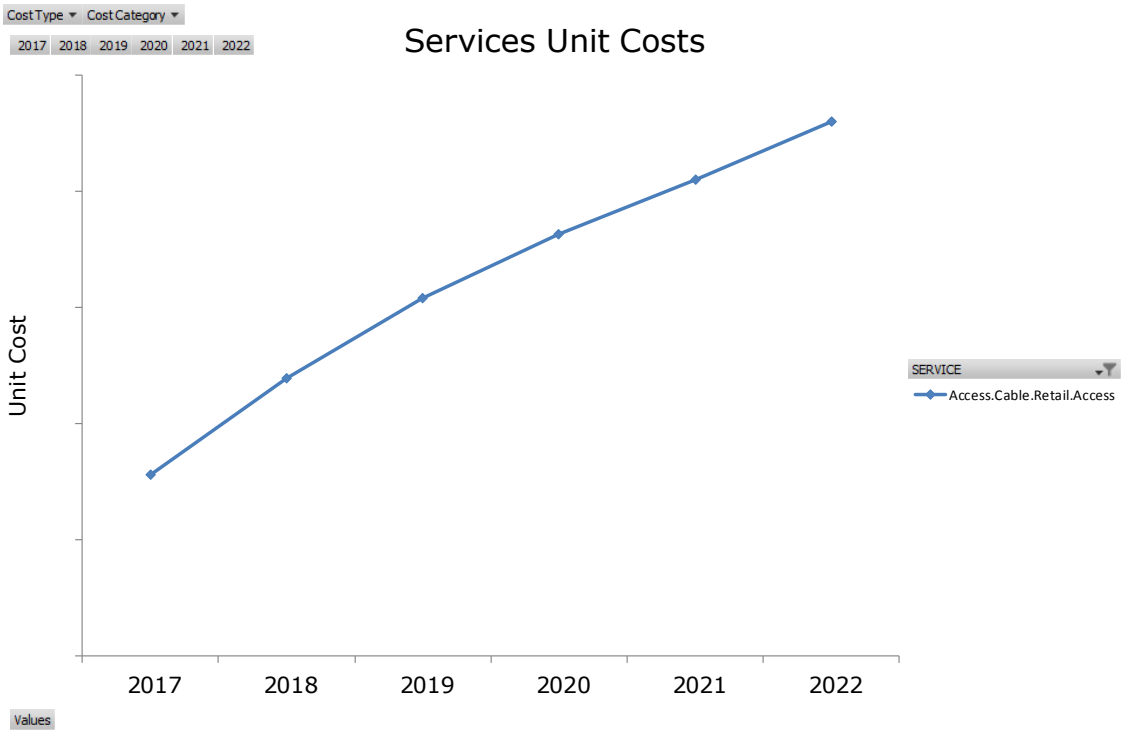



**Exhibit 5.9: Illustrative example of the dynamic chart created to show the unitary costs of the services selected by the user (illustrative data) [Source: Axon Consulting]**

As can be observed in the exhibit above, although the chart is predefined, the user can easily change the chart parameters (cost type, cost category) and the services to be shown.

### 5.3.1. How to configure pivot tables

Pivot Tables can be configured through the "PivotTable Field List" panel. The panel is located on the right side of the Excel window as shown in the following figure:

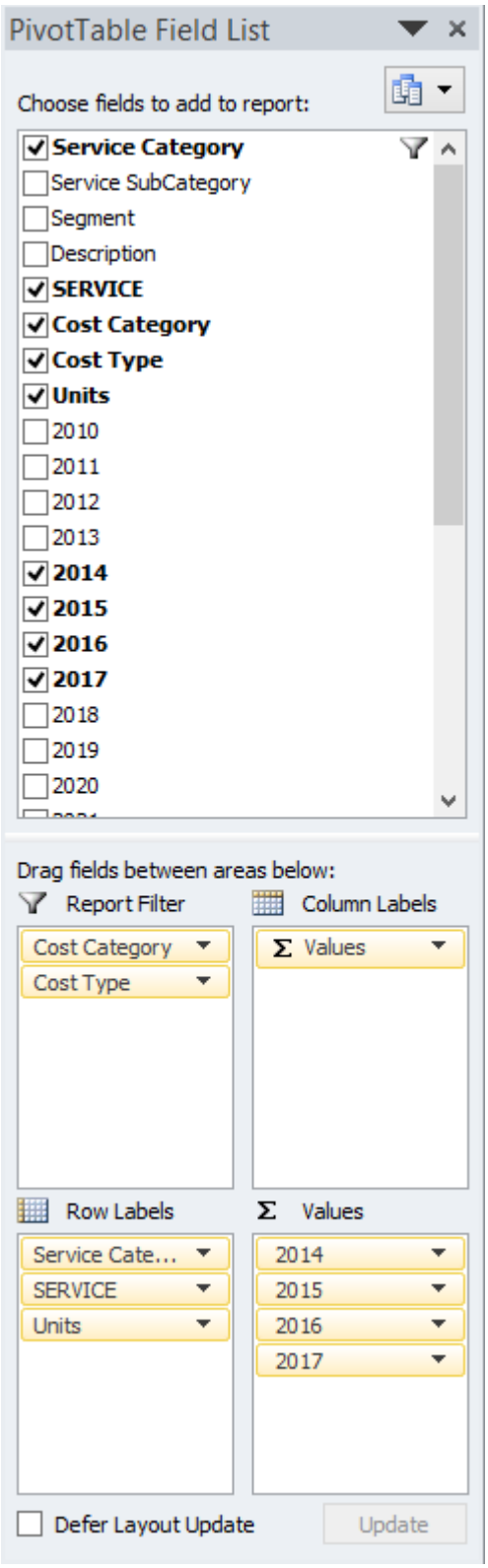



**Exhibit 5.10: Illustrative example of "PivotTable Field List" panel. [Source: Axon Consulting]**

To bring this panel up, select one cell of the pivot table. If it does not appear automatically in the right of the window, follow these steps:

1. Select a cell on the pivot table

2. Go to the label PivotTable Tools – Options

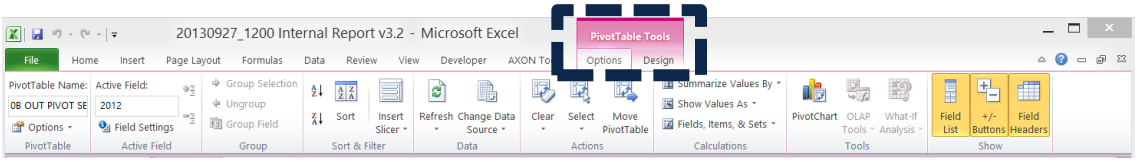



**Exhibit 5.11: Label PivotTable Tools – Options. [Source: Axon Consulting]**

3. Enable "Field List"

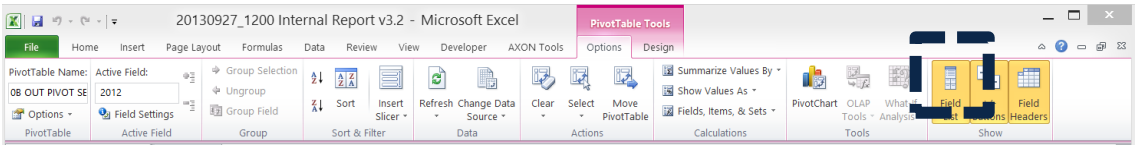



**Exhibit 5.12: "Field List" Button. [Source: Axon Consulting]**

To add or remove fields from the pivot table, marked or unmarked in the Field List.

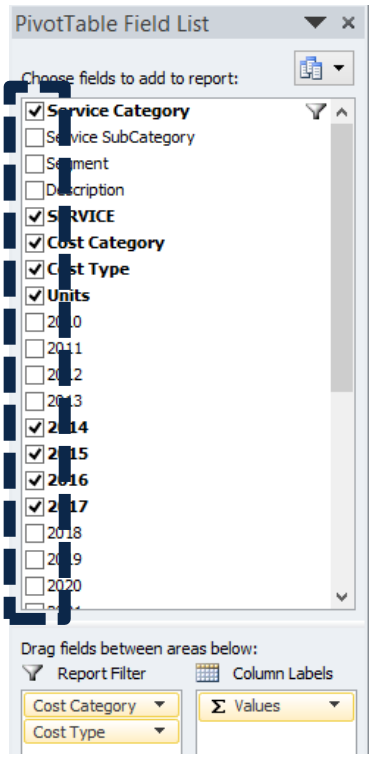



**Exhibit 5.13: Area dedicated to mark or unmark fields. [Source: Axon Consulting]**

After selecting a new field, it should be sorted in the desired position. In the example given below, the year 2013 was added.

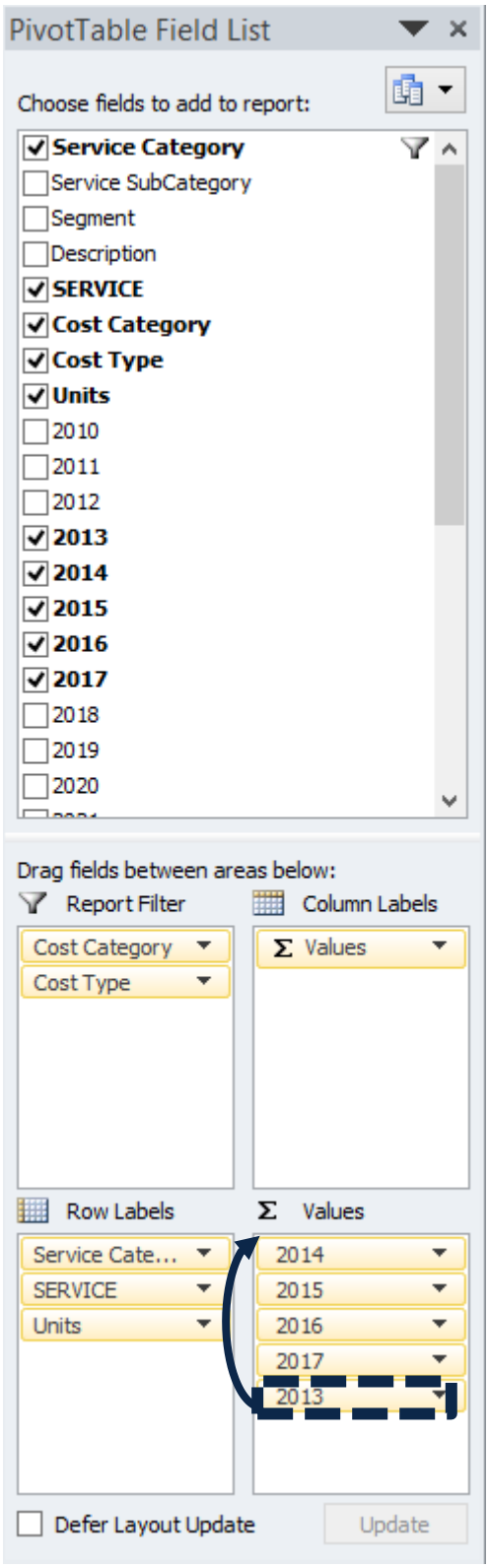



**Exhibit 5.14: After adding a new field, it should be dragged and dropped in the desired position. [Source: Axon Consulting]**

# 6. Definition of new parameters

This section explains how to define new parameters into the model. The parameters include:

- Definition of new services
- Definition of new resources

## 6.1. Definition of new services

The process of creating a new service in the BULRIC Model involves the addition of the service to the existing list, as well as the definition of the service inputs and the mapping of the new service in the different sections of the model. This section outlines the steps that need to be followed to achieve this purpose.

### *Step 1: Definition of the service*

The first step is to add the new service to the existing list of services in worksheet '0A PAR SERVICES' in table 'SERVICES PARAMETRISATION'

| CATEGORY | SUBCATEGORY | SEGMENT | DESCRIPTION | UNIT | INCREMENT | ALLOCATION TO GEOTYPES RULE | MONETARY UNIT DISPLAY | TO DISPLAY THE COST? | TIME PERIOD FOR COSTING | TO APPLY FACTOR OF CONSUMPTION PER USER? | TO ALLOCATE COST OF THE BRAS, DNS AND RADIUS? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Broadband | FTTH | Retail | 25 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 50 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 75 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 100 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 125 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 150 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 200 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 300 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 500 Mbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |
| Broadband | FTTH | Retail | 1 Gbps | Lines | Conveyance | # Lines | Unit | Yes | Month | Yes | Yes |

**Exhibit 6.1: Example services in worksheet '0A PAR SERVICES'. [Source: Axon Consulting]**

In this worksheet the following parameters must be filled:

- Category: This displays the main category of the service, for instance Broadband or Leased Lines. In the case that the service cannot be defined within one of the categories used, the user can create a new one for the service.
- Subcategory: This allows for a more specific differentiation of the services within the same category.
- Segment: 'Retail' or 'Wholesale'
- Description: Name of the service
- Unit: Units used to measure the service, for instance lines or minutes.
- Increment: Increment used to calculate the incremental cost of the service.
- Allocation to Geotypes Rule: Defines the allocation rule used for the defined geotypes.

- Monetary unit display: Subunits (EURCents) may be used as alternative to main units (EUR)
- To display the cost: 'Yes' or 'No' may be selected to display or not the cost of the service in the results block (final block of the model).
- Time period for costing: Used typically for subscription services that are billed monthly
- To Apply factor of the consumption per user?:`Yes´ or `No´ must be selected if the service refers to a broadband service charged per user for a specific speed profile.
- To allocate cost of the BRAS, DNS AND RADIUS?: `Yes´ or `No´ must be selected if the service makes use of those equipments for broadband.

***Step 2: Service demand***

The next step is the definition of the service demand, which must be included by the user in sheet `1A INP DEMAND´ for the time period modelled.

***Step 3: Service mappings***

This step includes updating two separate worksheets:

- '3A MAP SERV TO DRIV
- '3C MAP ROUTING FACTORS

Worksheet '3A MAP SERV TO DRIV' maps each service to the drivers in the model. The user should add a row for each driver in case that the new service applies and fill in the corresponding usage factor and the unit conversion factor. The user should also make sure that the variables included in columns E:J are properly filled using the existing formulas.

On the other hand, worksheet '3C MAP ROUTING FACTORS' outlines the different Routing Factors used for the allocation of resources' costs to each service. The user should add one row for each of the group of resources, in case the new service makes use of such group, and adding the corresponding routing factor, in a similar way as it is done for the already implemented services.

## 6.2. **Definition of new resources**

In order to define new resources that may be needed to accommodate the definition of new services, there are several steps that need to be followed.

### *Step 1: Definition of the resource*

Similarly, to the definition of new services, the first step is to define the new resource in worksheet '0B PAR RESOURCES', table 'RESOURCES PARAMETRISATION'

| Category | Name | Short Name | Cost Component | Unit | Equivalent Equipment |
|---|---|---|---|---|---|
| Transmission - LN to Core | Fibre Cable | Fibre | length | km | Transmission - Sec 1 - Distance |
| Transmission - LN to Core | Fibre Cable | Fibre | lines | # of fibre lines | Transmission - Sec 1 |
| Transmission - LN to Core | Trenches | Trenches | km | km | Transmission - Sec 1 - Distance |
| Transmission - LN to Core | Switch 100Mbps port | SWT 100Mbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | Switch 500Mbps port | SWT 500Mbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | Switch GE 1Gbps port | SWT 1Gbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | Switch GE 10Gbps port | SWT 10Gbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | Switch GE 40Gbps port | SWT 40Gbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | Switch GE 100Gbps port | SWT 100Gbps port | # of ports | # of ports | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 1Gbps - 4 Lambdas | DWDM 1Gbps port - 4 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 1Gbps - 8 Lambdas | DWDM 1Gbps port - 8 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 1Gbps - 16 Lambdas | DWDM 1Gbps port - 16 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 1Gbps - 32 Lambdas | DWDM 1Gbps port - 32 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 10Gbps - 4 Lambdas | DWDM 10Gbps port - 4 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 10Gbps - 8 Lambdas | DWDM 10Gbps port - 8 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 10Gbps - 16 Lambdas | DWDM 10Gbps port - 16 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | DWDM 10Gbps - 32 Lambdas | DWDM 10Gbps port - 32 | # of Lambdas | # of Lambdas | Transmission - Sec 1 |
| Transmission - LN to Core | Add-drop multiplexer chassis | Add-drop multiplexer | # of multiplexers | # of multiplexers | Transmission - Sec 1 |

**Exhibit 6.2: Example resources in worksheet '0B PAR RESOURCES'. [Source: Axon Consulting]**

The categories that need to be defined for each resource are as follows:

- Category: Main classification of the resource, typically one of the already defined categories should be used for any new resource.
- Name: Complete name of the resource.
- Short Name: Shorter version of the name for abbreviation purposes throughout the model.
- Cost Component: Separates costs for different types of resources, such as ones that are costed based on the length and others that are costed based on the number of elements.
- Unit: Unit in which the resource is measured
- Equivalent Equipment: Used to group resources whose costs are allocated to services using the same Routing Factors.

### *Step 2: Definition of unitary costs*

The next step is the definition of the unitary cost of the resource in worksheet '1E INP UNITARY COSTS'. It is important to note that in this worksheet the CAPEX as well as the OPEX for the historical period need to be introduced.

| Resource | Cost Type | Currency | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|
| Transmission - Core to Core.Fibre.length | CAPEX | EUR | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 |
| Transmission - Core to Core.Fibre.lines | CAPEX | EUR | - | - | - | - | - |
| Transmission - Core to Core.Trenches.km | CAPEX | EUR | 40.000 | 40.000 | 40.000 | 40.000 | 40.000 |
| Transmission - Core to Core.SWT 100Mbps port.# of ports | CAPEX | EUR | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Transmission - Core to Core.SWT 500Mbps port.# of ports | CAPEX | EUR | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| Transmission - Core to Core.SWT 1Gbps port.# of ports | CAPEX | EUR | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 |
| Transmission - Core to Core.SWT 10Gbps port.# of ports | CAPEX | EUR | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 |
| Transmission - Core to Core.SWT 40Gbps port.# of ports | CAPEX | EUR | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 |
| Transmission - Core to Core.SWT 100Gbps port.# of ports | CAPEX | EUR | 6.000 | 6.000 | 6.000 | 6.000 | 6.000 |
| Transmission - Core to Core.DWDM 1Gbps port - 4.# of Lambdas | CAPEX | EUR | 30.000 | 30.000 | 30.000 | 30.000 | 30.000 |
| Transmission - Core to Core.DWDM 1Gbps port - 8.# of Lambdas | CAPEX | EUR | 40.000 | 40.000 | 40.000 | 40.000 | 40.000 |
| Transmission - Core to Core.DWDM 1Gbps port - 16.# of Lambdas | CAPEX | EUR | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 |
| Transmission - Core to Core.DWDM 1Gbps port - 32.# of Lambdas | CAPEX | EUR | 60.000 | 60.000 | 60.000 | 60.000 | 60.000 |

**Exhibit 6.3: Illustrative example of resources in worksheet '1E INP UNITARY COST'. [Source: Axon Consulting]**

In order to include the unitary cost, the user must ensure that the name introduced in the 'Resource' column is the variable associated with the new resource created, which may be found in column H of worksheet 'OB PAR RESOURCES'.

### *Step 3: Definition of new cost trends*

As in step 2, the user must define the expected cost trends for both, CAPEX and OPEX in worksheet '1F INP COST TRENDS'.

| Resource | Cost Type | Unit | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Transmission - Core to Core.Fibre.length | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -2,0% | -2,0% | -2,0% | -2,0% |
| Transmission - Core to Core.Fibre.lines | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -2,0% | -2,0% | -2,0% | -2,0% |
| Transmission - Core to Core.Trenches.km | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -2,0% | -2,0% | -2,0% | -2,0% |
| Transmission - Core to Core.SWT 100Mbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.SWT 500Mbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.SWT 1Gbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.SWT 10Gbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.SWT 40Gbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.SWT 100Gbps port.# of ports | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 1Gbps port - 4.# of Lamb | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 1Gbps port - 8.# of Lamb | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 1Gbps port - 16.# of Lam | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 1Gbps port - 32.# of Lam | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 10Gbps port - 4.# of Lam | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 10Gbps port - 8.# of Lam | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 10Gbps port - 16.# of La | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |
| Transmission - Core to Core.DWDM 10Gbps port - 32.# of La | CAPEX | Annual Growth (YoY %) | - | - | - | - | - | -4,0% | -4,0% | -4,0% | -4,0% |

**Exhibit 6.4: Illustrative example of resources in worksheet '1F INP COST TRENDS'. [Source: Axon Consulting]**

### *Step 4: Definition of the useful life*

In order to allow the Model to distribute the acquisition costs over the years by means of the economic depreciation, the user must include the corresponding useful life of the new resource, in sheet '2E INP RESOURCES LIVES'.

### *Step 5: Routing Factor Mapping*

This step involves the mapping of services to the newly defined resource. The user should add a row in worksheet '3C MAP ROUTING FACTORS' for each service that makes use of the resource, including the corresponding Routing Factor in column G.

| EQUIVALENT EQUIPMENT (Group of resources) | Service CATEGORY | Service SUBCATEGORY | Service SEGMENT | Service DESCRIPTION | Routing Factor |
|---|---|---|---|---|---|
| Transmission - Sec 1 | Broadband | FTTH | Retail | 25 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 50 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 75 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 100 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 125 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 150 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 200 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 300 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 500 Mbps | 0,80 |
| Transmission - Sec 1 | Broadband | FTTH | Retail | 1 Gbps | 0,80 |
| Transmission - Sec 1 | Broadband | Copper | Retail and Wholesale | Broadband Traffic (Core Traffic) | 1,00 |
| Transmission - Sec 1 | Voice | Voice | Retail | Voice traffic | 0,05 |
| Transmission - Sec 1 | TV | TV | Retail | TV - SD channel | 50,00 |
| Transmission - Sec 1 | TV | TV | Retail | TV - HD channel | 100,00 |
| Transmission - Sec 1 | TV | TV | Retail | Radio - Channel | 5,00 |

**Exhibit 6.5: Illustrative example of mappings in worksheet '3C MAP ROUTING FACTORS'. [Source: Axon Consulting]**

In order to map the resources and the services, the user needs to set the equivalent equipment selected for the resource as well as the Category, Subcategory, Segment and description of the mapped services.

### *Step 6: Definition of the dimensioning algorithm for the resource*

The last step is the definition of the dimensioning algorithm for calculating the number of units of the new resource, based on drivers. In this step, the user should add the algorithm in one of the following sheets:

- 6A CALC DIM ACCESS
- 7A CALC DIM CORE

In each of these worksheets, there are tables reserved for calculations where the user can add the needed calculations to determine the number of elements of the new resource.

Additionally, the user should add the new resource to the 'Resources' table manually, and add the reference to the rows where the final dimensioning value is calculated.

# 7. Description of checks

This section describes the list of checks incorporated in the worksheet `CHECKS´ to guarantee the correct functioning of the Model:

- **GENERAL CHECK:** This check indicates if the model is working properly or if it is necessary to review any of its worksheets and calculations.
- **Duplicity of resources unitary cost input:** This check indicates that any of the resources is duplicated in the sheet "1E INP UNITARY COSTS". This duplication should be removed.
- **Resources unitary cost input:** This check indicates that any of the resources is missing in the sheet "1E INP UNITARY COSTS". It should be introduced.
- **Invalid name of resource:** This check indicates that the name of any resource in the sheet "1E INP UNITARY COSTS" is not correct and therefore, it should be reviewed.
- **Allocation of Incremental Costs:** This check indicates that some resources' costs are not being allocated to services. In this case, Routing Factors in sheet "3C MAP ROUTING FACTORS" should be reviewed.
- **Allocation of Common Costs:** Similar to the above, this check indicates that some resources' common costs are not being allocated to services. In this case, Routing Factors in sheet "3C MAP ROUTING FACTORS " should be reviewed.