

## DECLARATORIA SULLA TESI DI DOTTORATO

Il/la sottoscritto/a

COGNOME | SCORCA |

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Titolo della tesi:

| INCENTIVES FOR THE DEVELOPMENT OF NGN BROADBAND  
INFRASTRUCTURES: AN ANALYSIS OF EU POLICIES |

Dottorato di ricerca in | INTERNATIONAL LAW AND ECONOMICS |

Ciclo | XXVI |

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Anno di discussione | 2016 |

### DICHIARA

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Ai miei genitori, che mi stanno dietro anche quando non ascolto i loro consigli.

Alle persone con cui ho avuto la fortuna di lavorare, perché hanno investito su di me e mi hanno permesso di approfondire questo argomento durante i miei lunghi anni a Bruxelles.

A quanti, in questi anni, mi hanno fatto capire che vale la pena impegnarsi, sempre.

Nella vita ci vuole entusiasmo, speranza, fiducia e disciplina, e lo scrivo qui così non me lo dimentico.

*"Sentinella, quanto resta della notte?"  
E la sentinella rispose: "La notte è quasi finita, ma il giorno non è  
ancora iniziato: comunque tornate, domandate, insistete"*

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## List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
AGCOM	Autorità per le Garanzie nelle Comunicazioni
ANO	Alternative National Operator (as OLO)
ARCEP	Autorité de Rég. des Comm Electroniques et des Postes
ARPU	Average Revenue per Unit
BDUK	Broadband Delivery UK
BNetzA	BundesnetzAgentur
BT	British Telecom
BU	Bottom Up
CCA	Current Cost Accounting
CEF	Connecting Europe Facility
CJEU	Court of Justice of the EU
DAE	Digital Agenda for Europe
DRB	Dispute Resolution Body
DT	Deutsche Telekom
ECPR	Efficient Component Pricing Rule
EECMA	European Electronic Communication Market Authority
EEO	Equally Efficient Operator
EIB	European Investment Bank
EoI	Equivalence of Input
EoO	Equivalence of Output
EU	European Union
FEASR	Fondo Europeo Agricolo per lo Sviluppo Rurale
FESR	Fondo Europeo Agricolo per lo Sviluppo Rurale
FCC	Federal Communication Commission
FT	France Telecom
FTTB	Fiber to the Building
FTTCab or FTTC	Fiber to the Cabinet
FTTE	Fiber to the Exchange



FTTH	Fiber to the Home
GPON	Gigabit Passive Optical Network
IP	Internet Protocol
KII	Korea Information Infrastructure
KPI	Key Performance Indicators
KT	Korea Telecom
LEX	Local Exchange
LLU	Local Loop Unbundling
LRIC	Long Run Incremental Cost
MDF	Main Distribution Frame
MEIP	Market Investor Principle
MPoP	Metropolitan Point of Presence
NBP	National Broadband Policy
NGAN	Next Generation Access Network
NGN	Next Generation Network
NIA	National Information Agency
NRA	National Regulatory Authority
ODF	Optical Distribution Frame
OLO	Other Licensed Operators (as ANO)
OTT	Over The Top
P2P	Peer to peer
PIA	Physical Infrastructure Access
PPP	Public Private Partnership
RO	Reference Offer
ROI	Return Over Investment
SGEI	Service of General Economic Interest
SIP	Single Information Point
SLA	Service Level Agreement
SLU	Sub Loop Unbundling
SSNIP	Small but Significant and Non-transitory Increase in Price
SMP	Significant Market Power
TI	Telecom Italia

TFEU	Treaty on the Functioning of the European Union
VDSL	Very high bit-rate Digital Subscriber Line
VULA	Virtual Unbundled Local Access
WB/C/L/A	Wholesale Broadband/Central/Local Access

## Abstract

In the deployment of new high-speed fibre-based infrastructures there is a case of a nascent market that has to be treated differently from existing ones, thus posing a stance on the need to develop and implement policy measures different from the past. There is a tension between competition (regulation is its sub-optimal mean to achieve it) and investments: with the aim to achieve a competitive internal market, EU institutions have developed a complex legislation (in *sensu lato*), having different degree of enforceability, with the intention to provide a stable framework with clear procedures and predictable outcomes.

Each stakeholder have its own rationale: public actors aim to the deployment of high-speed broadband infrastructures while operators' interest is the maximum return for capital invested. In order to reach their targets, policy makers have to anticipate stakeholders' reaction and understand these factors to address operators' behaviours and, therefore, carry out successful incentives.

The scope is to assess, by a qualitative analysis based on a methodology presented in Ch. 2, the effectiveness of policies conceived at EU level and then implemented in 4 countries (UK, France, Italy and Germany - chosen for their national specificities). A benchmark of policies is provided, and two additional case studies are considered too. The study will investigate if private operators have followed, with their investments in NGAN, indications emerged from public policies, thus defining the scope for further intervention.

The structure of the document follow this scheme:

- Chapter 1 contains a literature review on the regulation of NGN infrastructures, with the description of the technological evolution of telecom networks, a presentation of remedies to address potential competitive problems arising in the market of electronic communications;
- Chapter 2 reports the investment problem and the role of regulators, with a pragmatic illustration of both public and private stakeholders, national market specific conditions as well as factors affecting their behaviour;
- Chapter 3 studies the EU framework for electronic communications and considerations are presented;
- Chapter 4 contains an assessment of some EU national policies to define potential best practices for the development of NGAN infrastructures.

## Introduction

There are (too) many papers stressing about the necessity to develop high-speed broadband infrastructures: if it is clear that broadband have strong effects of economic performances, what is still debated is the best policy to promote it. Telecom infrastructures are composed by complementary nodes and links: in the past networks were set up by a public incumbent, with monopoly rights and the company was vertically integrated. Technology evolution followed a path of network multiplication by competitors, the decoupling of wholesale and retail services and the substitution of copper wires with fibre ones. In the deployment of high-speed fibre-based infrastructures there is a case of a nascent market that has to be treated differently from existing ones, posing a stance on the need to develop and implement policy measures that are different from the past.

There is a tension between competition (regulation is its sub-optimal mean to achieve it) and investments: based on Art. 288<sup>1</sup> of the TFEU, with the aim to achieve a competitive internal market, EU institutions have developed a complex legislation (in *sensu lato*), having different degree of enforceability, with the aim to provide a stable framework with clear procedures and predictable outcomes. Such balanced combination of rules have to face both national conditions and different market dynamics, and then to achieve a target it is necessary to act differently from the past, either valuing the possibility to implement an arrangement based on national market specific conditions or tackling other variables in the analysis of the problem.

The main risk, not stressed enough in the public debate, is inaction. Each stakeholder have its own rationale: public actors' aims to the deployment of high-speed broadband infrastructures (sub-optimal outcomes are envisaged too) while operators' interest is the maximum return for capital invested. In order to invest, for operators it is important to value the timing for venture recovery in a landscape where revenues are influenced by rules set by public actors. Policy makers need to address different variables interconnected, like deployment costs, regulatory and market uncertainty, as any investment decision is made accordingly regulation in place and revenues estimations, as well as national specific market conditions (number of operators, deployment strategies, presence of facilities that might compete with negligible incremental costs, etc). Regulators must also take into consideration the behaviour of alternative operators, which might "free-ride" (discouraging) incumbent investments by using its assets to provide services instead of developing their own (the "make or buy" dilemma). In order to reach their targets, policy makers have to anticipate stakeholders' reaction and understand these factors in order to address operators' behaviours and, therefore, carry out successful incentives. Policy implementation is important and can take different forms, thus influencing the competitive dynamics of the market.

The aim of this study is to assess, by a qualitative analysis based on a methodology presented in Ch. 2, the effectiveness of policies on the development of NGN networks conceived at EU level and implemented in 4 main countries (UK, France, Italy and Germany - chosen for their different national specificities). A benchmark is provided, and two additional case studies are considered too. The study will investigate if operators have followed, with their investments

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<sup>1</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E288>

in NGAN elements, indications emerged from public policies, defining the scope for further intervention.

The methodology will consider three interconnected steps:

1. Specific conditions present into national markets and factors to be addressed;
2. Analysis of EU and of national government and regulatory policies implemented;
3. Definition of policies' impact on operators' behaviour and effectiveness over variables considered (point 1).

The structure of the document follow this scheme:

- Chapter 1 contains a literature review on the regulation of NGN infrastructures, with the description of the technological evolution of telecom networks, a presentation of standard (price and access) as well as non-standard (different modalities of network separation) remedies to address the main potential competitive problems arising in the market of electronic communications;
- Chapter 2 reports the investment problem and the role of regulators, with a pragmatic illustration of both public and private stakeholders, national market specific conditions as well as factors affecting their behaviour. It is presented the methodology by which is described the qualitative analysis of regulatory policies in the countries considered;
- Chapter 3 recalls the main EU legislation for electronic communications (Framework and Access Directives, SMP assessment and the definition of relevant markets) with a specific focus on policies for the promotion of NGAN (NGA Recommendation, EDA, Recommendation on costing methodologies and non-discrimination, as well as the Directive on reduction of broadband deployment costs and the Guidelines for State Aids on broadband) and, at the end, some considerations are presented;
- Chapter 4 enclose an assessment of policies implemented in UK, France, Germany and Italy, considered due to their diverging national specificities and providing a clear case to the analysis, compared to other contests as US and Korea and then benchmarked in order to define potential best practices for the development of NGAN infrastructures.

# 1 Literature review and remedies for the development of NGN infrastructures.

## 1.1 *The technological aspect*

### 1.1.1 Network effects and evolution of fixed telecom infrastructures

Telecom infrastructures are composed by a number of complementary nodes and links, whose value have a positive pattern with the increase of structural complexity (Ducey, 2008); they exhibits increasing return to scale in production<sup>2</sup>, with minimum incremental costs. The complementarity between network elements is the key reason for the appearance of network externalities, as for example the increasing returns to scale in consumption, that allow the possibility to violate *the law of demand*<sup>3</sup>, the feature of downward-sloping demand curve (Economides, 2004, p.6). Network effects can be direct or indirect (virtual), both presents in the Telecom industry: the first one appears when, for a buyer, the value of an extra unit increases with the rise of units sold<sup>4</sup>; the latter one arise instead when a larger sales of components of type A induce larger availability of complementary components B<sub>n</sub>, thereby increasing the value of components of the first type. To explain network effects we need to take into account the size of the network (more intense whereas bigger and more complex is the structure), the participation of agents (positive pattern) and the expected utility of all participants<sup>5</sup>. It is important to consider the timing of decisions and the standards issue too: the possibility to have a single standard, achieved by imposition of the regulator or set by the market or else by an industry agreement, may influence technology diffusion, innovation process and evolution of the business model (Gandal, 2002; Methlie, 2008).

In the past, Telecom networks were set up by an incumbent, public owned and with monopoly rights: they were vertically integrated companies, therefore having, under the same frame, a service provider unit, the infrastructure, retailers and other divisions; the technology allowed to offer only a limited range of products and most of the revenues were due to voice service, evolving with incremental adaptations. Networks were made by copper lines, following a structure similar to a tree, somehow valid still today: the core infrastructure, called Transport Network, consists of lanes that cover long distances between cities, then distributed into smaller and more capillary nodes (Tandem Exchanges) that, in turn, end into the smaller Local Exchanges. While in previous architectures each layer was connected only vertically, in modern networks they are linked horizontally with other nodes of the same rank as well.

From this point onwards, the exchanges are still vertically integrated (in the new architecture, both vertically and horizontally integrated) following the same path described above, and the facilities considered are called Access Network: other layers are Central Offices, that are the

<sup>2</sup> Unit (average) cost decreases with increasing scale of production

<sup>3</sup> The willingness to pay for the last unit of a unit decreases with the number of units sold.

<sup>4</sup> Anyway the value of the component does not grow to infinite: the additional positive value is expected to decrease (or at least being constant) with increases in the size of the network.

<sup>5</sup> According to Matutes and Regibeau (1996) there are two approaches for handling expectations: the first one is fulfilled-expectations (consumers' expectations are correct), the second one is myopic expectations (consumer utility is based only on network size at the time of purchase).

physical parts where the ULL<sup>6</sup> is considered to start whose are, in turn, connected to cross connections and then to the users. What it is called access (or distribution) therefore starts at the gateways linking the urban populated areas with the rest of the infrastructure: due to its capillarity, and to the cost to deploy wires in the cities, this part of the facility is considered a *bottleneck*<sup>7</sup>, economical and technical (due to services with an increasing bandwidth demand).

The distribution network is called “primary”<sup>8</sup> in the part connecting the user to the cabinet, while in the area between the cabinet and the local exchange it is called “secondary”<sup>9</sup>: in the distribution segment of the infrastructure, as it is easy to imagine, distances in urban areas are below the national average, and this feature has a strategic importance on the paths the evolution of the network may follow, as the distance between both the local exchange (in case of ADSL) or the cabinet (in case of VDSL), according to the technology used, has an impact on the speed of the service provided.

### 1.1.2 The Next Generation Network (NGN) and different modality of access.

The structure evolution followed both a path of partial network multiplication by rivals and substitution of copper wire with fibre: the first part to be involved in this process was the core (Transport) network. Some development occurred at software level as well, creating a new architecture for telecommunications defined Next Generation Network (NGN<sup>10</sup>): core of the new platform (called IP Multimedia Subsystem) is the use of standardized Internet Protocol (IP) to provide services and complementary applications (data, voice or video) via any type of physical network infrastructure (Kirsch, 2008). An ingredient of its success is flexibility, which is derived from the outcome split-up into transport and service. The move towards NGN has begun to transform the sector from vertically distinct markets with single-service offers into an horizontal, converging multi-service market: the new frame allow to uncouple the classic relationship between infrastructures and services and it facilitates technological convergence, which in turn allows the integration of networks, devices and services into a “network of networks”, using a common set of rules bundled into the IP single language. This effect increases the substitutability (demand-side and supply-side) of network infrastructures, while the horizontal dimension of the network derived from the use of the standardized IP reduces economies of scope between the infrastructure and the provision of services: both effects could support infrastructure competition in the access networks but, as we will see, they are not so significant in determining the final outcome. Furthermore, as NGNs (in fact, it is likely the case that multiple NGNs will emerge – see Kirsch, 2008) will enlarge the range of services accessible to costumers over their selected access network, the increase in bandwidth demand will equal, at least, the demand in the specific legacy networks: even if many operators will increase the capacity and the technology of their access networks, handling for some time the physical saturation of the copper access network, it seems that the new access network (NGAN) will continue to be a bottleneck for the whole infrastructure

<sup>6</sup> Unbundled local loop, regulated in market 11, Framework Directive.

<sup>7</sup> It is one process in a chain of processes, such as that its limited capacity reduces the capacity of the whole chain

<sup>8</sup> On average length 1,3 Km (Telecom Italia, 2004)

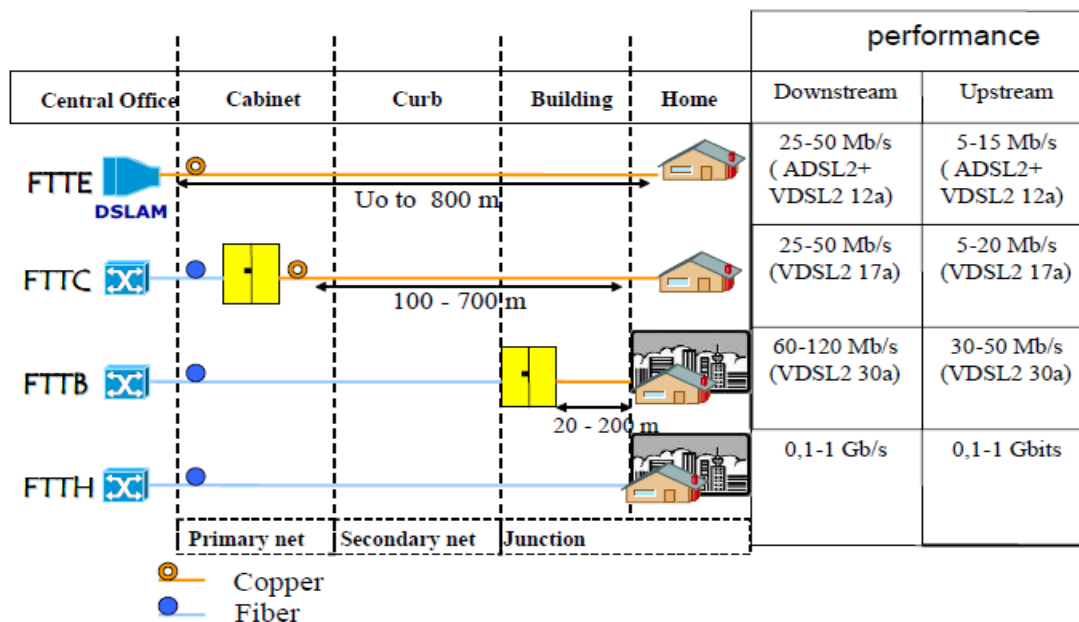
<sup>9</sup> On average length 0.5 Km (Telecom Italia, 2004)

<sup>10</sup> See ITU – T Recommendation Y.2001, pag. 53

(Pecur, 2007). As we will have possibility to see, both “the timing and the choices of specific technologies for NGAN may vary between countries” (Amendola, 2007b), even within different infra-national geographic area and between operators: the variation in fact “depends on a plurality of factors, including state and age of existing network infrastructure, length of local loop, population density and structure of the housing market, distribution of number of users [(according to their qualitative and quantitative propensity to consume and to the willingness to pay for each different service),] number of street cabinets for each local exchange, level of intermodal competition in the market [(it is important technological development and maturity of the market as well)] and existence of *ad hoc* national government plans for broadband development” (Ibidem). The deployment of NGAN is an attempt of “squeezing out” access bottleneck, and the different ways in which this is achieved is the consequence of a cost-benefits analysis followed by each of the operators. The solution of an infrastructure with a unique technology in fact, like in the past when telephone network was ruled by twisted copper cable while coax wire was essential for cable television, “was based on the old paradigm that maximizing network efficiency would automatically maximize customer value” (Ibidem). This technique is “challenged by different factors: different carriers may have different strategies; technological uncertainty [associated with new processes is higher; assessment of technology development brings to different results among operators;] competition is expected to take different forms, [while] market appears to be fairly segmented by a range of services and willingness to pay for them” (Ibidem).

The modalities by which NGAN can be deployed are mentioned below (Amendola, 2007b and AGCOM, 2007), while in the figure it is reported main characteristics as well:

**Figure 1 Different modalities to deploy NGAN**



Source: own elaboration on AGCOM, 2007

- **“Fiber to the Exchange (FTTE):** this solution [imply the use of] the current copper network in both the primary and the secondary distribution network” (Amendola,



2007b). By placing a DSLAM in the central, with VDSL2 technology and a fiber from central office to the transport network. “it allows for broadband connections up to 20 Mbit/s downstream and up to 1 Mbit/s upstream” (Ibidem) and, due to the limited use of fiber (thus limiting the increase in capacity), consumers’ distance from the central cannot be more than 800 meters and it is recommended only for areas not densely inhabited.

- **“Fiber to the Cabinet (FTTCab):** [in this case fiber is used until] the street cabinet and copper from [there] to the customer premises. [Furthermore] it consists of a new cabinet containing the Optical Network Unit (ONU<sup>11</sup>)” (Ibidem), use of VDSL2 technology and of ADF (Automatic Distribution Frame) to control from remote the infrastructure. This solution “allows downloading capacity up to 50 Mbit/s and, at distance up to 700 meters, uploading up to 10 Mbit/s” (Ibidem) (only if a limited number of consumers connected at the same time).
- **“Fiber to the Building (FTTB):** [here fiber is deployed] from the central office to the building, [with the use of] smaller ONUs (serving dozens of lines) [and using a] VDSL2 modem to connect the fiber to the copper network of the building. [The more intense use of modern technologies is reflected in both the downloading (up to 100 Mbit/s) and the uploading capacity (] [...] up to 40 Mbit/s at distance up to 200 meters[])].” (Ibidem)
- **“Fiber to the Home (FTTH):** [here fiber is deployed until] customer premises, bypassing completely the copper network. It does not require [the use of] new cabinets, [and through this frame it is possible to achieve] symmetric capacity up to 1 Gbit/s” (Ibidem) (without the constrain of the number of customers connected at the same time). This architecture may be configured in two ways: point-to-point, with a single fiber wire to each customer, and by Passive Optical Network (PON), using an optical splitter to direct capacity.

In deploying this modern network architecture, “the following broad cost categories can be distinguished:

- **[Civil engineering and] infrastructures,** [that] includes the (horizontal) trenching, [...] ducting and fiber cabling deployments. [...] For the FTTCab solution the fiber costs are relevant for connecting street cabinet to the local exchange [...] [but] they are even more important in the FTTB/H [case, as it includes the expenditure of in-house wiring and the one for the splitters: according to some] studies, these [...] [are calculated] between 50 % and 80% of the total costs per customer, depending on the population density” (Amendola, 2007b). Most of these costs depend on the status of the existing infrastructure: where the already deployed network or “other utilities infrastructures can be used, these [...] can be dramatically reduced” (Ibidem).
- **“Electronics/Customer Premises Equipment (CPE),** [that] includes the equipment costs such as ONU, [...] modem, all the electronics at the customer premises and, [...] for the FTTCab case, the cost of the cabinet [as well] [...] (in the FTTH solution the CPE cost includes the ONU itself that is placed at the customer premises). [Being these costs fixed for each cabinet, they need to be recouped by increasing the number of contracts: then], number of clients reachable per street cabinet plays a major role” (Ibidem).

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<sup>11</sup> A device converting optical signals into electrical signals.

## 1.2 *The regulatory aspect: access and price remedies.*

Increasing return of scales, network effects, a vertically integrated industry, huge investments in the network facility and bottleneck in the access (in most cases non-replicable), confirm the tendency of the Telecom industry to be organized as a monopoly: with the development of technology it is possible to have market structures either with different facilities as well as a single network and many operators competing on the provision of services (Atkinson, 2008).

As described in this analysis, in different cases operators deploy their own infrastructure, replicating in some layers the incumbent's network. For this reason, the market structure is divided in two main levels: the wholesale (upstream) one, where operators are users of the facility and require access to passive or active elements of the network; the retail (downstream) one, where operators interface with consumers using the technology accessed at wholesale level and their own one.

### 1.2.1 **Telecom market structure and incentives to discriminate**

Given the non-replicability of access network an incumbent might have market power in the market for electronic communication, and “literature [...] provide[s] four main categories of competition problems, [where influence on both price and non-price elements might foreclose the market to new entrants] (see also Perrucci, 2004, p.13):

- Vertical leveraging
- Horizontal leveraging
- Single market dominance
- Termination (two-way access)” (Amendola, 2007a, p.3)

Due to the interest for access and investments in NGN, the focus is on “vertical leveraging [which arises] when a dominant undertaking attempts to extend its dominance from the wholesale upstream market of the value chain, [where it owns the bottleneck part of the network,] to [the] retail downstream market where it faces competition” (Ibidem). This argument is considered “as the main responsible for [arising competition issues deriving] [...] from the vertically integrated structure of the dominant undertaking” (Ibidem). The “effectiveness of [this] [...] leveraging is directly proportional [...] to the intensity of market power of the dominant undertaking into the wholesale upstream market and [...] to the intensity of the bottleneck feature ([depending therefore on the availability of potential] alternative [access structures providing] comparable prices and quality of services”) (Ibidem): in practice it may take different forms, as stated in the “*Revised ERG common position on the approach to appropriate remedies in the ECSN regulatory framework*” published in 2006, from refusing to supply to discriminating by means of prices and/or non prices behaviours (see also Table 1), the latter summarized in the formula “deny, delay, degrade”.

There is a long literature arguing about the incentives for the dominant undertaking to put at a disadvantage its competitors (Cave, 2006c), especially about non-price discrimination, that is more difficult to detect: according to “the Chicago School, when the downstream market is (perfectly) competitive and inputs are used in fixed proportions<sup>12</sup>, a vertically integrated

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<sup>12</sup> Under the first hypothesis there are not extra profits to catch, while under the latter one the undertaking may maximize its profits by charging monopoly price for the input.

incumbent does not have an incentive to leverage its market power [in the] downstream market [(unless [...] [competitors] are less efficient[)]” (Ibidem, p.2); Economides (1998) discusses “that a vertically integrated company which competes downstream has always an incentive to engage in [a conduct of] non-price discrimination [like] reducing the quality [...], [even if its downstream company] is less efficient than [...] [the rival<sup>13</sup>, assuming] [...] that the downstream market is imperfectly competitive [...] [(then the competition is on quantities, as in the Cournot model) and that the incumbent would be able] to selectively lower the quality of the upstream input” (Ibidem, p.3) for the competitor<sup>14</sup>; an alternative model (Beard, 2001), assuming differentiated products and Bertrand price competition, thus in contrast with the one just mentioned, finds non-price discrimination possible only if the upstream part of the chain is regulated as, in case of lack of remedies on that layer, the best strategy for the incumbent would be to raise inputs' price instead of intervening on quality (stressing on price-cost margin influence at both upstream and downstream level).

It seems that “the incentive to engage in non-price discrimination depends on a number of factors. [...] In particular, incentives to discriminate increases:

- The tighter is price regulation of the upstream input [or else] less intense is [...] competition [in the upstream layer]” (Cave, 2006c): by chasing “downstream competitors, the [incumbent] [...] may lose some of its upstream sales but, [...] [with low margins kept] by regulation, it has only a limited impact on [...] [revenues]” (Ibidem, p.5);
- “The larger the potential profit opportunity in the downstream market [(or when the same market is not competitive)];
- The higher the degree of substitutability of [both] vertical integrated and competitors' products: [if those can be replaced, the revenues lost by rivals due to discriminatory behaviour would be gained by the downstream branch of the incumbent<sup>15</sup>];
- The larger the economies of scale in downstream activities: [the incentive exists both if the incumbent cannot spare operational costs when sales are falling and it has low incremental costs when gaining new customers]”. (Ibidem)

### 1.2.2 Modes of entry: service or infrastructure competition?

A central question that underlies policy interventions, is whether competition, and what type of competition, is feasible at all in the market for fixed telecommunications. To discuss the different kind of competition, we need to distinguish different modes of entry and compete.

In the market for the provision of electronic communication services based on a fixed network there are two stylized entry modes:

- **Facilities-based entry** where competitors roll out their own facility, including local access networks;

<sup>13</sup> Weisman (1999) challenges this argument by stating that a vertically integrated company with a downstream firm less efficient would redress incentives for the incumbent to discriminate its rivals on quality issues: being at the same time competitors and customers of the same firm, the incumbent has anyway interest to make profits in selling to companies competing with its own division.

<sup>14</sup> For others, like Sappington (2005), the disincentive to harm its own downstream is offset if the similar application of the behaviour considered would be more detrimental for the competitor. This effect follows a positive path of correspondence more products are homogeneous and more inelastic is the need for its product.

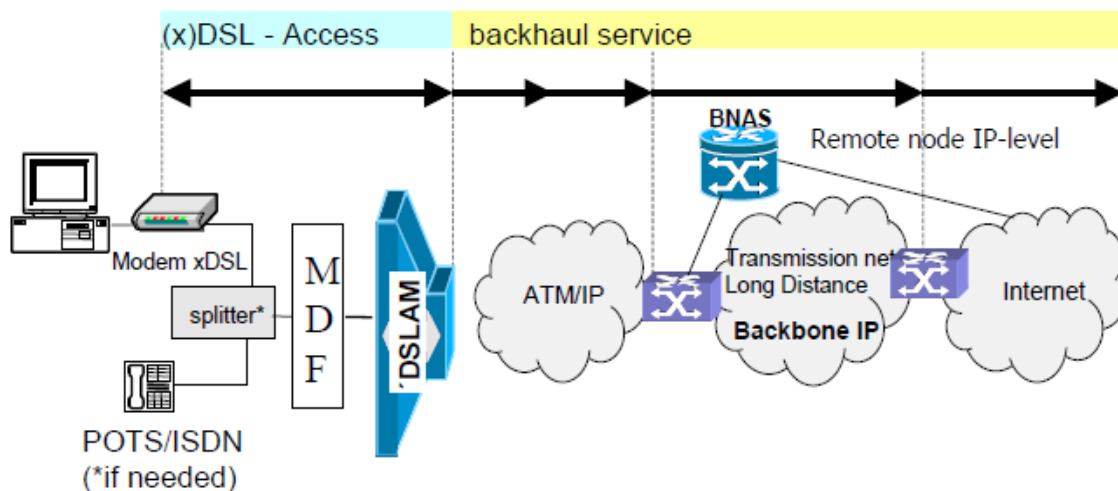
<sup>15</sup> In highly innovative markets the incentive to discriminate may be relevant as well when downstream products are differentiated.

- **(Local loop unbundling - LLU) access-based entry** where competitors roll out their own long-distance networks and lease local connections, in different technology combinations, from the incumbent: this case involve partial or no infrastructure investment with regard to local access networks.

Facility based entry might take different modalities, according the network topology chosen: operators might replicate fully the incumbent infrastructure or else might require access to civil engineering facilities like ducts, cabinets or other passive elements of the network (co-location). The LLU-based modality of access may come in different versions:

- full unbundling, which gives control of the wires pair to the competitor requesting access to the incumbent facility, in the section between the central office and the user;
- sub loop unbundling, which gives control of the wires pair to the competitor requesting access to the incumbent facility, in the section between the cabinet and the user;
- bitstream access (see Figure 2), is the case where wire spectrum is shared between the incumbent and the entrant and the infrastructure manager provide a service which include both passive and active elements: with this service, competitors do not have control over the physical line and they are not allowed to add different equipments, thus being restricted to supply what is designated by incumbent.

Figure 2 Bitstream access



Source: own elaboration on AGCOM, 2007

This description does not exhaust the universe of modalities that can be observed by alternative operators in entering the market: a strategy may include the combination of a network rollout for business customers and in the urban areas (because of the higher ARPU<sup>16</sup> and in order to retain more control over services provided) while using an LLU-based access (supplied at wholesale level by the incumbent) to reach private end-users in more rural ones.

Facilities-based entry leads, by definition, in "infrastructure competition" (or competition between networks), meaning competitors owning their local infrastructure, while access-

<sup>16</sup> Average Revenues per Unit

based entry brings instead to "services competition", where entrants sell services without having their own network: in the last years the discussion has been which kind of competition should be the regulator target, and a speech held in 2003 by EU Commissioner Mr. Monti may be useful to identify its goal:

*“The debate, it seems, is between those who advocate a facilities-based model of competition on one side, and those who advocate a model of competition based on access on the other side [...] However, it must also be that, in the longer term, the regulatory framework should privilege operators which base their competitive advantage on building their own infrastructure, simply because they are those who are likely to best improve the competitive conditions of the market.” (De Bijl, 2005a, p.9)*

Both way of competing have positive and negative consequences: infrastructure competition usually brings more innovation by entrants, and that it does not erode incumbents’ incentives to upgrade and maintain their own networks while, on the other side, there is an inefficiency due to duplicative sunk investments; service competition instead leads quickly to an intensified competition, it avoids networks’ duplications (both increasing static efficiency in the short run), while it limits the scope for innovation by the entrants, due to the little efforts in terms of investments and the heavy dependency on regulation, leading to a lower dynamic efficiency in the long run. Overall, services competition tends to lead to higher static efficiency in the short run, but it strongly depends on the regulatory framework and this effect is offset in the long run, while infrastructure competition tends to lead to more innovation and higher dynamic efficiency in the longer run, with less need of regulatory intervention (Ibidem, 2005a; Cave, 2006a; Caio, 2008).

### **1.2.3 Vertical leveraging and standard remedies.**

Even in applying a forecast model of technology diffusion, which in the past were able to predict accurately the deployment of new services and appliances, special attention should be given to issues as sector specific regulation and competition (Gentzoglanis, 2008). Anyway, the literature has not answers in one direction: some studies found that broadband service competition allowed faster diffusion than by infrastructure deployment; other arguments show how interconnection and multiplatform competition may work as an incentive while unbundling and price regulation may lower technology diffusion.

It is therefore important to analyse the impact of regulation in the development of NGN facilities: standard sector-specific policy options are

- mandated access to the infrastructures or services provided at wholesale level and
- price regulation for the access to infrastructure or wholesale services
- or, as in the last developments, structural measures.

These options affect downstream competition and the level of innovation and investments as well: the aim of regulation is to increase market efficiency, and in the case of NGN, balancing static efficiency on the basis of existing competition conditions and industry investments during the transition phase, while structural measures target principally the problem of discrimination between an integrated monopolist and its competitors: discriminatory behaviours might take different forms (as shown in the Table 1) and remedies have the target to address them.

A competition problem in telecommunications market is price discrimination, which occur when the incumbent charge an higher price at wholesale level to its downstream competitors than the price implicitly charged to its own retail division for a product belonging to the same relevant market: if the undertaking cannot deny the access, it can foreclose the market to its rivals gaining higher profits. In this case the risk of price discrimination can be neutralized by a combination of access obligation, cost-oriented prices and accounting separation (Cave, 2006c). However, acting on non-price terms is a dominant strategy and it is the one often chosen by the undertaking, as it is both less costly to implement and less likely to be detected and hence punished (Cave, 2006c): although *ex ante* obligations may be effective for price discrimination, they are considerably less so for non-price discrimination. It is therefore difficult, for the regulator, to avoid discrimination by standard remedies, and for this reason new measures have been taken into account in order to face this challenge. In the table below are discussed different standard remedies, specified in the EU regulation and case law, in order to face discriminatory (price and non-price) behaviour set by the vertically integrated incumbent. Sometimes these remedies fails to achieve the result: the mix of structural and behavioural measures imposed by NRAs might be too mild and they did not consider market specificities and the possibility of creative behaviour.

**Table 1 Solving vertical leveraging through standard remedies.**

Potential Vertical Leveraging Related Anticompetitive Behaviour	How to solve the potential problem?	Standard Remedy Provided by Directives
Refusal to Deal/Denial of Access	Ensuring access	Mandatory access to, and use of, specific network facilities
	Setting wholesale access price (by the use of some pricing methodology.)	Price control and cost accounting obligations
Discriminatory Behaviour (Non-price issues): <ul style="list-style-type: none"> <li>➤ discriminatory use or information withholding</li> <li>➤ delaying tactics</li> <li>➤ bundling/tying</li> </ul>	<ul style="list-style-type: none"> <li>➤ disclose the information</li> <li>➤ setting of a regulatory timeframe for compliance with obligations</li> <li>➤ unbundle sufficiently the wholesale elements for access</li> </ul>	<ul style="list-style-type: none"> <li>➤ access obligation including transparency</li> <li>➤ access obligation including conditions covering fairness, reasonableness, and timeliness</li> <li>➤ transparency obligation</li> </ul>

<ul style="list-style-type: none"> <li>➤ undue requirements</li> <li>➤ quality discrimination</li> <li>➤ strategic design of product</li> <li>➤ undue use of information about competitors</li> </ul>	<ul style="list-style-type: none"> <li>➤ make the contract conditions clear and transparent</li> <li>➤ ensure that dominant operators shall apply equivalent conditions in equivalent circumstances to other undertakings</li> <li>➤ avoid discrimination</li> <li>➤ ensure the confidentiality of the information</li> </ul>	<ul style="list-style-type: none"> <li>➤ transparency obligation</li> <li>➤ non-discrimination: equivalent conditions are applied in equivalent circumstances to all operators and transparency</li> <li>➤ non-discrimination rules</li> <li>➤ prohibition of the undue use of information on all operators independently from SMP</li> </ul>
<p>Discriminatory Behaviour (Price Issues):</p> <ul style="list-style-type: none"> <li>➤ price discrimination</li> <li>➤ unfair cross-subsidization</li> <li>➤ predatory pricing</li> </ul>	<ul style="list-style-type: none"> <li>➤ avoid margin squeeze</li> <li>➤ avoid the subsidization between wholesale prices and retail prices</li> <li>➤ avoid margin squeeze by charging low retail prices.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Access, accounting separation obligation, price control and cost accounting obligations</li> <li>➤ Accounting separation</li> <li>➤ Regulatory controls on retail prices</li> </ul>

Source: own elaboration on Amendola, 2007a

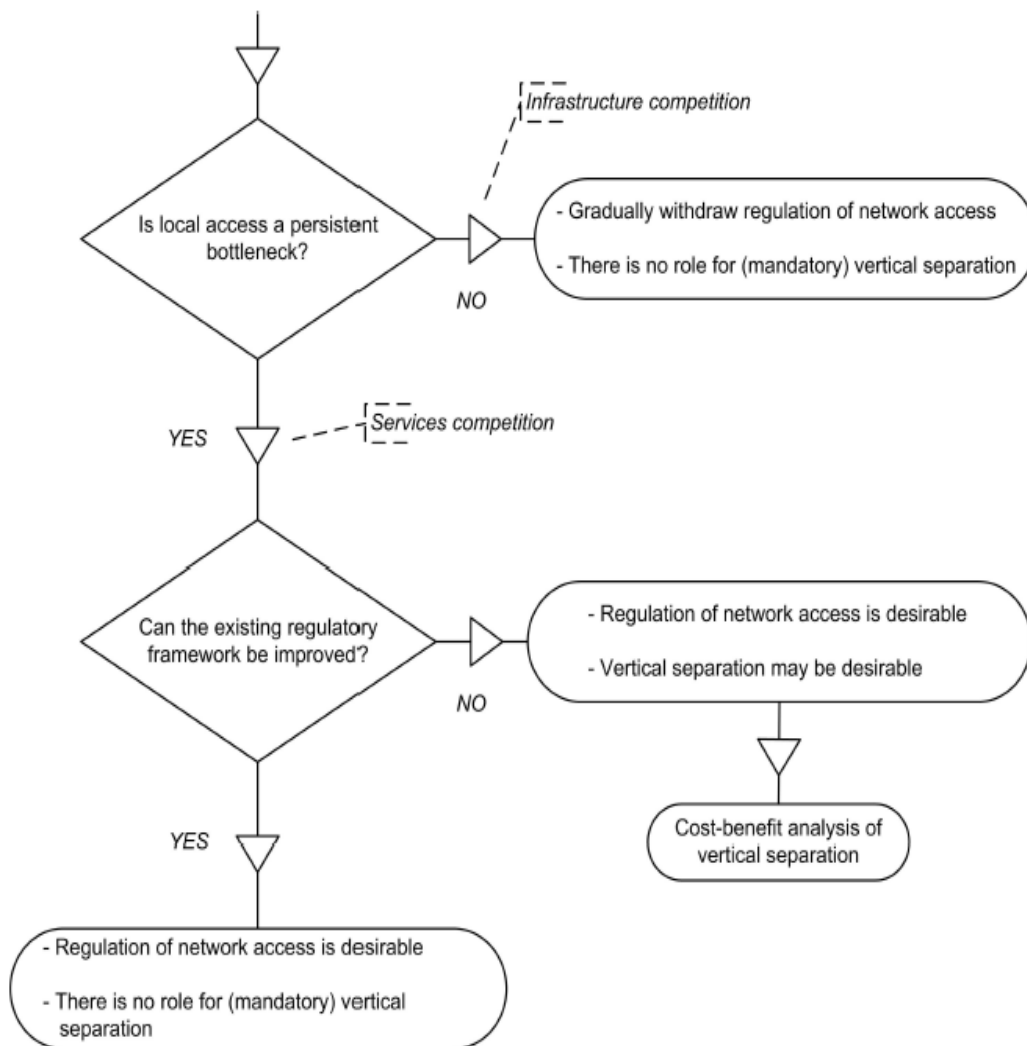
### 1.2.4 The regulatory methods to assess the kind of competition and separation

Having defined the difference between service and infrastructure competition, it is important to define when each option is feasible, and within it, which path has to be followed. We need to have clear that, if market allows for network competition, this would be the best choice: the decisive circumstance for choosing service-based competition is the finding that local access is a bottleneck<sup>17</sup>, so an insurmountable barrier for the entrant. In this case, the choice between

<sup>17</sup> As already mentioned, this assessment is made by considering different factors: costs, demand, technological and institutional characteristics as population density and geography.

mandated access and structural separation is made by assessing the regulatory regime: as separation is risky, and may leads to direct and indirect costs, it has to be considered the improvement of current regulation before taking this decision. Figure 3 summarizes guiding principles just explained (De Bijl, 2005).

**Figure 3 Guiding principle for assessing separation option and competition modality**



Source: De Bijl, 2005

This scheme may be affected by national characteristics and the outcome changes according the country area taken into consideration: as noted in the paper, “structural separation may be an option in some areas but not in others” (Ibidem, p.16).

Another model, valid only for unbundling, has been indicated in literature (Amendola, 2007a): to apply an exceptional remedy as functional, operational or else structural separation, NRAs first have to assess the necessity and then they should analyze costs and benefits. A two-step tests method is therefore introduced, leading to implementing these measures if both results are positive:



- **Access Market Failure Test:** this test is conducted by investigating the possibility of abuse of market power by the incumbent vertical structure, by checking the availability of wholesale access elements on the market that allow competitors to “replicate [...] incumbent retail [downstream] offers” (Ibidem) and the number of legal disputes concerning the access to the network. If the result is positive, then we need to move to the following step;
- **Exceptional Remedy Test:** in case the result of the above-mentioned test is positive NRAs, after having proved the incapacity of standard remedies to solve access problems, it “should assess the appropriateness and proportionality of [the] [...] remedy” (Ibidem), keeping in mind that “if the objective of full non discrimination is achievable without separating the access network [...], it is not appropriate to choose stronger remedy” (Ibidem).

These two models have an opposite approach but, on the other hand, both have in common the necessity to consider national market conditions in assessing the best degree of separation to be implemented. By the first model it is possible to argue that the network competition aimed by the EU Commission is possible only if the local access ceases to be a bottleneck. In this direction it may be useful to remember that by NGN are available a plurality of networks, thus innovation and a new level of competition are bundled to the convergence of “triple-play” and the NGN deployment.

### 1.2.5 Options of price regulations

Access pricing are of two main categories:

- one way access, where a competitor needs access to infrastructures and services provided by the incumbent;
- two ways pricing, where also the competitors own bottleneck facilities and both the incumbent and alternative operators must purchase essential inputs from each other.

The analysis of the structure for the provision of electronic communication services mainly consider the event of a vertically integrated firm owning the access network to which downstream competitors would like to accede, thus focusing only on one-way access pricing. The literature is wide, with different outcomes taking into account the competitiveness of the downstream market, the vertical industrial structure, the regard of one or more products, the information held by the regulator, a static or dynamic point of view: we will consider the case related to an homogeneous product traded in a downstream competitive market, an access to a vertically integrated firm network, considering both existing and new investments.

In a downstream market with no distortions, the “first-best” solution would be setting the price equal to the marginal cost of production, allowing then only the entrance to competitors at least efficient as the incumbent: in this case the loss for the latter one would be equal to the fixed costs (which may be covered by a public subsidy, for example). As the first option is difficult to obtain, it is necessary to move to a “second best” which may consist, for example, in setting as price level the average price (Valletti, 1999), in order to recover the fixed ones.

It is therefore necessary to introduce some sort of mark-up in order to allow the owner to recoup its investments. Pricing rules for compensating the incumbent for the provision of the access to its network to competitors are:

- **Ramsey pricing:** the mark-up (in percentage) over the marginal cost is present both in the access and in the retail prices, and it is inversely related to the elasticity of the demand. It considers both costs and demand characteristics (Canoy, 2004), without changing final consumption: it is not easy to implement it, because it requires a high degree of information and it is difficult to adopt it (furthermore, is it not contradictory to use a usage-based access price, discriminatory *per se*, to face discrimination?);
- **Efficient Component Pricing Rule (ECPR):** the access price is set equal to the difference between retail price and the marginal cost (Valletti, 1999), or else, equal to the average incremental costs of access plus the opportunity cost (Vogelsgang, 2003). The aim is to recoup productive efficiency, being revenue-neutral for the incumbent and giving incentives to the competitors to entry into the market only if they have lower costs (Canoy, 2004): the neutrality part has been criticised, because in a case where incumbent's profits would be excessive, they would remain as such under this pricing rule.

To assess the interaction between access regulation and incentives to invest in a new network, we need to consider both incentives for new entrants to deploy a new infrastructure and the incumbents' convenience to upgrade its network. These effects depend on both current and forecasted access prices (Ibidem): in fact, if both of them are predicted low, the incumbent will not have incentive to invest while competitors will not deploy own network elements (on services, instead, there will be a fierce competition); if instead they are set high, infrastructure competition will be quicker, hampering the service-based one in the short term.

As the process takes into consideration more periods, we need to apply dynamics pricing access rules, that might be listed as:

- **Backward-looking access prices**, based on incumbent's historical costs, provide a weak incentive in order to improve the efficiency (both cost reduction and entrance are discouraged);
- **Forward-looking access prices** (as LRIC<sup>18</sup>), take into account technological progress and possible cost efficiency. The problem is that it neither takes in full account risks for new investments, so it needs to be adjusted with an incentive correction term, nor markets (Valletti, 1999), leading to partial outcomes if not implemented with tailored instruments; another problem is that, by using LRIC prices, the incumbent may still hinder competitors through exclusionary strategies (Geradin, 2005).

Risks of investment issue is dealt in the "real option" model, used to tackle the "truncation"<sup>19</sup> problem, predicting that "the investment is carried out when the revenues gained from having implemented the project exceeds the value of the marginal information obtained by waiting [...] plus the financial benefit due to the fact that the up-front disbursement investment cost (cash outflow) becomes smaller in present value terms." (Gavosto, 2008, p.19). Giving a right price to risks for investment while avoiding anticompetitive behaviours is difficult, and, as pricing possibilities (described below) used by NRAs might have both positive and negative consequences, regulators can just aim to achieve a "second best", tailored on national market and competition specificities, with an intervention either on wholesale or on retail market, in one of the forms specified below:

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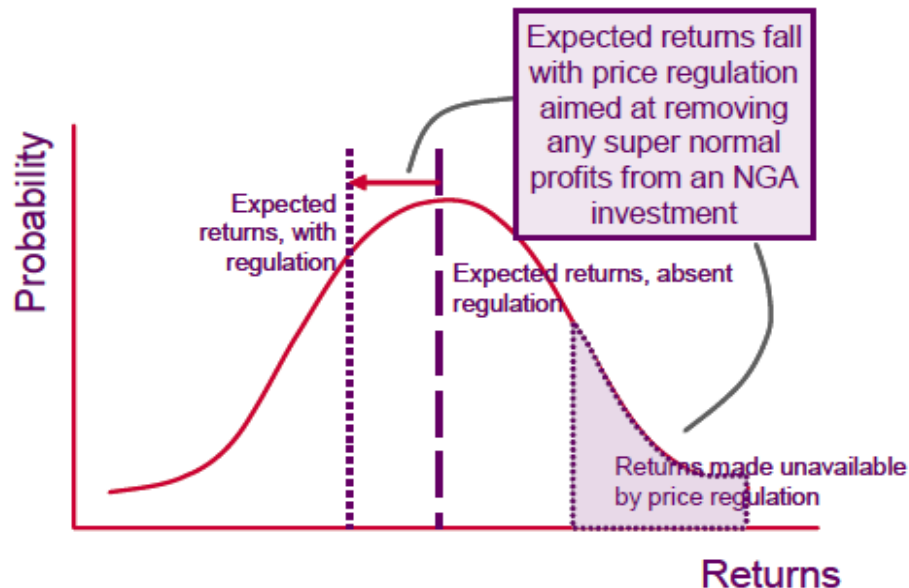
<sup>18</sup> Long Run Incremental Cost

<sup>19</sup> Delaying or cancelling investments

- **Retail minus**, where access price is equal to retail price minus the costs that it avoids by sharing the costs of providing the service with the new entrant (Geradin, 2005). It is usually adopted on innovative markets, with high risks on demand side: it might not be the best option as it does not lead to a reduction of “excessive wholesale prices to a cost-oriented level without a retail price regulation” (Ibidem);

Figure 4 Regulation and its influence over returns and investments.

### Risk of regulation may skew expected investment returns



Source: Ofcom, 2007

- **Cost plus mark-up**, difficult to apply due to the high level of information (on risks and on return of capital) required. According to Ofcom (2007, p. 37, and in figure above), “a straight-forward application of the standard cost plus pricing approach may result in lower incentives to invest. This approach would cap the total returns that the firm could make if demand turned out to be high [...] to bear all of the losses in the event that [...] no demand” but, through the “real option” model (Gavosto, 2008), this effect appears only in the initial stage, as in the long run investments are not affected;
- **Rate-of-return**, where the regulator fix a reasonable rate of profit for the incumbent. It is a cost-based analysis and it may lead to over-investments (Sappington, 2002);
- **Price caps** (incentive regulation), where the regulator fixes the price (of a product or a basket) for a pre-determined period (Ibidem) and the incumbent gains any possible profit due to a later increase of efficiency.

The last two pricing are the most indicated because they are more prone to encourage network investments, but incentives set in price cap may allow the incumbent to harm competitors with a margin squeeze behaviour (or, in case of tariff baskets, incur in strategic non-linear pricing or manipulate quantities so to overcome cap constraint), while this counter-indication does not appear in fixing a rate of return on capital (provoking other problems, as encouraging cost shifting or else limiting incentives for innovation). Another indicated access price regime is a combination of LRIC costs corrected with the “real option” model described above (but

this view is challenged in Valletti, 2004, where it is discussed a model with two networks with different levels of quality<sup>20</sup> and a regulator that can commit itself *ex ante*): such option seems to give the right signal (in the “make or buy” dilemma) to operators, and it is described as appropriate to implement the “ladder of investment” theory explained later<sup>21</sup>. Therefore, academic literature suggests the importance to consider a plurality of factual variables and the influence that costs have on allowed prices.

### 1.3 *Non-standard remedies: which form of separation?*

#### 1.3.1 Different degrees of separation

The necessity of appropriate regulatory remedies has, as result, the necessity to rely on non-standard remedies too: as in the Access Directive it is mentioned only accounting separation, imposition of remedies like those implemented both in Italy and United Kingdom (described below) requires par. 3, art. 8 of the same Directive, mentioning that a special procedure may be started by a national regulatory authority if it is demonstrated the existence of “exceptional circumstances”.

There are different form of separations, and if it necessary to use this tool, two dimensions have to be defined, one structural and one behavioural: what to state is which components have to be separated and which rules have to be settled in order to manage transactions between these layers. The first dimension is important, as it is stressed in some literature (Astrid, 2008), and the layers mostly interested by the split are retail and wholesale on one side while access and non-access are on the other, ending in a three-way split (Cave, 2006b). On the behavioural side, targets are the transactions and boundaries between components, with the aim to achieve non-discrimination between downstream competitors by the concept of “equivalence”: here below are stated eight degrees of separation, from the most mild (accounting) to the most intrusive (ownership), then explained in broad categories.

**Figure 5 Separation options.**

**Figure 1 - Separation options**

Ownership separation(in whole or part)
6-Legal separation (separate legal entities under the same ownership)
5-Business separation with separate governance arrangements
4-Business separation with localised incentives
3-Business separation (BS)
2-Virtual separation
1-Creation of a wholesale division
Accounting separation

Source: Cave, 2006b

- **Accounting separation (with or without a separate wholesale division):** it implies separate balance sheets for each entity, and it may be followed by the creation of a wholesale division with its own management, responsible only for their business.

<sup>20</sup> See also Dodd, 2009.

<sup>21</sup> Cave, 2006a

Even if this is the operative way followed by most EU incumbents it does not guarantee the equivalence between downstream competitors, due to the lack of incentives (Cave, 2006b);

- **Virtual separation:** it is the outcome of an obligation, by the regulator, to achieve equivalence in the services offered to both the downstream division and to the rivals, without a separation of the network that would involve physical layers. Therefore there is not a change in the production process, but only in the sales procedures: for both clients, those have to follow common rules and they have to be equivalent (price and quality characteristics).
- **Physical business separation:** it is meant by settling a new and separate operative unit, with control over particular assets, in order to process both internal and external customers in the same way. As there are different assets to separate (see figure below), as many as these are included into the unit, as higher will be the degree achieved.

The other layers are simply different grades of achieving separation, adding other parts to the steps concerning transaction conducts and physical production procedures, like relations between units within the production process, incentives to managers linked to the financial performance of their division or creating a divisional board with independent directors.

### 1.3.2 The UK “best practice”: BT-Openreach case (Functional Separation).

Upon the conclusion of the Strategic Review of Communication, a series of public consultation that assessed the competition level of the telecommunication sector in the UK, Ofcom decided to remove sector-specific regulation except for the access layer. BT, the incumbent operator, feared that national authority, relying on competition law, could impose ownership separation of the infrastructure unit, then offered voluntarily some undertakings in order to address concerns about its ability to discriminate against downstream rivals. Three were the main issues:

- **Equivalence of input:** an obligation to supply a range “*of upstream inputs to downstream rivals and its own downstream division on the same timescales, terms and conditions (including price) and by the same systems and processes. BT will provide to all providers the same information about these products and their associated services, systems and processes*” (Cave, 2006c). Its characteristics are that it is a more stringent concept than the equivalence of outcome<sup>22</sup>, it covers both price and non-prices elements of the services, and it presumes that the discrimination operated by BT would negatively influence welfare (Ibidem);
- **Establishment of a business unit,** providing different services<sup>23</sup> at the mentioned equivalence condition, called “Openreach”, with a separate staff, accounting and auditing, location, annual operating plans, brand name and information system (by 2010), while user access control is shared between the unit and the rest of BT. Openreach has full responsibility for building, maintaining and repairing the assets contained within the physical layer of BT’s access network and backhaul network, while BT Wholesale (another BT unit integrated with the incumbent) controls the core

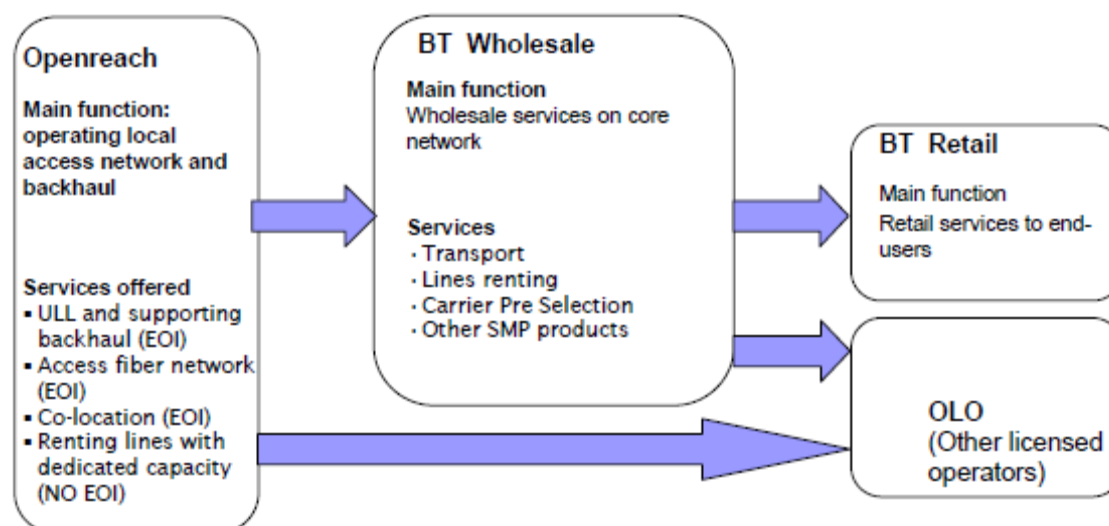
<sup>22</sup> Wholesale products offered to competitors should be comparable to those offered by the incumbent to its own retail division

<sup>23</sup> Wholesale line rental, ULL (full and shared access), wholesale extension services, IP-based stream, backhaul extension services and others.

network assets, the transmission layer of access and backhaul network<sup>24</sup>. In Figure 6 below it is stated how BT business functions are organized.

- **Equality of Access Board (EAB):** an independent body established to control the compliance with undertakings and to suggest how to remedy concerns. It is composed by 5 members, 3 of whose independents.

Figure 6 BT-Openreach separation.



Source: Own elaboration

The result of the implementation of this approach seems to be successful: the number of LLU lines has increased since then, reaching the level of 4 million at the end of 2007. For this reason, the Openreach case is taken by the EU Commission as a “best practice” as method for similar issues in other countries.

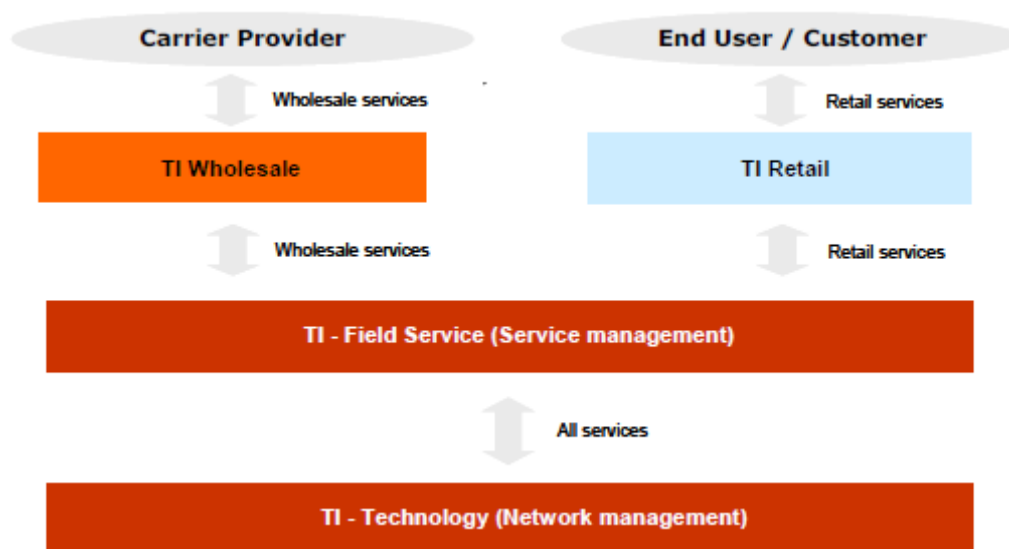
### 1.3.3 TI and the Operational Separation: equality of treatment and Open Access.

In Italy, the national regulator for telecommunications (AGCOM) started the path of separation in 2002, by Decision 152/02/CONS, that introduced what is called Administrative (by AGCOM) or Operational (by Telecom Italia-TI) Separation, in addition to the existing obligation of accounting separation<sup>25</sup>. AGCOM requirements on TI internal organization led to a separation between retail (TI Retail) and wholesale (TI Wholesale) business units, the latter one providing inputs exclusively to OLO’s, each with separate staff, location, management and incentives based on results of its own division, but keeping in TI hands both network (operated by TI Technology) and service (by TI Field Service) management.

<sup>24</sup> Openreach is entitled, in case of necessity, to have influence on these assets as well.

<sup>25</sup> A price test considering the possibility of margin squeeze by the incumbent was introduced, but we do not consider it in our analysis.

Figure 7 TI Operational Separation in 2002



Source: Amendola, 2007a

Another important principle set by the Decision was the internal and external equality of treatment, achieved by the separation between information systems of network and retail units and different access systems<sup>26</sup>. This model was overcome by the possibility of undertakings with the incumbent operators, which we have already discussed: AGCOM, unsatisfied by the results achieved by this form of regulation, started in May 2007 a public consultation which ended into Decision 208/07/CONS, where the BT-Openreach case was, in brief, considered the “best practice” to follow (p.18). In this Decision three possible paths for reforming the regulatory framework were described: the strengthening of Decision 152/02, the imposition of functional or else, deeper separation<sup>27</sup>. The strategy, facilitated by the legal institution of undertakings in Italy<sup>28</sup> and the possibility, then vanished, to impose functional separation to the incumbent<sup>29</sup>, pushed TI to present a list of additional remedies at the beginning of 2008<sup>30</sup>, with the creation of a new business unit, Open Access, with the aim to achieve a better access performance, and more guarantees of equal treatment between downstream competitors.

Open Access would manage TI access infrastructures for providing services to both TI Retail and other OLO's, the latter one by TI Wholesale division: its main products, defined SMP access services, include copper physical link supply between consumers and local exchange, WLR<sup>31</sup>, co-location service supply in the central exchange, maintenance on links and access to ducts (Amendola, 2009). The evaluation of the equivalence of access for TI commercial department is made by a “wholesale-like” phase of access to services<sup>32</sup>: in brief, by the less constraining concept of equivalence of output already mentioned.

<sup>26</sup> Subject to a yearly certified auditing by an independent third part.

<sup>27</sup> Interview A with an AGCOM civil servant

<sup>28</sup> By legislation (Art, 14 bis, DL 223/2006) and AGCOM Decision 645/06/CONS

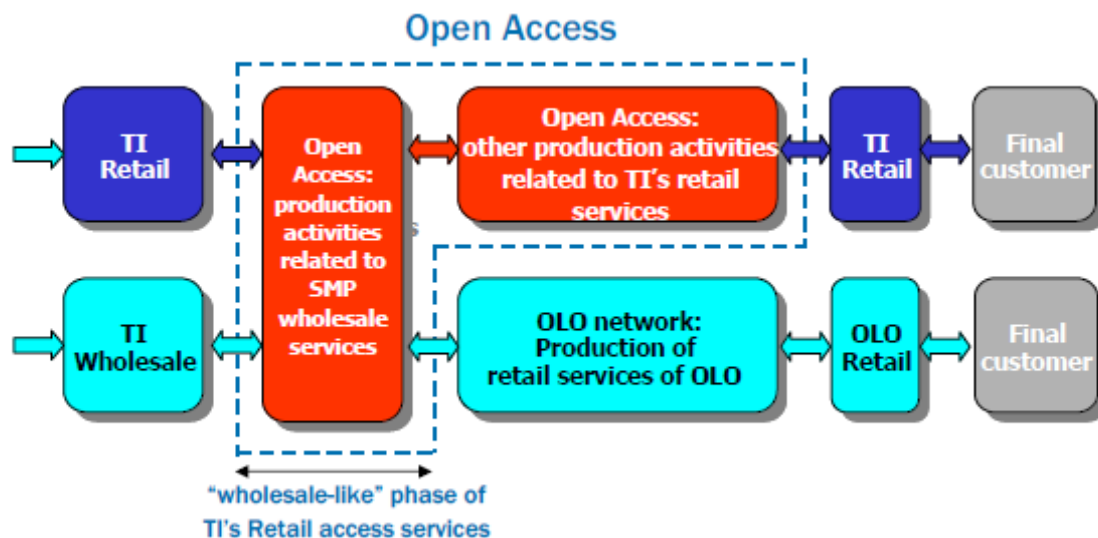
<sup>29</sup> By an emendament to Gentiloni Law

<sup>30</sup> Approved by Decision 718/08/CONS

<sup>31</sup> Wholesale Line Rental

<sup>32</sup> Corresponding to a sort of procurement of both LLU and other services like activation and number allocation

Figure 8 TI Operational Separation in 2008



Source: Amendola, 2009

Within measures for equal treatment between downstream competitors, it was introduced a new single delivery process for all the SMP services and new operational procedures for the co-location services management<sup>33</sup> and, besides that, a more stringent code of conduct, internal contracts related to the provision of services<sup>34</sup>, guarantees on NGAN development plans and the setting up of an independent board<sup>35</sup> supervising the proper implementation of the undertakings.

The separation achieved by AGCOM is something less deep than the functional separation which was aimed as target. Given the lack of legal tools for imposing any deeper separation to the incumbent, this result was the best one the Italian regulator could obtain: NRA could have used Art. 8, but it feared that the burden of proof was too heavy to lead, reasonably, to a positive outcome. Following this path, AGCOM aim is to continue monitoring the market and to improve the current situation through an effective control of measures offered by TI.

### 1.3.4 Differences, costs and benefits of separation

The main differences between TI Operational Separation and BT Functional Separation therefore are (Annex II):

- Equivalence to access to services: for BT, equivalence of input, while TI apply equivalence of outcome, less stringent.
- In the Operational case, access and core network are bundled in a single division, without any separation in the network structure; in Functional Separation instead, access division controls the physical layer of access and backhaul of BT network, while the rest is operated directly by the incumbent;
- In UK both BT Retail and downstream competitors deal with Openreach for the access service and with BT Wholesale for other services, like bitstream; In Italy OLO's

<sup>33</sup> Group of Undertakings n.1

<sup>34</sup> Ibidem, n.8

<sup>35</sup> The Supervisory Board has five members appointed by TI, three of which are designated by AGCOM.



interact for any service with TI Wholesale, which in turn contact Open Access, while TI Retail deals, in the same circumstances, directly with Openreach.

As a deeper level of separation would be implemented only if standard remedies (including accounting separation) have failed to avoid anticompetitive behaviours, it is necessary to take into account primarily national competition circumstances as well as incremental benefits deriving from the introduction of these exceptional measures: in the TI case, they would consist in avoiding non-price discrimination behaviours as quality discrimination and delaying tactics, but through a lower incidence by regulatory measures due to reliance on the “equivalence of output” scheme; in the BT case, with the introduction instead of “equivalence of input”, a stronger non discriminatory principle has been introduced, as it implies “*a provision of wholesale access services by the functionally separated access services and network division to all operators, at the same price and non price conditions, including the own retail arm, as a fully separated entity with its financial autonomy*” (Amendola, 2007b), by meaning a quality improvement for wholesale services sold to downstream competitors.

On the other side, a deeper separation is likely to lead to higher costs, that may consist in:

- Direct and indirect transaction costs: direct ones are those linked to the necessity to increase staff, to the increasing of procedures and to coordinate these activities; for the indirect ones, vertical separation eliminates economies of scope between upstream and downstream businesses, leading operators of both layers to set each a profit, thus to mark-up twice (double marginalization). Another negative outcome is the case where equivalence leads to the degradation of service quality for all operators, including the retail division of the vertically integrated firm.
- Reduction of incentives to invest and to innovate for both incumbent and competitors: the loss of coordination implied into the separation, may increase the high risks for the incumbent to invest in the modernization of its network, while the provision of equivalence, meaning for rivals better access to the incumbent’s infrastructure, may hamper network-based competition as well, as downstream competitors would have less incentives to deploy their own elements.

## 2 Stakeholders, variables and problems to be solved by regulatory policies.

In the definition of a coherent policy on this issue, for public actors the main risks to face are the setting of a new monopoly and that operators would deploy infrastructures with coverage limited only to the most profitable areas. Nevertheless, what is not stressed enough in policy discussions is the risk of inaction. In fact, besides well-known threats to an open and competitive environment in creating such emerging new market, once more it is important to recall that the deployment of such facility is essential for ensuring growth and wealth, as already described. In order to define possible outcomes, it is necessary to set the rationale behind stakeholders' interests and interactions according to subjects' characteristics. There are public and private subjects and each of them have peculiarities that might bias their normal behaviours, thus modifying the final result: these discrepancies appear because their decision-making process might be misled by illegitimate or else distorted expectations, information, incentives (structure-derived biases): under these definitions there are conditioned behaviours both from public and private actors, thus meaning that the bias might appear in the definition of policies as well as just (or at the same time) in their implementation.

### 2.1 Stakeholders and their interests

It is important to distinguish parties and interests, logics and possible biased behaviour into two main parts (see Table 2):

- Public actors (EU Commission, Governments, NRAs, local authorities, municipalities, etc.). All these institutions have the duty to support, in different modalities, public interests, in the way it is briefly described here:
  - EU Commission. Following the TFEU, its target is to ensure the functioning of the internal market, promoting trade and competition within Member States. As consequence, regulatory measures on the development of the electronic communication market have as target the deployment of NGN infrastructures that are neutral, open and accessible to competitors, as well as to ensure a competitive market environment so to maximize consumer benefits and foster innovation and competitiveness. Given the plurality of DGs, each with its particular targets, its action might result fragmented so the outcome, even within a public-goal framework, is difficult to predict. Nonetheless, procedures are open and transparent, and the complicate decision-making process ensures that measures are coherent with the Treaty;
  - Governments, local authorities, municipalities, etc. The eagerness to have a network covering the population delegated to its jurisdiction clashes, in most of the cases, with the lack of resources for the ownership of an infrastructure separated from private operators. Local authorities, mainly regions, even with limited resources, are more pressed on this issue due to the closeness with their populations and the existence of digital divide areas within their territories: for these reasons, it has been a flourishing of broadband local initiatives, with different notifications at the EU Commission for State Aids (Art. 107 TFEU);
  - NRAs. Regulators, by setting remedies, ensure the developing of a competitive (and, in economic terms, efficient) market for electronic communications and

encourage investments (see Art. 8, Framework Directive): protect competition, which does not mean safeguarding competitors.

Gomez-Barroso and Feijo (2010) and Noam (2010) take the position that the public sector has an important role to play in the transition to high capacity broadband. Public actors target is, as optimal first-best solution, a market with the deployment of more NGAN infrastructures covering the territory (infrastructure-based competition). The quality of the network is correlated to proximity of fiber to the end-user. An option is also a service-based competitive market, where an operator deploy and manage a single infrastructure that would be accessible to all competitors facing each other on the provision of services to end-users. A combination of these two options, with infrastructure-based competition only in the most profitable areas, is also feasible. Any limitation of the in size (infrastructure limited to the most profitable areas) or in the extension of the fiber facility (f.e.g., GPON instead of P2P, FTTC instead of FTTH) is a sub-optimal outcome that needs to be addressed.

- Private actors (incumbents, OLOs, OTTs, investors). For all of them, the ultimate interest is to provide, to their shareholders, the maximum return for capital invested: in order to assess extension and technology deployed it is necessary then to consider this rationale.
  - Incumbents. Former monopolies, some are still participated by Governments. In most cases, they own copper-based infrastructures. Their target is profits, as all other private entities;
  - OLOs. Competitors are characterized by fiber networks limited to backhaul: in some cases they own an access network in main cities too, usually in fiber<sup>36</sup>;
  - OTTs. These companies are not owned by operators: they are developing services bandwidth-intensive, so they are interested in the development of a high-speed network. Some of them might develop limited networks into specific areas<sup>37</sup> in order to test concretely technologies and a possible business model, but their extension is limited to small portion of territory;
  - Investors. In this category there are two set of actors: private funds, merely interested in receiving a viable return to the capital they have invested, and public funds (*Caisse des dépôts et consignations* and *Cassa Depositi e Prestiti*, are two examples) which might have a behaviour biased by considerations of public utility.

## 2.2 Factors affecting stakeholders and operators' incentive to invest

It has already mentioned the difference between service and infrastructure-based competition, their peculiarities and what should be regulators' target: in the long run, network competition is the "first best", as it tend to higher dynamic efficiency and, in comparison with the other option, it avoid the arising of network congestions. Some studies stress how each competitive option often interacts each other: platform competition on first step may lead to an increase in service competition on a later stage, by better price and quality (Aron, 2008).

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<sup>36</sup> Fastweb, Iliad, Hansenet, etc.

<sup>37</sup> <http://www.lightwaveonline.com/fttx/news/Google-announces-experimental-FTTH-network-plans-84040427.html>

Investment decisions are a matter of choices, and for economic actors it is difficult to calculate their own expectation on the return of their investments (Ruhle, 2009) in an environment where those are related to rules set by public actors and they are evolving. In the list of factors described above an important role is played by uncertainty (of different kinds), therefore public actors must reduce that typology of factor in order to promote a market where private players might correctly assess the potential return of their investments.

In defining a coherent policy for the development of NGAN elements, there is a clear case of interaction between regulation and investments. While regulators largely agree on promoting exogenous rules, literature points as well on the necessity to set collateral incentives, which we can divide into two main types:

- Fiscal, where Governments can modify tax burden on companies/consumers in order to facilitate undertakings' investments or else to foster merely market development or users' demand (Singer, 2010) through tax reductions, fiscal exemptions, financial incentives, tax credits and allowances;
- Behavioural, where both NRAs and Governments set rules to modify the rationale behind investors' behaviour. In order to achieve that, it is necessary that policy makers have clear in mind what are market forces at stake, targets and which kind of market they want to achieve (service-based or infrastructure-based) (De Bijl, 2005a) through the regulation of price or non-price variables<sup>38</sup>, like access duties to the infrastructures, measures to reduce costs over investments, rules to provide the sharing of essential infrastructures, particularly involving the sharing of passive portions like ducts, and remedies ensuring the owner of the facility a certain return over the investments (f.e.g. functional or else ownership separation of the network, promotion of co-investments, legislative and administrative measures as a single agency to process network-related authorizations, switch-over of copper infrastructures, etc.<sup>39</sup>) or public-funded actions (State Aids, PPP) to reduce uncertainty or to redress market failures in non-profitable areas (Doyle, 2008). Other remedies are the measures to lower barriers that discourage investments to flow, like licenses and sunk costs' stocks to set a new business. (Cave, 2006; Ibidem, 2007).

The description of main regulatory measures (standard, access and price, and non-standard, like network separation) show that literature stress on national market specific conditions in order to assess how regulation might influence investments: given this assumption, to address then investments in NGAN elements it is important to undertake different measures assessed according variables and factors in place.

Policy makers need to address different variables interconnected (Ruhle, 2009):

- Deployment costs, because its reduction influences the economic convenience of operators to invest in new facilities;
- Regulatory uncertainty, as any investment decision undertaken by stakeholders are made accordingly regulation in place: as regulation sets access and price obligations in turn impacting on revenues, any change exercises an influence over the expectations

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<sup>38</sup> The forthcoming list is not exhaustive.

<sup>39</sup> See EDA actions and NGA Recommendation Staff Working Document (link: [http://ec.europa.eu/information\\_society/activities/broadband/docs/nga\\_swd.pdf](http://ec.europa.eu/information_society/activities/broadband/docs/nga_swd.pdf))

under which investments have been made. The only perception of a potential change increases, *per se*, the risk over the commitment;

- Market (retail) demand, because uncertain market and the estimation of low revenues means more risks for operators investing, thus limiting their incentive to commit only into areas where there are conditions ensuring sufficient return to their investments, or else to deploy a network with an architecture which requires limited financial resources;
- Market (wholesale) demand, due to the same factors mentioned in the retail case. A market based on competing infrastructures may lead to circumstance of territories served by more networks, while other areas might be not covered at all: the operator committing to deploy a facility would not contemplate any considerable return from other operators requiring access to their services, reducing the convenience to invest in areas not profitable enough for their own use;
- Market dynamics, due to the necessity to consider national market specificities, as the number of operators, which deployment strategy are pursued (f.eg. market developed, infrastructure or service-based, and what is replicated in terms of network topology). It is necessary to assess as well the presence of a copper facility, owned in most cases by the incumbent, which might reduce the incentive to deploy a new infrastructure.

There is a sort of tension between competition and investments, “*There is in general a trade-off between promoting competition to increase social welfare once the infrastructure is in place and encouraging the incumbent to invest and maintain the infrastructure*” (Laffont, 2000, p.7), so it is important to define exactly “if, what and in which terms” it is necessary to regulate (LEGC, 2007, p.34). The relationship between the two has been described as an inverted U-curve process with two stages, where first competition leads to an increase of investments and then to a decrease: the focal point is that before the investment is made, firms have incentives to invest due to competitive pressure, while once the investments is done the attention is diverted to recoupment (Janssen, 2008).

The analysis of structural characteristics provides a fragmented landscape, which emphasizes the necessity of different tools to incentivize their action.

- Public actors' (EU Commission, Governments, NRAs, local authorities, municipalities, etc.) action might be affected by factors distorting their policy action and its effectiveness:
  - EU Commission risks to be lobbied by aggregate interests like operators, and not by diffuse bottom-level stakeholders (consumers, associations): therefore, the policy-making process might be distorted in favour of one part, biasing the final policy goal;
  - Governments might result sensible to instances set by former monopolists as in case of an integrated incumbent; the interest of the operator in perpetrating the *status quo* might coincide with a wishful thinking of a “*national champion*” from the public side. Local authorities have access to EU regional funds and they feel more pressed by the necessity to connect some areas (like industrial areas, etc.), but their action might result limited. Furthermore, even with the respect of the procedure for granting a State Aid, they might lack of capacity to use efficiently public funds: as explained in Ch. 3 and 4, public intervention might take different modalities, and local entities can subsidy the deployment while keeping the ownership of the infrastructure developed.

- NRAs. Their action might be biased by the inclusion of complementary targets (f.eg. industrial policy), which might distort their primary objective, or else regulators might interpret their role passively by settling rules with the scope to favour incumbents, based on the considerations that network facilities are, *tout court*, non-replicable monopolies and bigger operators might implement more easily their policies, sustaining investments in NGAN.

**Table 2 Public actors' targets, factors influencing policy makers and potential effects.**

	Stakeholders' targets	Factors	Potential effect
	<b>influencing policy makers</b>		
<b>EU Commission</b>	Policy actions (f.eg EDA) promoting an harmonized deployment of a NGN network covering the Union, in accordance to Treaty provisions.  A competitive market through sector-specific regulation.	A less fragmented representation of interests might induce a legislation favouring more some stakeholders.	Biased regulation and weak implementation of policy actions.
<b>NRA</b>	A competitive market through sector-specific regulation.  Promoting nationwide NGN infrastructures, in connection with the EU Commission.	Industrial policy objectives.  Closeness to incumbent's arguments.	
<b>Governments</b>	Industrial policy objectives.  Nationwide NGN network.	Lack of financial resources.  Closeness to incumbent's arguments.	Leaving the action to other stakeholders, which follow their own targets  Promoting the deployment of a single infrastructure owned by the incumbent.
<b>Local authorities</b>	Local NGN network. Filling Digital Divide.	Lack of capacity to develop projects for the subsidy of a broadband network with the most efficient use of resources for the administration.	Small infrastructures, often covering only some areas (f.eg. Industrial areas).  Granting subsidies without getting any ownership in return

Source: own elaboration.

- Private actors (incumbents, OLOs, OTTs, investors) responds to different factors that might influence their investments' decisions:
  - Incumbents. The presence of public actors within shareholders might be distortive in terms of strategic choices, involving investments also in areas where there would not be an economic return, while an elevated stock of debts might play as a disincentive to invest aggressively on NGN. Operators' decisions to invest is the consequence of the assessment of market conditions, which involve different factors interacting:
    - Uncertainty has an important role, and the reduction of it is important to incentive operators to invest:

- Regulatory uncertainty, as economic returns over the investment is a outcome of (price and access) obligations set by regulators, and operators might postpone investments in new facilities until they are confident about policies in place;
- Uncertainty in the economic return on the provision of services, at wholesale and at retail level, implying a delay in investments or else a limitation in what are deemed to be the most profitable areas;
- Uncertainty in the costs of deployment and technological progress: civil engineering costs account for a big component of the investment and therefore it is significant for the economic sustainability of projects.
- Potential competition by operators or else infrastructures that might be upgraded with negligible incremental costs for the provision of broadband services (f.eg. cable networks) is likely to determine an operator decision to postpone investments;
  - SMP are former national monopolists and they own nationwide copper-based infrastructures: the negative correlation between the development of NGAN (fiber) and the value of the copper facility diminishes the incentives to set a new network as it would render obsolete the copper one; at the same time, the mere existence diminishes the incentives to set a new NGN network as it would render obsolete the current one.
- OLOs. Uncertainty plays, also in this case, a role in influencing the decision to invest in the deployment of new facilities, in principle with the same variables described for the incumbents: regulatory measures, in defining both access obligations and prices, might influence their choices about the possibility of using incumbent's assets to provide retail services to end-users instead of building its own one (and, eventually, provide wholesale services to other operators). Due to their size, it is more difficult to access to capitals in order to support a large stock of investments (with uncertain returns), so they are often involved in initiatives with more players to diminish risks and uncertainty.
- OTTs. Regulation, unlikely from the request of incumbents, do not set any cost to be beard by them. Due to their businesses, they are not focusing on the provision of broadband services and therefore are not interested to invest. Furthermore, they are marginally more sensible to coverage than to speed: over a certain rate (which make users interested to accede those services), the economic return of those products is correlated to both network (direct) and bandwagon effects, as the value (inherent and network-related) increases, more than proportionally, with the fruition of users (Economides, 1996).
- Investors. Those actors have capitals to engage in this issue, but in case of private ones they are sensible to the same variables described for the operators (uncertainty). Many of the public ones might still consider to undertake such investment in case of market failure, with an involvement having potentially different formulas (PPPs, company owning only the infrastructure, etc.). The choice is between the decision of a direct involvement by creating its own an infrastructure (and managing it), or else just to finance other actors, lowering their involvement and risks.

**Table 3 Operators' targets and factors influencing investments' decision.**

<b>Stakeholders' targets</b>		<b>Factors</b>
		<b>influencing investments' decision</b>
<b>Incumbents</b>	Economic return over investments	Stock of existing debts - lack of resources
		Regulatory (Access and price obligations) (Wholesale and retail) market Deployment costs Technological progress Market dynamics (infrastructure-based competition) Macroeconomics
		Presence of Government within shareholders Copper infrastructure already in place
<b>OLOs</b>	Economic return over investments	Regulatory (Wholesale and retail) market Deployment costs Technological progress Market dynamics (infrastructure-based competition) Macroeconomics
		Lack of resources Make or buy? (Access and price obligations)
<b>OTT</b>	Ensuring the existence of NGN networks for the development of their business model. Economic return over investments	Change in regulation (currently not involving OTT)
<b>Investors</b>	Economic return over investments.  Public policy objectives in case of public investors.	Regulatory (++) (Access and price obligations) (Wholesale and retail) market Deployment costs Technological progress Market dynamics (infrastructure-based competition) (++) Macroeconomics
		Presence of Government within shareholders Create or finance others?

Source: own elaboration.

### 2.3 *The investment problem and the role of regulator*

The main features making investments less attractive are the irreversibility of the decision and the importance of fixed costs, whose recoupment is decided by the regulator: its policies



interact with the infrastructure owner in two layers, both as principal and towards end-users, with the risk for the latter of changing target after it has set its investment (Pietrunti, 2008).

Main problems observed in literature are both the delay of investment decisions as well as under-investments (Ibidem), and there are four main approaches to consider in order to assess the influence of regulation on the timing of investment:

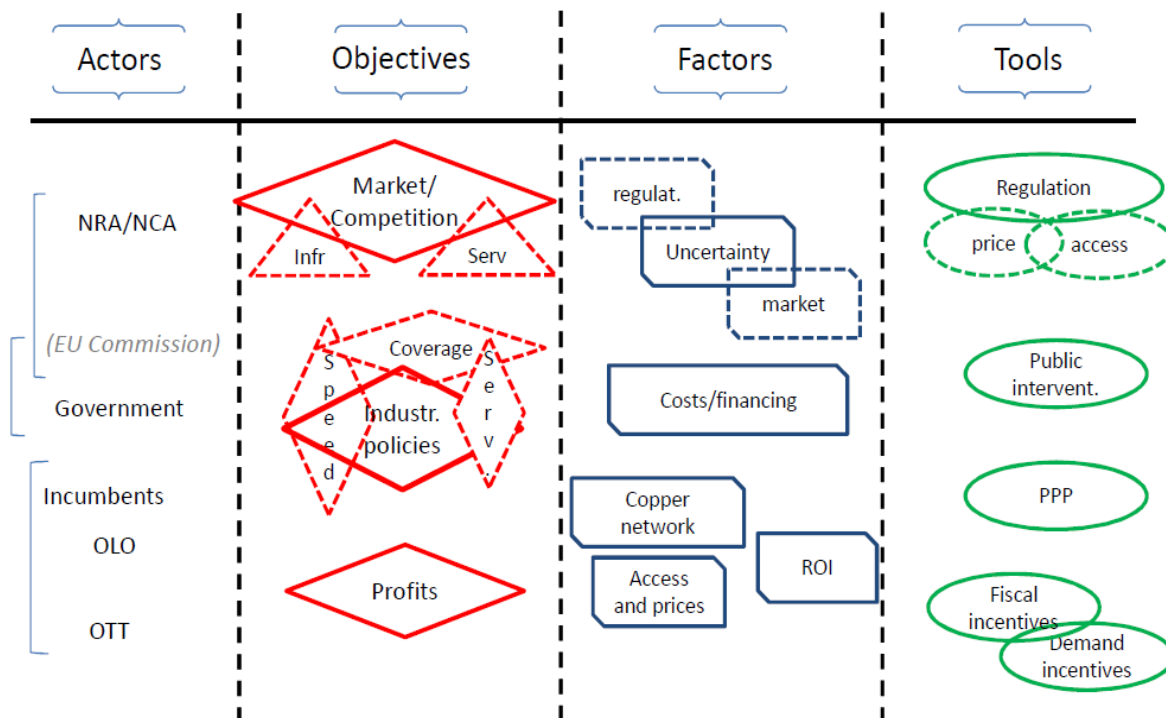
- **Absence of regulation (forbearance)** (Brito, 2008): consisting in no regulatory intervention (thus withdrawing ex-ante regulation) regarding a specific issue (as NGAN), which may be effective in pushing investments but may also lead to the arise of competition issues;
- **Permanent regulation:** consisting in the definition of a permanent regulation (which still might change over time - "multi-phase");
- **Sunset clause:** the regulator impose a set of unbundling obligation to the incumbent for a certain period of time (pre-determined), which will be removed after that. In this way the incentives for the incumbent to build its own network are only partially reduced, while competitors are induced to roll out their own (Pietrunti, 2008).
- **Regulatory holiday:** similar to sunset clause, it consists in a multiphase policy where the regulator does not impose any obligation on new investments for a certain period, starting from the project (Gavosto, 2008). As uncertainty is high in the beginning, the regulator decides to give an incentive by lowering risks on the operator deploying the network, until it is sufficiently small: then, with the removal of the "holiday", it will promote service-based competition between firms.

If the regulator could commit itself ex ante, "it is socially desirable to have access usage prices that differ depending" (Gans, 2002) on the success of the investment. As many times cannot, the best way to tackle truncation problem is through the last option described (regulatory holiday), and the main reason is the difficulty for the regulator to achieve a proper degree of information. In general, by its action, the regulator can easily disincentive the firms considering to invest: by reducing the possibility to create immediate value for its investment, the operator is likely to delay the capital expenditure (Baake, 2006). Through regulatory holiday instead, the risks of suffering service-based competition by rivals that are simply "free-riding" its infrastructure or else, a lower return on capital (compared to the one expected), it is reduced if not cancelled. Anyway, it is important to take into account the amount of revenues, because it is possible that a distorted outcome would appear: if most of the exceptional profits obtained would disappear with the end of the period, regulatory holiday may delay investments, unless the amount "front loaded" is so high to achieve the opposite trend (Gans, 2002). Therefore, the "*effect of a marginal change in the length [...] will depend on how monopoly profits are changing at the end [...]. If the holiday end [...] when monopoly profits are relatively low, then reducing the length [...] encourage earlier investment*" (Ibidem). According to these arguments, the optimal length of an access holiday is when it maximize the difference between marginal gain from earlier investment and the marginal cost due to a longer period of monopoly profits (Ibidem).

As described later in the analysis, regulators have adopted active policies to foster the deployment of NGA: the argument is, therefore, which variables have been pointed by those measures, and if they have been addressed correctly. Policies should be effective and transparent to target the result desired, so to ensure operators that their strategies would achieve a predictable outcome, at least in the short term. It is regularly mentioned (Ibidem)

that different outcomes come as consequence of NGN policies might be due to different interests at stake, therefore policies should be tailored according those variables.

**Figure 9 Overview over variables at stake**



Source: own elaboration.

The tools that public actors can use to influence private operators are different (Cambini et al, 2009) and have different modalities:

- Regulation (symmetric, applicable to all operators, or asymmetric, imposed only on SMP);
  - Cost reduction measures, with obligation/incentives to access public facilities or to use technologies as well as procedures to reduce investment costs, f.e.g. co-investment;
  - Access (non-discrimination) and price (costing methodologies and definition of risk premium) obligations:
    - copper elements
      - passive facilities
      - active facilities
    - fiber elements
      - passive facilities
      - active facilities
- Public intervention (State Aids);
- PPP;
- Fiscal and demand incentives.

In the deployment of a new infrastructure there is a case of a nascent market that has to be treated differently from existing ones. NRAs might take different regulatory actions, and they need to ensure that their intervention address correctly variables so that operators would act in order to achieve public goals:

- as mentioned, regulation needs to be stable and predictable, in order to diminish investors' risk to invest;
- in the definition of access and price obligations, NRAs must anticipate stakeholders' reaction: access to active elements of the networks increase service-based competition at the expenses of infrastructure-based one; prices not assessing correctly the risk of investors disincentive their willingness to deploy a new network; access prices without an appropriate step between fiber and copper facilities might incentive operators to focus on the latter one; assessing prices too strictly, instead, would push competitors to "free-ride" the incumbent's network (the "make or buy" dilemma), decreasing their incentive to build a proprietary infrastructure as well as for incumbents to improve the capacity or to create a new fiber-based access network;
- it is also important that the regulators impose obligations efficiently: in a case where more operators are replicating part of the infrastructures, asymmetric regulation (with obligations imposed only on the SMP) in combination with a market assessment at national (geographic) level might not lead to an efficient outcome. Operators classify areas with different terms of economic convenience and prioritize their investments in those with more potential: in some areas the only facility in place might be owned by an alternative operator (that might refuse access to others) and competitors would be obliged to deploy their own infrastructure because they would not be allowed to require access, with the consequence that some areas would have more overlapping networks (while other areas, those with low profitability, would not be covered). A geographical segmentation of market would target areas where all operators (not only the incumbent) have deployed their own facilities and symmetric regulation would incentive to commit in areas not covered yet.

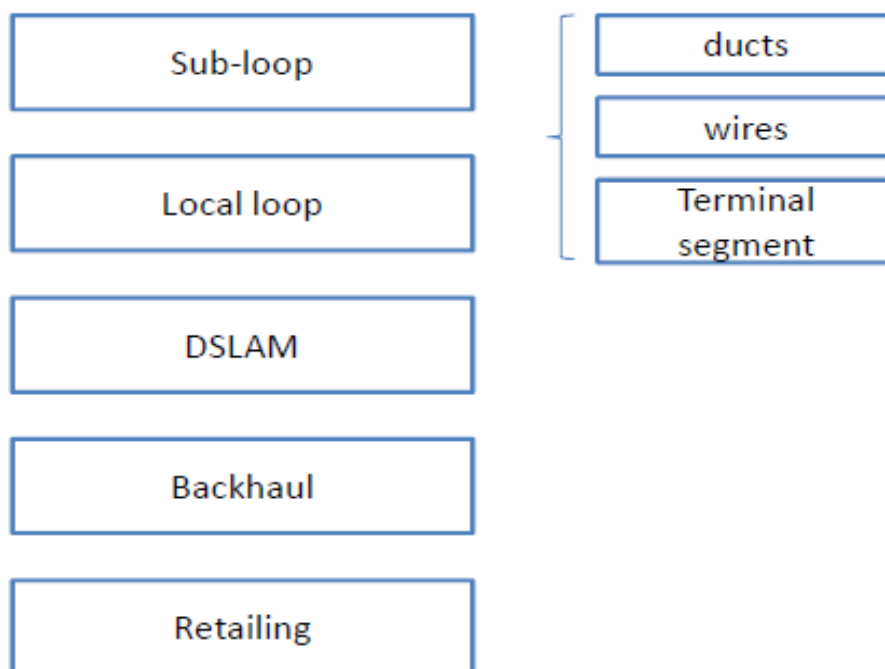
### 2.3.1 Facility-based competition by the ladder of investments

As the regulator aim is to develop competition between networks, the key is to address a policy that would encourage entrants' investments without discouraging the one undertaken by the incumbent. A credible approach is the one described into the "ladder of investments" theory proposed by Cave (2006a): in brief, it is a multi-phase approach where the authority signal its intention to change over time access conditions, first making feasible and then giving incentives to entrants to build up their own infrastructure. The target is first to allow competitors to achieve a critical mass of end-users by competing on services and then, with a solid financial structure, to force them to roll out their own infrastructure, starting from the part that is most easy to replicate.

In order to determine relative replicability (Cave, 2006a), it is possible to use an empirical approach, taking into account past similar experiences, or else to model it by studying the cost structures, by assuming perfect productive efficiency and competitive interactions (hard to predict): in this case the model risks to be biased towards a finding on non-replicability so, in presence of empirical data, this would not be the best option (Ibidem). Considering the

broadband chain of supply, we can split the layer in the following levels, with an ascending order of replicability:

**Figure 10 Telecom chain structure by (ascending) level of replicability.**



Source: own elaboration

- Sub-loop and local loop: in copper wire, it is the least replicable of all network parts, due to the deployment costs described;
- DSLAMs: competitors may install the appliance, co-located into local exchanges owned by the incumbent, but for them it is difficult to achieve the same economies of scale (Ibidem);
- Backhaul: it implies low fixed costs and the feature of replicability rely on geography, as it is more feasible to replicate in central areas while it is less on other routes;
- Retailing: consisting in reselling the incumbent service.

In order to implement this approach, it is necessary to proceed by steps, and the first one is to assess the replicability of each stage considered: in the negative case, it is not appropriate to deal this issue through this approach; in the positive one instead, NRAs need to signal how it wants to modify its intervention, using price options already described. The second step is to rank chain components are possible to reproduce according to their degree of replicability; then (step 3) it is important to identify both the incumbent and competitors' position on the development network chain; in step 4 is necessary to define the length of each transitory period, then the mode of intervention (step 5), using a price-based approach (between the ones described before) for layers whose replicability is more uncertain, while intervening by the withdrawal of mandatory access for parts of the chain more replicable (Ibidem).

In order to make this approach working, it is important to take into account national specific market structure (Distaso, 2008) to calibrate intervention according the needs. It is important

as well to be credible in committing the policy (Cave, 2006a; Valletti, 2004), otherwise the regulator would incur in an arise of “moral hazard” by the competitors, deleting the incentives set indirectly by the implementation of its own policy.

### **2.3.2 The relation between copper and fiber access prices, geographical segmentation of remedies and co-investment.**

The topic stresses the need of regulatory interventions with the aim to stimulate investments in NGAN without distorting competitive conditions. A role of stimulus could be played by the relation between fiber and copper access tariffs, geographically segmented remedies (f.eg. different rules and/or prices according the degree of competition in the market) or else the possibility, for operators, to co-invest for the deployment of new facilities.

The debate on how to regulate access prices for copper, with the aim to incentive investments, has been wide. Recent academic papers (Borreau et al., 2012) showed that investments in fiber NGA elements are strongly influenced from copper’s access prices by the following effects:

- Replacement effect: with low copper access prices, alternative operators have less incentive to invest in a proprietary fiber infrastructure (in a logic of “*make or buy*”);
- Wholesale revenues effect, tied with the profitability of wholesale services based on copper: lower copper prices incentive the switch off of such network, thus increasing investments in fiber elements (higher copper prices would disincentive the incumbent to invest in a new infrastructure that would win over the current one);
- Retail-level migration effect: low access prices for copper reduce as well retail prices for broadband services, in turn influencing negatively over services based on NGAN elements, thus reducing their profitability and investments.

Another effect is due to financial limits over the investments made by operators: the incumbent has the advantage to use the cash flow derived by its own copper network to finance NGA investments, while alternative operators rely over margins or else debt, thus increasing the risk of investing. In such context, an increase of copper prices might lead over more capacity to invest by the incumbent but then are necessary rules that would oblige the operator to invest in this sense. Other studies (Borreau et al., 2014) showed that, in case of market conditions where a FTTC network is implemented, the retail-level migration effect results emphasized. The bundle of effects is therefore complex, and the influence of each factor depends from specific market conditions.

There are evidences (Borreau et al., 2014b, Neumann et al, 2013) of a relation between the two typologies of access prices, so that NRA should determine them concurrently: if prices would be set at the same level (with a reduction linked to the difference in performance), operators would have the incentive to offer most advanced broadband services, thus migrating their clients over fiber.

Another relevant topic is the relationship between the geographical dimension and regulation, as in recital 10 of the NGA Recommendation<sup>40</sup>. There are territories where it is more

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<sup>40</sup> 2010/572/EU.

convenient to invest in NGA, due to population density and higher demand, and just in those areas there might emerge a market with competition between infrastructures, whereas in other areas there might be one or none: the heterogeneity of market conditions might then require a regulatory framework that would adapt accordingly, reflecting different competitive pressures. Different remedies might be adopted: the regulator might choose to scrutiny only areas where just one infrastructure is present, leaving operators to negotiate access where there is an infrastructure-based competition; another possibility is to set different obligations (both access and price), segmented according to market conditions (competitive pressures).

Academic literature (Borreau et al., 2014) shows that in a case where there are areas with only the copper network and others with the presence of both copper and fiber infrastructure, access prices segmented on geographical base is a stimulus to fiber investments: in areas with the only traditional network, copper access prices should be cost oriented; instead, in areas with competition within infrastructures, copper prices should be higher than incremental costs to favor migration over fiber. Differentiating geographically fiber access prices according to infrastructure competition might as well to boost investments in NGN (Borreau et al., 2013): in case of areas with different competitive pressures, access prices on fiber elements should be set relatively higher where there is only one network, in order to incentive operators to deploy in such areas.

In a market with a sensible risk for investors to find profitability, fiber deployment might be favored by co-investment between more operators, with an higher rate of deployment as well as coverage, as showed in recent literature papers (Nitsche et al., 2011), as sharing costs and risks allow to find more easily financial sources, as well as reducing the asymmetry between those investing and those merely requiring access to the infrastructure. Co-investment agreements should be left to market discretion, but NRA might still impose them in some areas, as well as symmetric access obligations. Cost saving are different according to the agreement between parties, as they can cover only passive or also active infrastructures. As mentioned in the NGA Recommendation, co-investment might take different form of legal arrangement:

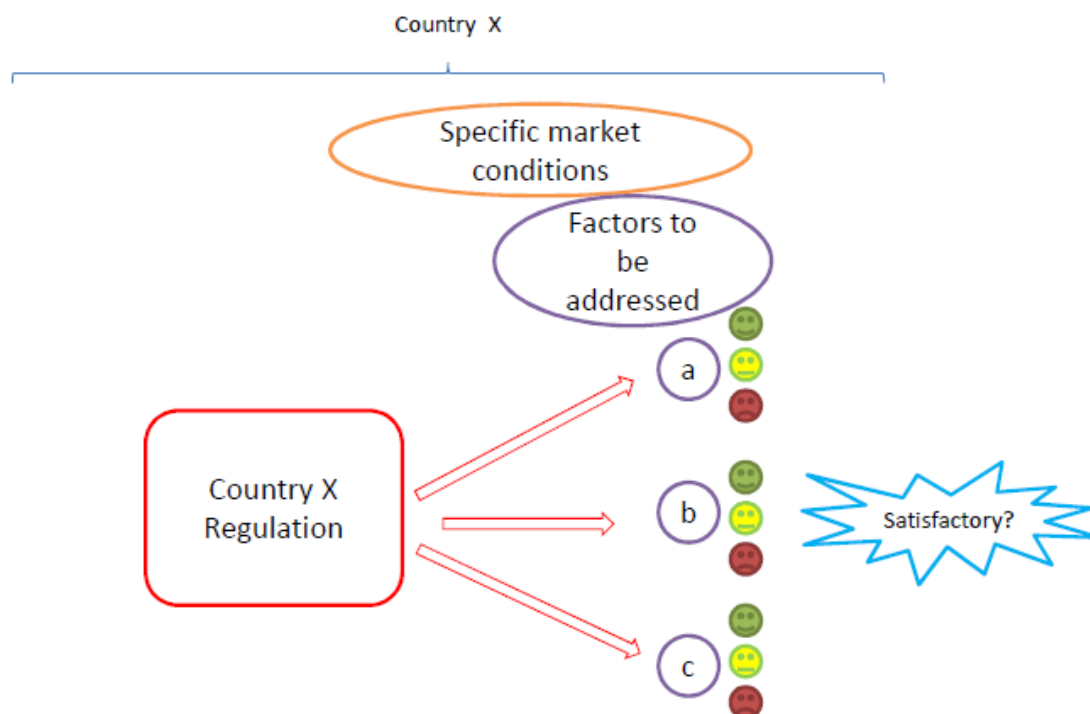
- With the joint venture, operators form a new company with a specific scope, partner provide capital and take risks according to their share, so reducing risks and potential discriminatory behavior from other parties;
- With long-term contractual agreement, IRU (Indefeasible Right of Use), the investor reduce its risks over time while the operator seeking access can involve just a fraction of the capital necessary.

## *2.4 A methodology to assess the effectiveness of regulatory policies*

In order to define the effectiveness of policies conceived at EU level and implemented within the 4 main EU countries considered in this analysis (Chapters 3 and 4), it is important:

- to assess specific conditions present into national markets and factors to be addressed;
- define policies implemented (both at EU and national level);
- then to analyze factors addressed and, potentially, their impact on operators' behaviour for the development of NGAN.

**Figure 11 Scheme of the methodology implemented into the analysis.**



Source: own elaboration.

The qualitative analysis of policy effectiveness will assess if private operators (both SMP and competitors) have followed, with their behaviour/investments in NGAN elements, indications emerged from regulatory policies about broadband deployment, defining the scope for further public intervention. The methodology will take into consideration three interconnected steps and, given such plurality of conditions, it is necessary to assess some tables to provide a clear result from the analysis:

1. Specific conditions present into national markets for electronic communications (as present in NRAs' market analysis exercise) and factors to be addressed, as described in par. 2;

**Table 4 National market conditions to be considered.**

National conditions to consider	Market analysis	Number of operators
		Market shares
		Number of infrastructures present
		Market dynamics (infrastructure-based competition)
		Copper infrastructure already in place

Source: own elaboration.

**Table 5 Factors to be addressed.**

Factors to address	Financing	
	Uncertainty	Regulatory (Access and price obligations)
		(Wholesale and retail) market
		Deployment costs
		Technological progress
		Macroeconomics

Source: own elaboration.

2. Analysis of EU and of national regulatory policies implemented on network layers and relevant market/products, using the most updated one at national level (at the moment only Italy has approved a market analysis based on Recommendation 2014/710/EU). Government policies for the development of NGAN will be considered as well;

**Table 6 Table of national regulation (remedies) according to relevant products.**

Market	Product	Geographical	Operator with SMP	Remedies	
				NGA Price	Copper Price
1	WLR				
4	Ducts and dark fiber Terminal segment LLU SLU				
5	WBA				

Source: own elaboration.

3. With the analysis of regulatory/government policies for the development of NGAN, it is necessary to define and to benchmark then:
  - a. policy effectiveness over variables considered (point 1).
  - b. the impact of policies (point 2) on operators' behaviour;



**Table 7 Benchmarking of national policies' impact over factors to be addressed.**

Impact of national policies over factors to address								
			UK	France	Italy	Germany	US	S. Korea
Factors to address	Financing							
	Uncertainty	Regulatory (Access and price obligations) (Wholesale and retail) market Deployment costs Technological progress Macroeconomics						

Source: own elaboration.

### 3 Analysis of policies at EU level.

#### 3.1 EU regulatory framework

The Telecom market is regulated by a number of legislative acts, addressing different sides of the sector: keywords for the EU regulatory framework are convergence (as it set the same rules for different technologies), antitrust-based (based on the finding of dominance/SMP - Significant Market Power as a mean for establishing ex-ante regulation) and flexibility (as these EU rules are applied by NRAs – national regulatory authorities).

Some of these legislative acts (*in sensu lato*) are regulating the Telecom sector in general and define targets, tools (f.eg. definitions, obligations) and procedures (f.eg. assessments) with the scope to promote an open and competitive market for electronic communication networks, like for example the:

- Framework Directive (2002/21/EC),
- Authorization Directive (2002/20/EC),
- Access Directive (2002/19/EC),
- Universal Service Directive (2002/22/EC),

modified in 2009 by Directives 136 and 140 “Better Regulation” and “Citizens’ Rights”;

- Recommendation on relevant markets (2007/879/EC),
- Guidelines on market analysis and the assessment of significant market power (2002/C 165/03);

Some others, instead, have as defined objective NGAN broadband development, like the:

- NGA Recommendation;
- Recommendation on costing methodology;
- Broadband Communication and Digital Agenda for Europe;
- State Aids Guidelines;
- Directive 2014/61/EC on broadband reduction;
- CEF Guidelines (funding).

Although the latter ones are acts not directly enforceable, Art. 16(1) of Framework Directive requires Member States to ensure that NRAs, in carrying out their duties, "*utmost take into account*" recommendations: if a regulator decides not to conform to a particular non-binding act (for specific reasons related to market conditions), it should inform the Commission.

In order to describe the regulatory structure targeting the development of next generation (NGAN) broadband infrastructures, this analysis will describe only strictly relevant measures, thus not considering commitments approved into both Authorization and Universal Service Directive (in the latter directive there is only an non-exhaustive list of appropriate remedies to be applied at retail level, that can be imposed only in case wholesale obligations would not achieve the target, as retail tariff regulation, no undue preference to specific end-users, not unreasonable bundled services – see Art. 13(a) and Artt. 17-18-19 of the Universal Service Directive).

### 3.1.1 Framework and Access Directives

Directive 2002/21, and later on, Directive 2009/140, sets general principles that are enhanced by other parts of legislation. Important measures defined by this act are the followings:

- Artt. 7-7(a)-7(b): notification to the EU Commission of draft measures (definition of market and its analysis, SMP assessment, imposition of remedies) undertaken by NRAs at national level, in order to have a consistent application of EU legislation. Directive 2009/140/EC has reinforced the procedure: the Commission can require NRAs to withdraw or amend the draft measure but still it has no veto power (See Annex I);
- Art. 8, where are stated major policy objectives and regulatory principles: regulation should promote competition (where possible, infrastructure-based) to the benefit of consumers and with the purpose to develop the EU internal market, promoting both investments and innovation while considering different conditions (technology, market, geography, etc.) as well as ensuring that regulatory principles are objective, transparent, non-discriminatory and proportionate. Art. 8(5)(e) by “[..] *taking due account of conditions [..] that exist in the various geographic areas [..]*” states the possibility, for NRAs, to introduce differentiated remedies within a (national) geographical market;
- Artt. 11-12 state the right to install facilities (f.eg. wiring, ducts, manholes, ducts, etc.) for an undertaking authorised, on private or public properties, while NRAs can impose sharing and co-location of those infrastructures/network elements to providers;
- Art. 14 reports to the relevant Guideline (2002/C 165/03) for the definition of undertakings with significant market power (SMP);
- Art. 15, together with Recommendation 2007/879/EC, empowers the EU Commission about the identification of relevant markets;
- Art. 16 stresses about the procedure of undertaking an economic market analysis appropriate to national circumstances (through a competition law methodology), with the imposition of specific regulatory obligations;
- Art. 19 defines that in case the EU Commission finds divergences into Member States about the harmonized implementation of Directives, it might issue a recommendation or a decision for the achievement of objectives stated in Art. 8.

The harmonisation of regulatory approaches (which does not involve the harmonisation of results) is due to the marginal discretion given to NRAs, and it is ensured mainly by two mechanisms: market analysis review under Article 7 of the Framework Directive (consisting in the EU Commission control over NRAs draft decisions affecting trade between MS) and by the European Regulatory Group (BEREC). In this list we can also include legal precedents as the infringement procedures before the ECJ and antitrust cases. As result, NRAs are discouraged from being an active part of the decision process: an example is in the different procedures in defining geographical markets, as the NRA identification of them is subject to an assessment by the EU Commission<sup>41</sup> whereas this is not the case if the relevant market notified does not differ from those listed in the Recommendation.

Access Directive establishes rights and obligation at wholesale level (Directive 2009/140/EC adds only the possibility to impose functional separation on SMP) whereas NRAs should

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<sup>41</sup> Art. 7, par. 4, Framework Directive

promote access to network infrastructures in order to foster competition, without reducing incentives to alternative operators to deploy their own facilities:

- Artt. 6-8(2) state that, following a market analysis according Framework Directive, if NRAs assess a significant market power (SMP) on one or more undertakings, access obligations (also different from those listed below, if necessary, see Art. 8) should be imposed to allow competitors to access network facilities, like:
  - Art. 9: Transparency on making public to other operators specific information, as “*technical specifications, network characteristics, terms and conditions for supply and use*”, with the publication of a reference offer where services might be acquired unbundled;
  - Art. 10: Non-discrimination between competitors, which should enjoy “*equivalent conditions in equivalent circumstances*”;
  - Art. 11: Accounting separation on access services in order to avoid cross-subsidies between activities (see EU (C(2005) 3480 final), on accounting separation and cost accounting systems for electronic communications;
  - Art. 12: Obligation to provide access and use of specific network facilities as well as co-location to third parties, and “*to provide specific services on a wholesale basis for resale*”;
  - Art. 13: Price control and cost accounting obligations for the provision of access services, through a methodology for cost-oriented prices having an adequate rate of return (which takes into account investors’ risks);
  - Artt. 13(a)-(b): in case competition is not achieved even after the imposition of remedies, NRAs might impose functional separation of wholesale access activities to vertically-integrated operators; designated SMPs might as well separate voluntarily their wholesale activities in a separate business entity in order to provide equivalent access products to all operators, including their own retail division.

### 3.1.2 Market analysis and SMP assessment (Guidelines 2002/C 165/03)

Guidelines 2002/C 165/03, whose legislative basis are in Art. 15(2) of Framework Directive, are designed to help NRAs to conduct their market analyses, addressing:

- market definition (product/service and geographical);
- assessment and designation of SMP (with the imposition of regulatory obligations);
- procedural issues related to these subjects.

Assessing the relevant market is essential as effective competition can be assessed only in relation to that. Main relevant product/service markets where it is possible to impose regulatory obligations are already identified by Recommendation 2007/879/EC, although NRAs can define other relevant markets under Art. 15(3) of Framework Directive.

In order to define a relevant market it is necessary to consider competitive constraints on the price-setting behaviour of an operator, which might then be:

- demand-side (measuring to which extent consumers are willing to move to another product);
- supply side (measuring to which extent other operators are willing to switch their production in order to provide the product in question);

- or potential competition (measuring to which extent potential suppliers are willing to enter the market to provide the product in question);

NRA should identify relevant markets (first product/service, then geographical) using the SSNIP test, analysing the consequences of a small but significant increase of relative prices for a defined product/service: substitutable products will therefore be added as the scope is to delineate a market (both product/service and geographical) where a relative price increase would not lead consumers to switch to available alternatives.

#### Definition of relevant markets (product/service and geographical)

According to case law of the CJEU, the relevant products/services market comprises all those products or services that are sufficiently interchangeable or substitutable, not only in terms of their objective characteristics, but also in terms of the conditions of competition and/or the structure and demand in the market in question. This was established by several judgments by the CJEU (Case C-31/80, *l'Oréal*, Case C-322/81, *Michelin v Commission*, [1983] ECR 3461; Case C-62/86, *AkzoChemie v Commission*, [1991] ECR 3359).

According to case law, the relevant geographic market comprises an area in which the undertakings concerned are involved in the supply and demand of the relevant products or services where the conditions of competition are similar or sufficiently homogeneous and can be distinguished from neighbouring areas where the prevailing conditions of competition are appreciably different (Case C 27/76, *United Brands*, [1978] ECR 207).

#### SMP assessment

The proposed definition of SMP (see Art. 14(2) of Framework Directive) is similar to the definition that the CJEU ascribes to the concept of dominant position in Art. 102 of the TFEU: a position of economic strength enjoyed by an undertaking, affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers (Case C-27/76, *United Brands*, [1978] ECR 207). However, the ex-ante assessment of SMP requires adjustments to the way market power is assessed (ex-post) under Art. 102 TFEU (abuse of a dominant position). SMP assessment needs to be forward looking, and NRAs will have to ensure that decisions are in line with the EU Commission practice and the relevant jurisprudence of the EU Courts.

#### Criteria for assessing SMP

In a traditional ex post analysis of market power, a competition authority may have a number of examples of market behaviour indicating the dominant position of an undertaking. In an ex ante environment, market power is essentially measured by reference to the power of the undertaking to raise prices by a small but significant amount for a non-transitory period without incurring a significant loss of sales or revenues.

Market shares are normally used as a proxy for market power:

- undertakings with market shares of no more than 25% are not likely to enjoy a (single) dominant position;
- single dominance concerns normally arise in the case of undertakings with market shares of over 40%;
- very large market shares (beyond 50%) are, except in a few circumstances, evidence of the existence of a dominant position.

Other criteria for assessing SMP in a given market include:

- existence of potential competitors;
- overall size of the undertaking;

- control of infrastructure not easily duplicated;
- technological advantages or superiority;
- absence of or low countervailing buying power;
- easy or privileged access to capital markets/financial resources;
- product/service diversification (e.g. bundled products or services);
- economies of scale and scope;
- vertical integration;
- highly developed distribution and sales network;
- absence of potential competition;
- barriers to expansion;
- barriers to entry.

#### Leverage of market power

Art. 14(3) of Framework Directive says that an undertaking with SMP in a specific market may also be SMP in a closely related market, where the links between the two markets allow the market power in one market to be leveraged into the other. In other words, because of the firm's dominance in the first market, and its presence in the associated market, the undertaking may leverage its dominance into the secondary market. According to the CJEU, close associative links are often found in vertically integrated markets, which is often the case in the telecommunications sector. (see case C-333/94, *Tetra Pak v Commission (Tetra Pak II)*, [1996] ECR I-5951)

After having defined a relevant market and assessed an SMP, if a NRA finds that competition in the relevant market is not effective because of the existence of an undertaking in a dominant position, on the designated operator must be imposed some specific regulatory obligation in accordance with Art. 16(4) of Framework Directive: this measures, in order to be lawful, must be justified in relation to objectives and proportionate to the achievements.

### 3.1.3 Definition of relevant markets (Recommendation 2014/710/EU)

In order to decide if an issue within electronic communications needed to be regulated, the framework set a four-step procedure that, first of all, obliges the EU Commission to identify which markets are susceptible to ex-ante regulation. Recommendation 2014/710/EU is the revised version of the first (2003/311/EC) and second (2007/879/EC) legislative act on relevant markets: this new document identifies (in accordance with the principles of competition law) 5 relevant product and service markets in the electronic communication sector where competition law remedies are insufficient to effectively address market failures and therefore ex-ante regulation is necessary.

The EU Commission defines those markets on the basis of a three cumulative criteria test<sup>42</sup> (De Streeel, 2008a):

- high and non-transitory entry barriers of a structural, legal or regulatory nature;
- market structure which structurally cannot bring to effective competition within a reasonable time horizon (assessing competition without considering barriers to entry);
- insufficiency of the sole competition law to address adequately the market<sup>43</sup>.

<sup>42</sup> Recital 27, Framework Directive

Then, at national level, NRAs should identify relevant markets by using the SSNIP<sup>44</sup> test and within the recognition of national specificities, delineating both product and geographic dimension of the market<sup>45</sup> within their territory: some studies have shown that it is possible to define infra-national markets, according to population density and the existence of infrastructures (Amendola, 2007b). NRAs may also identify markets that differ from those listed in the recommendation, provided they act in accordance with Art. 7 of the Framework Directive (i.e. consultation with other NRAs and possible Commission veto): they have to prove that these markets fulfill the ‘three criteria test’. So-called ‘emerging markets’ should be exempted from ex ante regulation, as they are so new that it is not possible to assess whether or not the three criteria test would be fulfilled.

The 2007 Recommendation lists the following relevant markets:

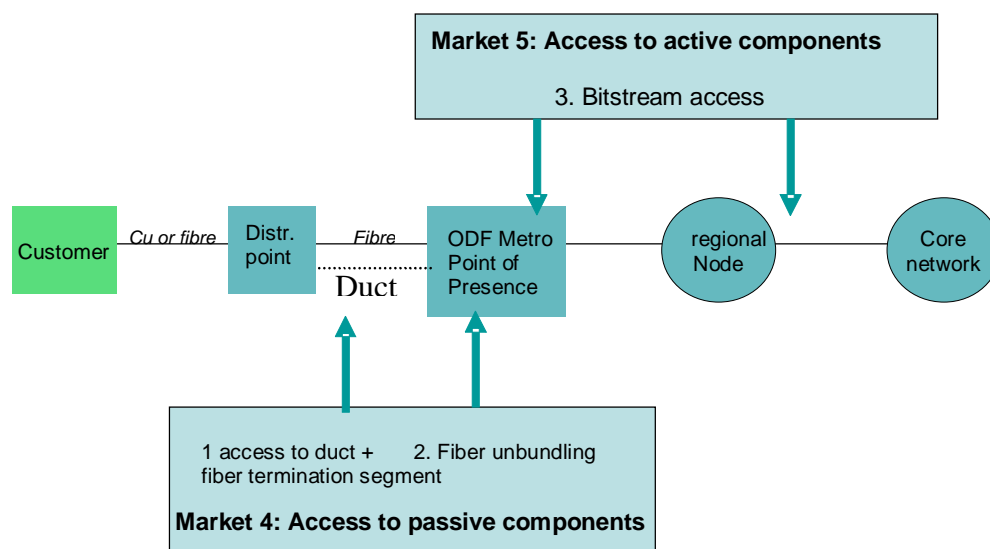
Retail level

1. Access to the public telephone network at a fixed location for residential and non-residential customers;

Wholesale level

2. Call origination on the public telephone network provided at a fixed location;
3. Call termination on individual public telephone networks provided at a fixed location;
4. Wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location;
5. Wholesale broadband access;
6. Wholesale terminating segments of leased lines, irrespective of the technology used to provide leased or dedicated capacity;
7. Voice call termination on individual mobile networks;

**Figure 12 Technical segmentation of market 4 and 5, Recommendation 2007/879/EC.**



Source: NGA SWD

<sup>43</sup> Article 2, Commission Recommendation 2007/879

<sup>44</sup> Small but Significant and Non-transitory Increase in Price

<sup>45</sup> As addressed in the EC Guidelines on Market Analysis and the Assessment of Significant Market Power (2002), the geographic dimension is set only in a second stage: first a certain market has to be identified in its product dimension, then the definition of a geographic one can be analysed by the regulator.

With the 2014/710/EU Recommendation, entered into force on October 9th, 2014, the number of markets susceptible to ex ante regulation has been reduced to 5, with the drop of markets for retail fixed telephony access and wholesale fixed call origination (markets 1 and 2, 2007). Former market 4 and 5 (according 2007 definitions), now defined as markets 3a and 3b, relevant to our analysis, has been redefined according functionality of modes of access, rather than deployment modalities, and differences in the retail need of consumers and business customers.

**Table 8 Relevant markets according 2014/710/EU Recommendation.**

	<b>Wholesale Local Access (WLA) - market 3a/2014 (former 4/2007)</b>	<b>Wholesale Central Access (WCA) - market 3b/2014 (former 5/2007)</b>
<b>Characteristics</b>	<p>More control for access seeker</p> <p>Access provided at local switch level</p> <p>Uncontented transmission capacity</p> <p>Sufficient control - access is a functional substitute for LLU</p>	<p>Standardized level of control for the access seeker</p> <p>Access provided at regional or national level</p>
<b>Access solutions</b>	<p>Physical unbundling (LLU)</p> <p>WDM when available</p> <p>VULA - if functionality required is met</p>	<p>Bitstream</p> <p>VULA</p> <p>"non-physical or virtual access products with an improved quality of service" which can be used to provide retail products for business users</p>

Source: own elaboration

### 3.1.4 The NGA Recommendation (2010/572/EU)

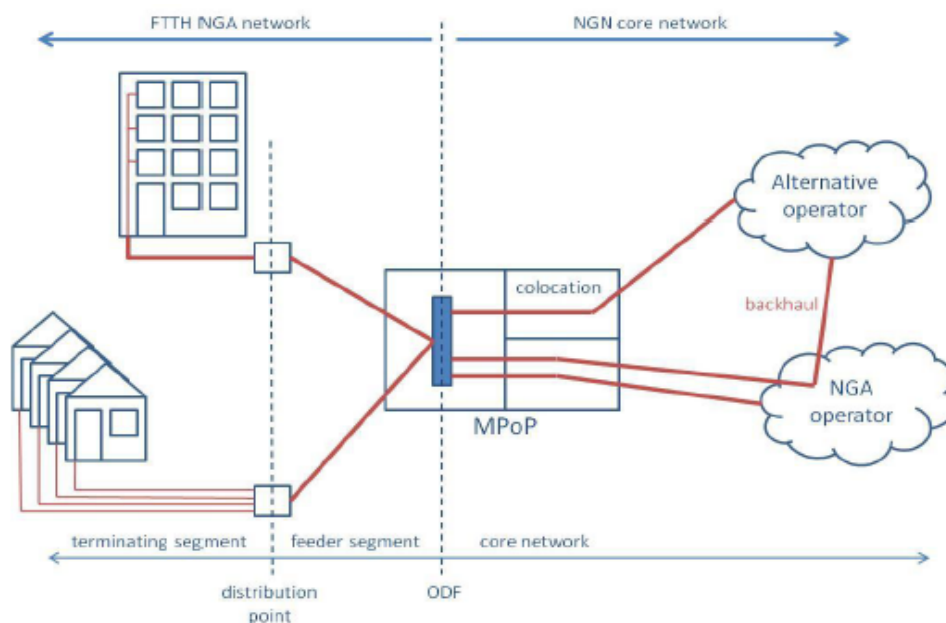
The NGA Recommendation is the result of several public consultations started in September 2008: various drafts were submitted, and different tools were analysed, from the emphasis on access to ducts to foster competition among multiple infrastructures, to the prescription of remedies (both on active and passive layers of the network) designed to govern the competition on services between operators. The aim of this measure is to promote a coherent approach to the rules on access<sup>46</sup> to NGN, with regard of remedies imposed by NRAs on operators qualified as SMP (with significant market power) in markets 4 and 5, as defined in the Recommendation 2007/879/EC above mentioned, in order to avoid distortions in the internal market and promote legal certainty for operators who want to invest in broadband infrastructures, therefore implementing the provisions of Art. 8(2)(c) of Directive 2002/21 ("*encouraging efficient investment in infrastructures*").

The Commission defines a set of terms relating to different parts of FTTH networks are important for the concrete design of the Recommendation:

<sup>46</sup> Focusing on the terminating part of the infrastructure, as backbone networks are already in fiber.



**Figure 13 Network access according the NGA Recommendation.**



Source: Cullen, 2010

- Node Metropolitan (Metropolitan Point of Presence - MPoP) is the point where the access network and the core part of an NGA infrastructure interconnects, equivalent to the main distribution frame (MDF) in copper networks. All connections of NGA subscribers, within a defined area (usually a city or else part of it), are centralized in metropolitan node (MPoP) on an optical distribution frame (Optical Distribution Frame - ODF);
- Point of Distribution is the intermediate node in a NGA network where one or more fibers, starting from the MPoP, are then separated and distributed underground to connect end users' homes (termination segment). Usually they cover more buildings and they can be located at the basement or on the road;
- The termination segment is the portion of the home network that connects end users to the first point of distribution. It includes the vertical segment, the wiring inside the building and possibly the horizontal cabling to an optical splitter located in the basement;
- FTTH or fiber-to-the-house infrastructure is an access network consisting of fiber optic lines and power supply segment to the user, meaning both the final part to the home and to the building;

The Recommendation suggests corrective measures to be imposed on operators who, after the market analysis conducted by the NRA in accordance with Art. 16 of 2002/21/EC, have Significant Market Power (SMP): from the development of next-generation networks emerges differing conditions of competition, stable and substantial, in which there is a tendency towards sub-national geographic markets and therefore there is a need for different remedies depending the area observed<sup>47</sup>. Therefore, it is even more important that NRAs should evaluate carefully these markets, collecting all the necessary information as expected changes in network topology or the availability of conduits, in order to apply appropriate remedies.

<sup>47</sup> considerata n.9 et al.

The staff working paper attached to the Recommendation suggests that NRAs should adopt a regulatory system based on five principles:

- application of the principle of the ladder of investment;
- application of symmetrical obligations about the access to the "bottlenecks" of the network;
- return on investment risks (risk premium);
- taking into account differences in competitive conditions between geographical areas (setting differentiated remedies within a national geographic market);
- Incentives for co-investment initiatives.

SMP operators may, in a specific geographic area, not be subject under any obligation if the regulator finds that there is an adequate level of infrastructure competition, as in the case of development by several co-investors in a multi-fiber FTTH network, after having taken into account the following factors:

- each co-investor has equivalent access and cost-based infrastructure;
- there is effective competition in the market for end-user services;
- third party access is guaranteed at cost oriented prices and there is a sufficient capacity in ducts.

In accordance with Artt. 9 to 13 of Access Directive, below are listed the obligations present in the Recommendation:

- Access obligation:
  - to civil engineering facilities where capacity is available. NRAs needs to encourage or, where it is possible, to oblige SMP operators to install sufficient capacity in civil infrastructures so to facilitate their use by competitors;
  - to the termination segment (including the vertical one) and fiber breakdown (MPoP) in case of FTTH deployment, unless in the area there are alternative infrastructures with competitive offers;
  - to the copper network, where a FTTN (fiber to the point of distribution) is present;
  - to wholesale broadband access (WBA);
- Price-oriented cost (except in the case there is a functional separation of network), risk premium included in the cost of capital in order to reflect the increased risk of an investment<sup>48</sup> in the FTTH network (not in case of FTTN deployment) and obligation on the SMP to provide a reference offer (RO) within six months from the imposition of remedies;
- Adoption of tools to spread the risk of investments, including long-term access pricing (period and volume discounts) may be acceptable if the it apply equally to all access seekers willing to buy at the same conditions, it only reflect the reduction of risk for the investor and, judged over an appropriate timeframe, the test (REO<sup>49</sup>) shows that there is no margin squeeze.

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<sup>48</sup> Annex I provides, as criteria to estimate investment risks, the following factors: uncertainty related to wholesale and retail demand, uncertainty related to cost of deployment, uncertainty related to technological progress, uncertainty related to market dynamics (infrastructure-based competition), uncertainty related to the macroeconomic situation.

<sup>49</sup> Reasonable Efficient Operator

- In the process of migration to fiber, the SMP operator must inform competitors with 5 years' notice before changing points of interconnection.

**Table 9 NGA Recommendation measures.**

Recomm	Mandated access to:	Conditions	Cost-oriented pricing	Risk premium
<b>Market 4 remedies</b>				
§ 13-17	Civil engineering infrastructure	Where duct capacity is available	Yes	No
§ 18- 21	Terminating segment of access network	Where FTTH is deployed	Yes	Yes
§22- 28	Unbundled fiber loop	At MpoP level - where FTTH is deployed. Except in areas where several alternative infrastructures or competitive offers exist.	Yes	Yes
§29- 30	Copper sub-loop	Where FTTN is deployed	Yes	No
<b>Market 5 remedies</b>				
§31- 38	Wholesale broadband access (WBA)	Enabling alternative operators to compete efficiently	Yes. Except where functional separation guarantees equivalence of access.	Only where FTTH is deployed

Source: own elaboration.

### 3.1.5 The European Digital Agenda (EDA) and the BB Communication

The European Digital Agenda (EDA), published in 2010, is a Communication [COM (2010) 245] which defines the main EU policies for ICT, that have to be implemented by 2015, to achieve targets set for 2020. Part of this action is the Broadband (BB) Communication [COM (2010) 472], which describes the EU Commission proposals to facilitate the development of broadband NGN networks in Europe.

The EDA (which replaces the former i2010) is one of seven initiatives proposed in "Europe 2020", the economic strategy for Europe, following the Lisbon Strategy. As also evidenced by the publication of the Digital Competitiveness Report (ECDA), the EU Commission through the Agenda identifies seven priority areas aimed at promoting ICT development:

1. Digital Single Market;
2. Definition of standards and interoperability;
3. Trust and confidence in the Internet world;
4. Ultra-fast network access (more investment);
5. Investment in research and development;
6. Digital Literacy;
7. Using technology to address the challenges facing our society such as the aging population and climate change.

Within the same topic, in the above documents are mentioned the following measures:

- The creation of a digital single market, where the EU Commission assesses the impact of e-commerce Directive (110/2009/EC), and proposes measures on the management of collective rights in order to improve governance, transparency and pan-European licensing;
- According to the EU Commission, devices, applications, services, applications and networks must be interoperable and platform should be open and standards-based. For this reason, the EU Commission will adopt a European Interoperability Strategy;
- In line with Art. 13 (2), (3) of Directive 140/2009/CE, the EU Commission will put forward measures to achieve a strengthened policy in the field of network security (cyber-attacks) and information;
- The EDA established the following objectives for the deployment of broadband NGN:
  - 2013: basic broadband (whose speed is legally undetermined, but it is possible to assume it is around 2Mbps) for all Europeans;
  - 2020: Broadband at above 30 Mbps for all Europeans, ultra-fast speeds exceeding 100 Mbps for 50% of EU households. (BB Communication estimated investments up to 268 billion Euros);
- The financing of high speed NGN broadband networks must be eased by introducing rules to facilitate infrastructure sharing and reduce the risk of setting up new investments. The BB Communication provides the possibility of setting a cooperative framework between the EU Commission and the European Investment Bank (EIB) for the development of additional tools, as funding support for joint investment between public and private partners (PPP);
- With regard to research and innovation, the EU Commission intends to raise more private investment using structural funds for research and innovation and increasing the budget for R&D, promoting the development of applications and services;

### **3.1.6 Recommendation on costing methodologies and non-discrimination (2013/466/EU<sup>50</sup>)**

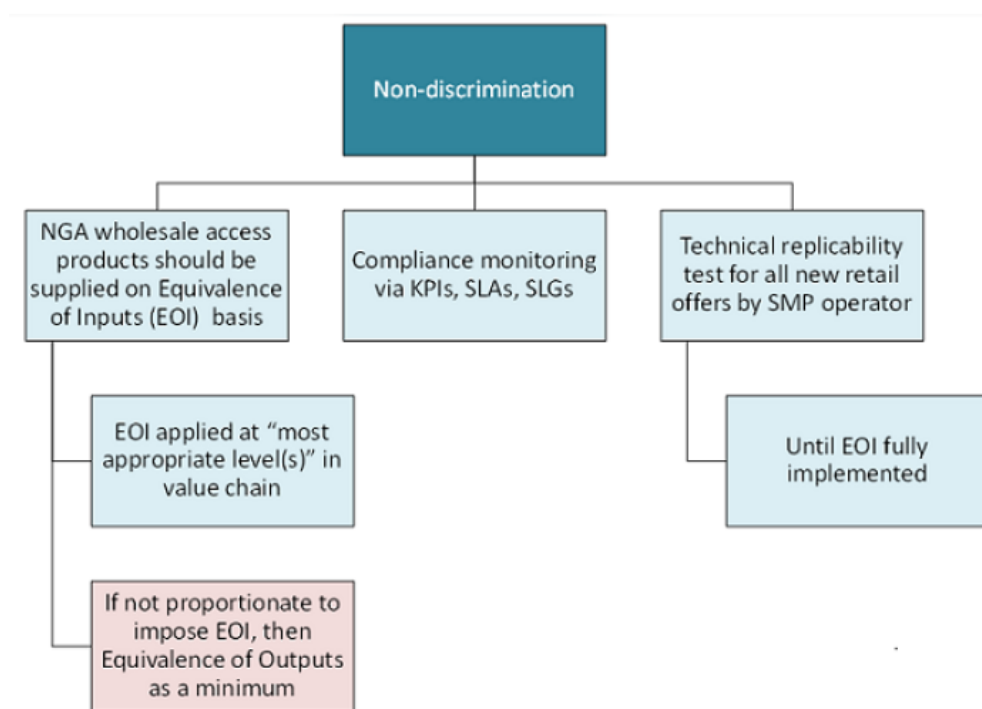
The recommendation is a follow-up to the Commission recommendation on *Regulated access to NGA networks* of September 2010. The 2010 NGA recommendation had suggested an approach where NRAs should impose on SMP operators all possible types of network access (both passive and active) and should set cost-oriented prices. However, the NGA recommendation has been widely ignored by NRAs, which have taken a variety of approaches to the types of obligations imposed for NGA access and in terms of the pricing obligations.

Elaborating on the NGA recommendation, it provides further guidance on the conditions under which non-discrimination (see Art. 10 of Access Directive) should be imposed.

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<sup>50</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:251:0013:0032:EN:PDF>

Figure 14 Non-discrimination measures.



Source: own elaboration

The recommendation covers both “*legacy and NGA networks in so far as they allow for the provision of broadband services*” and is applicable to the wholesale markets (at the time it was still in charge Recommendation 2007/879/EC) for physical network infrastructure access (market 4/2007) and wholesale broadband access (market 5/2007):

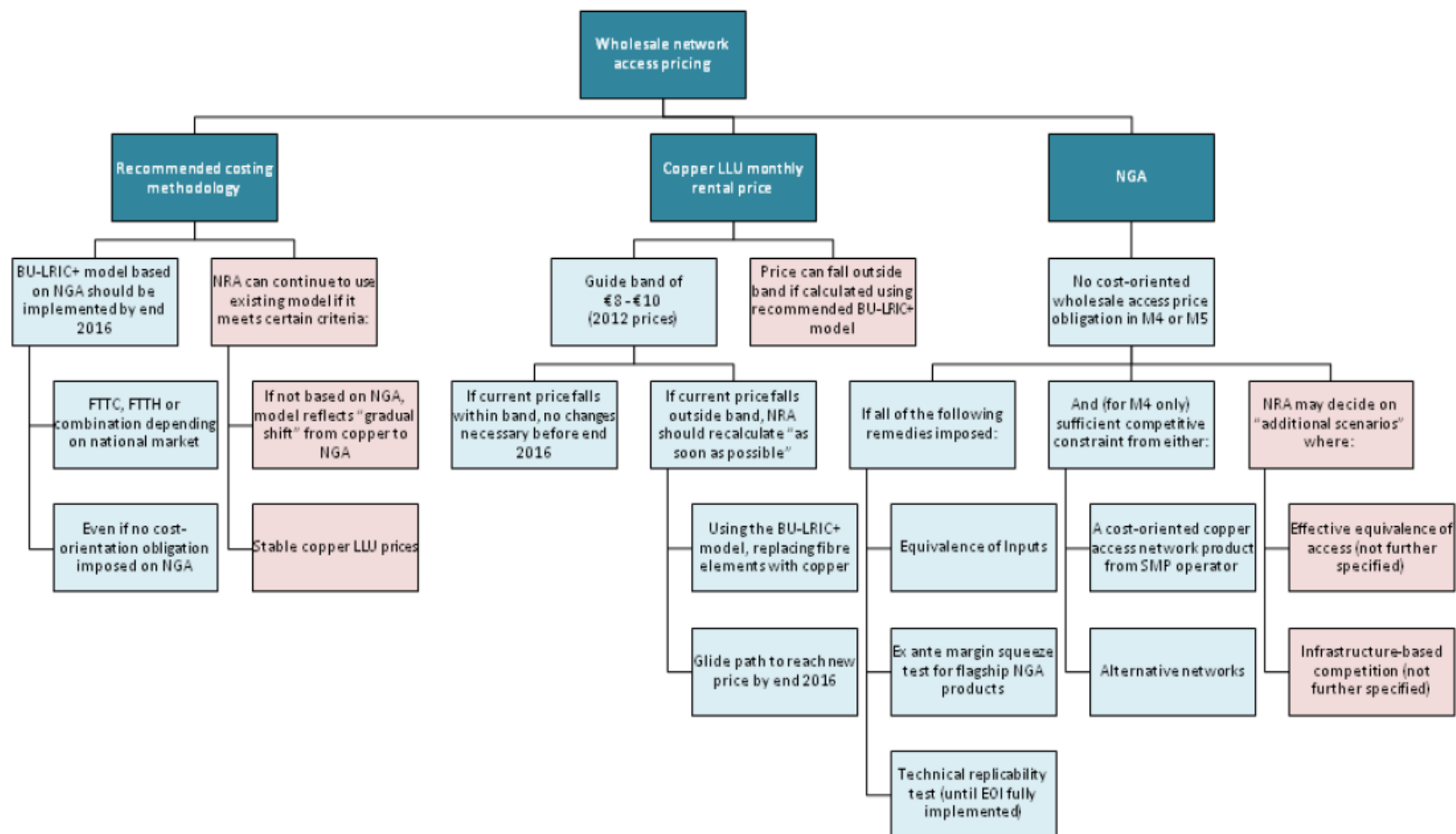
- On wholesale access pricing (Art. 13 of Access Directive) for NGA, it recommends a cost-oriented bottom-up BU LRIC+<sup>51</sup> model based on current replacement costs of hypothetical efficient NGA network (with a different valuation<sup>52</sup> for reusable civil engineering), and with cost adjustments for copper network elements (§30-37);
- No cost-oriented wholesale access price must be imposed (§40) in cases where:
  - the current network model represent a gradual shift from copper to NGA;
  - it applies a methodology for asset valuation that consider certain civil engineering elements not replicable in the competitive process;
  - LLU wholesale copper prices are predicted stable;
- Copper LLU wholesale prices should, according the EU Commission, fall within a band of 8-10 Euro/month: if not, NRA should recalculate the model with the one recommended (except in the case such price is the outcome of a BU LRIC+ model already implemented), replacing fiber elements with copper (§41-43);
- About NGA, there is no obligation to impose cost-oriented wholesale access prices (§48-49) on markets 4 and 5 (with the exception of civil engineering access elements) if, provided that take-up of passive wholesale inputs create price constrain in the retail market, the following cumulative remedies are present:

<sup>51</sup> bottom-up long run incremental cost plus

<sup>52</sup> current costs, taking account of the infrastructure life and costs already recovered

- Equivalence of inputs (equivalent access to NGA wholesale products for both competitors and for the incumbent's retail business) is ensured;
- Ex-ante margin squeeze test is imposed;
- Technical and economic replicability test both on active and passive wholesale NGA products is imposed;
- Only for market 4, NRAs need to show that there is a price constraint by two additional conditions:
  - copper network of the SMP is subject to a cost oriented methodology;
  - alternative operators/infrastructure competition on the retail market.

Figure 15 Scheme of costing methodology measures.



Source: own elaboration

Tesi di dottorato "Incentives for the development of NGN broadband infrastructures: an analysis of EU policies"  
di SCORCA LUIGI

discussa presso Università Commerciale Luigi Bocconi-Milano nell'anno 2016

La tesi è tutelata dalla normativa sul diritto d'autore (Legge 22 aprile 1941, n.633 e successive integrazioni e modifiche).

Sono comunque fatti salvi i diritti dell'università Commerciale Luigi Bocconi di riproduzione per scopi di ricerca e didattici, con citazione della fonte.

### 3.1.7 Legal framework of European State aids on Broadband

The objective of the EU legislation on State Aids for the development of Broadband is to guarantee that such subsidies do not substitute market initiative, they bring to better results compared to a situation where aids are absent as well as positive effects deriving from public intervention are superior to negative ones in terms of distortion of competition.

In order to make sure that the objectives derived from granting a State Aid do not collide with common market principles, the TFEU provides a legal framework under the provision of Art. 107. Art. 107(1) TFEU contains the definition of state aid establishing a general prohibition: *“Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the common market.”* Article 107(3) TFEU, instead, provides then the Commission certain discretion to assess and authorize state aids, which are compatible with the common market.

Therefore, only measures satisfying all the cumulative criteria set by Art. 107(1) TFEU:

- use of State resources;
- the aid must confer an advantage to the beneficiary;
- favor certain undertakings, i.e. it is selective;
- the aid must have an effect on trade between Member States;
- and it must distort or threaten to distort competition;

constitute a State Aid and are then subject to supranational (EU Commission) control.

#### Analysis of 2013 Guidelines

Due to the sector specificity, the EU Commission, in order to increase stakeholders' regulatory certainty, delivered the Communication *“Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks”* (2013/C 25/01), updating the 2009 version.

For the evaluation of measures, the Guidelines distinguish between broadband and NGA infrastructures, clustering the intervention areas into three parts:

- **white** areas (basic and NGA) – territories where broadband infrastructures do not exist and they will not be deployed in the medium term (3 years);
- **grey** areas (basic and NGA) – territories where there is one broadband infrastructure in operation or, in the case of NGA networks, areas where a company will develop the facility before 3 years<sup>53</sup>;
- **black** areas (basic and NGA) – territories where there are two (or more) operators providing broadband services with their own infrastructures.

Having present the discipline for state aids (Article 107 (1) TFEU), the case law indicates some criteria by which the public investor can take action:

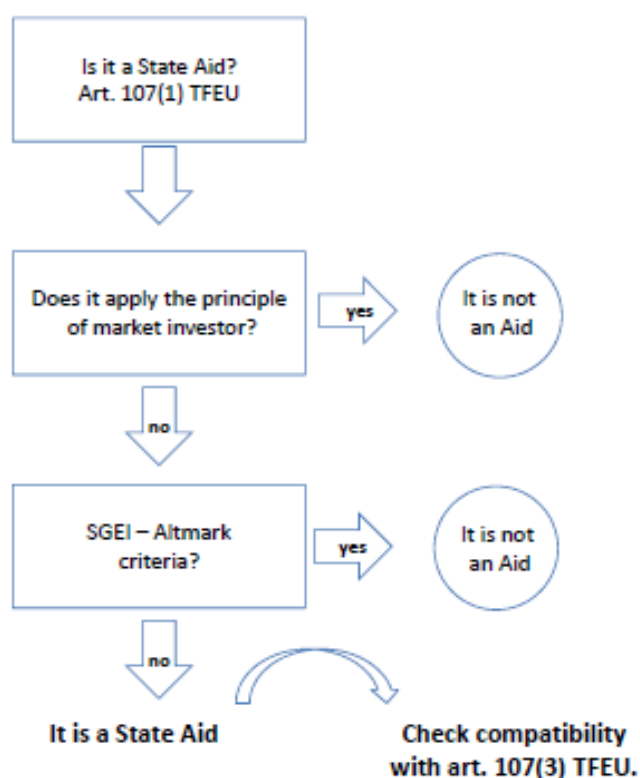
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<sup>53</sup> (§63, 2013/C 25/01);



- One of these is the "market investor principle"<sup>54</sup> (MEIP), in the case of broadband, in the decision C53/2006 Citynet Amsterdam (See Box 1 below, at the end of the paragraph). The document stress, in par. 2.2<sup>55</sup> that “[..] conformity of a public investment with market terms has to be demonstrated thoroughly and comprehensively, either by means of a significant participation of private investors or the existence of a sound business plan showing an adequate return on investment. Where private investors take part in the project, it is a sine qua non condition that they would have to assume the commercial risk linked to the investment under the same terms and conditions as the public investor. This also applies to other forms of State supports such as soft loans or guarantees;
- Article 107 (1) TFEU does not apply if the “Altmark<sup>56</sup> criteria” are met or else the project is a SGEI<sup>57</sup>;

**Figure 16 Procedure for assessing the compatibility with Article 107.1 TFEU.**



Source: own elaboration

<sup>54</sup> The assumption underlying the principle is that the business conduct of a State must be conformed to the one of a private contractor, which is in line based on the principle of achieving a profit.

<sup>55</sup> (§17, 2013/C 25/01);

<sup>56</sup> Case C-280/00, *Altmark Trans GmbH e Altmark Trans GmbH e Regierungspräsidium Magdeburg / Nahverkehrsgesellschaft Altmark GmbH*, Racc. 2003, pag. I-7747.

<sup>57</sup> Services of General Economic Interest, as under Art. 106(2) of TFEU;

### A. Balancing test

If it is established that a measure constitutes State Aid under Art. 107 (1) TFEU, the Commission assesses the compatibility directly in accordance with Article 107, paragraph 3, letter c). "[...] *the Commission ensures that the positive impact of the aid measure in reaching an objective of common interest* <sup>58</sup> *outweighs its potential negative side effects, such as distortions of trade and competition. This exercise is conducted in two steps. [(balancing test)]:*<sup>59</sup>"

*"[...] every aid measure has to comply with the below necessary conditions. Failure to comply with one of the following conditions will result in declaring the aid incompatible with the internal market.*

- 1. Contribution to the achievement of objectives of common interest*
- 2. Absence of market delivery due to market failures or important inequalities*
- 3. Appropriateness of State aid as a policy instrument*
- 4. Existence of incentive effect*
- 5. Aid limited to the minimum necessary*
- 6. Limited negative effects*
- 7. Transparency*<sup>60</sup>"

*"[...] if all necessary conditions are met, the Commission balances the positive effects of the aid measure in reaching an objective of common interest against the potential negative effects."*<sup>61</sup>

The Commission then approves measures whose positive effects outcome, in total, negative ones.

### B. Compatibility test

If intervention in black areas is deemed per-se damaging, it is necessary to undervalue the proportionality of measures notified that are under "white" or "grey" areas. For this reason the Commission has identified a number of conditions to minimize distortions deriving from State Aids [(**compatibility test**)<sup>62</sup>]:

- a) Detailed mapping (by a public consultation) and detailed analysis of broadband coverage;
- b) Call for tender by an open procedure;
- c) Criteria to choose the most economically advantageous offer coming from operators concurring for the subsidy<sup>63</sup>;
- d) Technological neutrality;
- e) Use of existing infrastructure (operators that intend to participate to the competition must provide information related to the presence of own infrastructures in the area considered);

<sup>58</sup> As the deployment of a new infrastructure that otherwise would not be built, or else that bring price reduction on services, wider choice for consumers, new investments on capacity (from basic broadband to NGA, the so called "step change") or better quality and innovative services.

<sup>59</sup> (§32, 2013/C 25/01);

<sup>60</sup> (§33, 2013/C 25/01);

<sup>61</sup> (§34, 2013/C 25/01);

<sup>62</sup> (§78, 2013/C 25/01);

<sup>63</sup> Pertinent criteria are geographic coverage, sustainability of technological option and incidence of proposed solution over competition. With two offers having same conditions, it has to be preferred the one requesting less amount of subsidies.

- f) Open and non-discriminatory wholesale access (at least 7 years, on the whole subsidized infrastructure);
- g) Benchmarking wholesale prices;
- h) Recovery mechanism to prevent excessive compensation (claw back);
- j) Transparency mechanism (regarding information on facilities present in the area);
- k) Reporting with information on measures implemented.

Compared to the 2009 document, the new version has added the following features:

### C. Conditions for grey areas

Grey areas might benefit of public intervention, in respect of compatibility conditions described above, only when it is assessed that *"affordable or adequate services are offered to satisfy the needs of citizens or business users and that there are no less distortive measures available (including ex ante regulation) to reach the same goals"*<sup>64</sup>

In this regards, the Commission evaluate if those grey areas satisfy the following admissibility criteria, in order to assess such territories with the compatibility test already described:

- *"the overall market conditions are not adequate, by looking, inter alia, into the level of current broadband prices, the type of services offered to end-users (residential and business users) and the conditions attached thereto;*
- *in the absence of ex ante regulation imposed by an NRA, effective network access is not offered to third parties or access conditions are not conducive to effective competition;*
- *overall entry barriers preclude the potential entry of other electronic communication operators; and*
- *any measures taken or remedies imposed by the competent national regulatory or competition authority with regard to the existing network provider have not been able to overcome such problems.*"<sup>65</sup>

### D. Conditions for NGA infrastructures

The new Guidelines distinguish in a more precise way between basic and NGA broadband<sup>66</sup>, envisaging additional conditions (to the balancing and compatibility tests already mentioned) for the development of NGA networks (§61 and 80 stress on the *"positive characteristics of projects for the financing of backhauling or limited to civil works open for access to all operators"*):

- Wholesale access, for at least 7 years: *"[...] third-party operators must have access to passive and not only active network infrastructure. Apart from bitstream access and unbundled access to the local loop and sub-loop, the access obligation should therefore also include the right to use ducts and poles, dark fibre or street cabinet"*<sup>67</sup>;
- Fair and non-discriminatory treatment.

### E. The "step change" for NGA networks and NGA black areas

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<sup>64</sup> (§69, 2013/C 25/01);

<sup>65</sup> (§70, 2013/C 25/01);

<sup>66</sup> (section 3.5 and 3.6)

<sup>67</sup> (§80a, 2013/C 25/01);

The new NGA infrastructure might be subsidized, even in NGA black areas, if it shows that brings a clear "step change"<sup>68</sup> on the basis of the following cumulative criteria (§83-84):

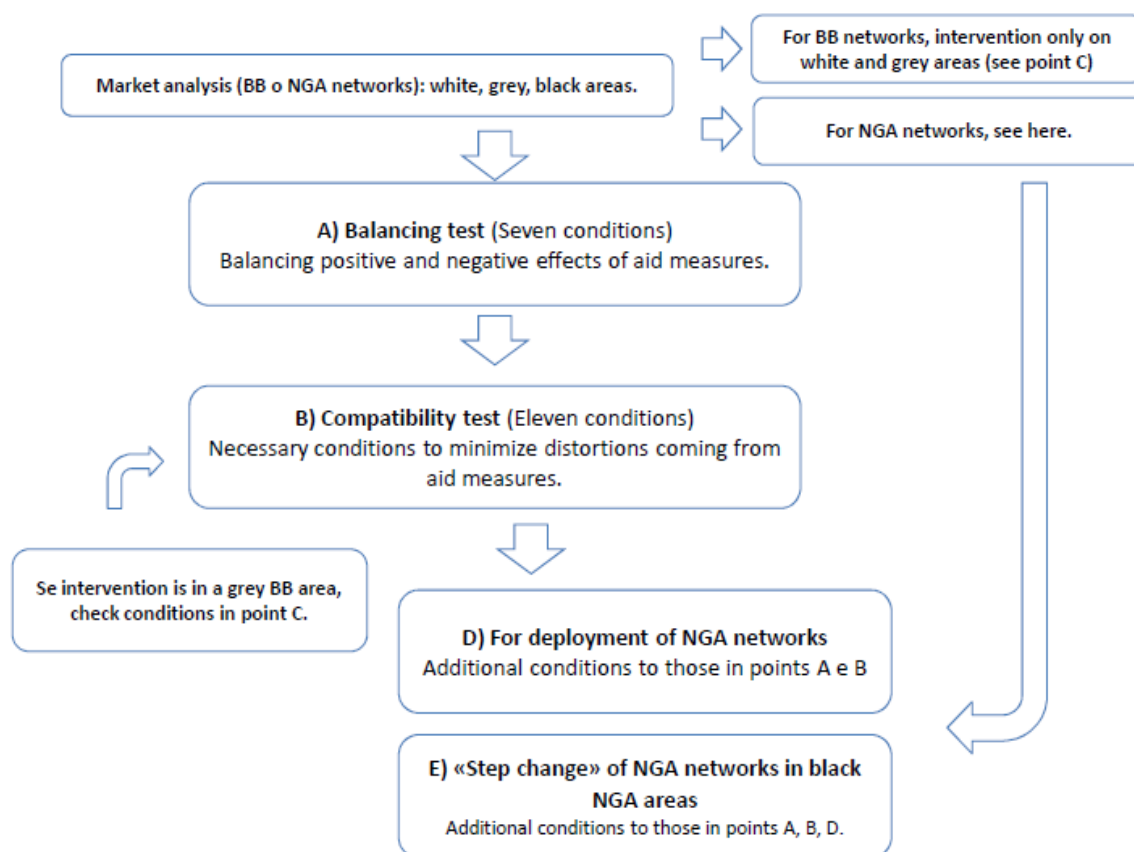
- Forecasted or already existing NGA networks do not reach final users;
- Market does not evolve towards a competitive arena for the provision of ultra-broadband services;

*"(a) the subsidized network exhibits significant enhanced technological characteristics and performance compared to [...] performance of existing or planned networks; and (b) the [...] network will be based on an open architecture operated as a wholesale only network; and*

*(c) the aid does not lead to an excessive distortion of competition with other NGA technologies [...] by market operators in the same target area"*

Only if those additional conditions are met, the public subsidy might be considered compatible on the basis of the balancing test.

**Figure 17 Procedure for assessing the compatibility with Article 107.3 TFEU.**



Source: own elaboration.

<sup>68</sup> (§51, 2013/C 25/01);

#### Box 1 - Citynet Amsterdam

Amsterdam's fibre network, CityNet, is owned by a consortium with the municipality and private investors through ownership of *Glasvezelnet Amsterdam* (GNA). The project to build a municipal fibre network, CityNet, started in 2004, when the municipality decided to create a PPP to invest in the passive infrastructure. In 2008, Reggefibre (the largest communications operator providing fiber based services in the Netherlands) purchased the private stakes in GNA, leaving the municipality with a 30% share of the consortium.

CityNet passive infrastructure is a point-to-point architecture with Ethernet networks up to the premises, competing with the cable operator UPC and its Docsis 3.0 network. At the active infrastructure layer, it is designed to facilitate competition by the architecture topology, enabling the unbundling of the local loop and collocation of various operators. The services available depend, instead, on the communications operator responsible for capacity services on the network, usually double and triple play packages, with a combination of broadband connection as well as services such as VoIP, TV and online backup.

CityNet was successful in achieving the coverage, even if take-up of the services remains low (in part due to competition from cable services). The maximum speed available to household is up to 200 Mbps symmetric connections.

The project was a case for municipality holding a significant financial stake in the deployment of fiber infrastructures. The municipal involvement in the project was challenged in court twice by UPC under State Aid regulations. In December 2007, the EU Commission ruled that the investment was not State Aid, and the municipality was permitted to invest in the network provided that substantial private investment was made at the same time and on the same terms (cd. "*market investor principle*" - MEIP).

### 3.1.8 Directive on reduction of broadband deployment costs (2014/61/EC).

The EU Commission has issued a directive (to be implemented from Member States by 2016) with the scope to reduce capital expenditure for operators deploying NGA. The legislation defines that in any EU country a Single Information Point (SIP) and a Dispute Resolution Body (DSB) should be appointed and it is based on 4 pillars:

- Transparency and access to existing physical infrastructure: any network operator (utilities) has the duty (without prejudice to the property) to offer access to its physical infrastructure for the deployment of NGA upon reasonable request and under fair terms and conditions, including price. Reasons to refuse access must be transparent, proportionate and objective, f.e.g. technical suitability, safety, security, availability of space. Besides that, both network operators and public bodies must provide, on request and via SIP, information on both the location and type of existing facilities;
- Coordination and transparency of planned civil works: network operators must negotiate coordination of civil works with telecom providers, and they are obliged to

meet reasonable requests if those works are financed by public means (and provided that additional costs are covered by the applicant). Planning must be public 6 months in advance and the following information (unless of security reasons) must be available: location, type, network elements, starting date, duration, contact point;

- Permit granting: procedures for granting permits to undertake civil works must be available through a Single Information Point and an assessment must be taken within 4 months;
- In-building infrastructures: all new buildings must be equipped with physical infrastructures, and providers have the right to access them under fair and non-discriminatory terms and conditions, including price.

### 3.1.9 EU funding: CEF and project bonds

The strategy implemented by the EU Commission about funding and promotion of NGN infrastructures has two pillars:

- The Connecting Europe Facility (CEF – Regulation 1316/2013 and Regulation 283/2014 for the guidelines for telecoms infrastructures);
- The Regulation on Project Bonds.

CEF funds a total of €3.24bn of investments in infrastructure for the 2014-2020 period. However, only €1.14bn (3.5% of the total) is dedicated to NGN projects: the funding takes the form of equity, guarantees, debt instruments and grants to complement investments by private parties and public authorities at local, regional, national and EU level.

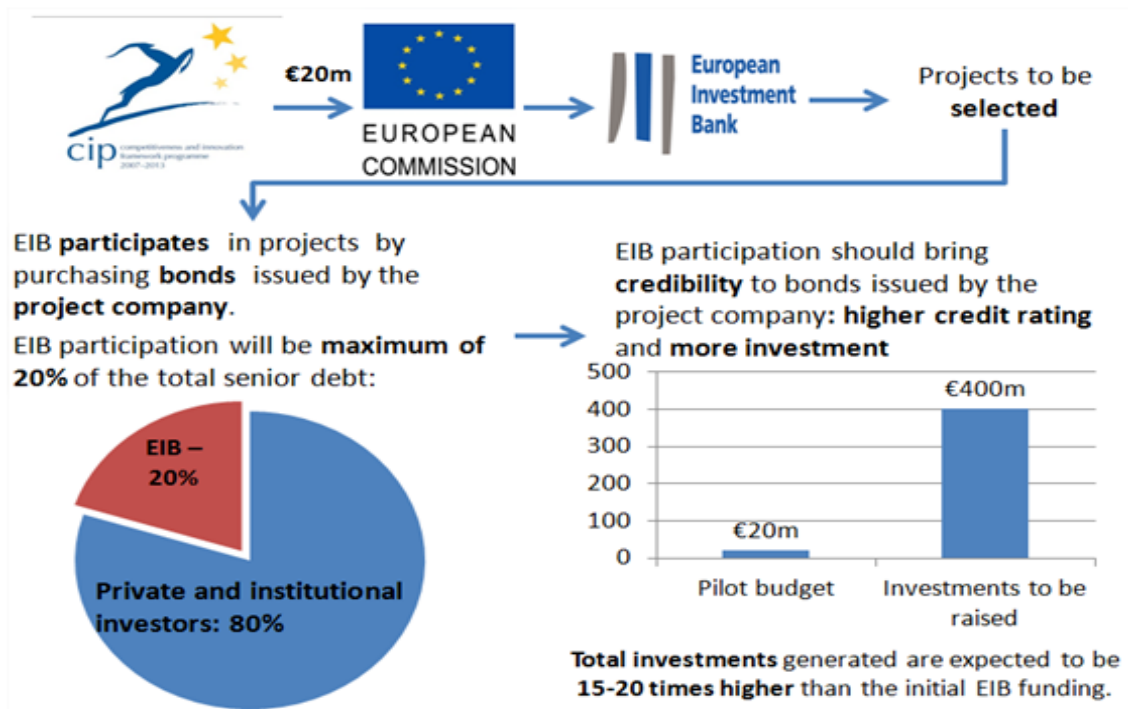
The Regulation lays down the criteria to select a few "projects of common interest", the legal basis for this measure is in Art. 172 of TFEU and the scope is to fund trans-European projects regarding digital public services and promote private investments for the deployment of physical infrastructures, through financial instruments.

Broadband NGN networks receive the minimum funding required for "*cost-effective interventions*", the amount being set at 15% of the budget for telecoms (€71mE). At least one third of the broadband projects receiving financial support shall aim at speeds above 100 Mbps. This contribution is intended to attract investment from the private sector and from other public authorities at local, regional, national and European level (from the EIB). The percentage of broadband funding and the share of high-speed broadband projects may be revised following the regulation's mid-term evaluation. The main part of the funding (€70mE) goes to digital service infrastructures, and more specifically to so-called 'building blocks', a newly introduced concept referring to "*reusable digital service infrastructures*" which provide essential elements for the delivery of digital services.

#### Project Bonds pilot

The Regulation enables a project bond pilot to be implemented. It released 230m of Euro, of which €20m for ICT projects for 2012-2013, it prepared the operational phase and tested the reactions of the financial markets to the new instrument.

Figure 18 EU Project bonds.



Source: Cullen, 2015.

On July 23, 2014, the EU Commission and the European Investment Bank (EIB) announced that the first project bond for digital infrastructure will benefit the French holding Axione Infrastructures. The French group will issue a bond of €189.1m, to which the EIB contributed with a guarantee of 20% in order to make the investment more attractive. The project will provide NGAN broadband services (xDSL, fibre optics, FTTx and some minor investments in wireless access technologies) in sparsely populated French areas, and contribute to the France superfast broadband plan (*France Très Haut Débit*) for 2020.

### 3.2 Summary and consideration over the EU regulation on NGN.

EU regulation on the development of broadband NGA infrastructures has been built up on the same framework that was in place for the opening of electronic communication market to competition: the specific legislative adopted by the EU Commission, in fact, still refer to the assessment of an operator (the SMP) on which specific obligations would be imposed.

In this circumstance, the case is quite different: there is no yet an infrastructure to be opened to competitors and, as investments in NGAN are limited, regulation needs first to incentive operators to commit into the deployment of network elements before obliging them to provide access to competitors. The EU legislation seems to have recognized the necessity to tackle the issue with a different sensibility by 2010, with the publication of both the EDA and the BB Communication, followed then by the NGA Recommendation.

Through this latter measure (Recommendations are not directly applicable nor enforceable) were identified some network elements to which competitors should have had access as well as the cost-oriented pricing for it, with specific mention to risk premium for FTTH networks and to long terms (both volume and period) discounts: these measures, in the EU Commission view, by defining some obligations on SMP, should have had the scope to reduce regulatory uncertainty as well as to ensure access to competitors whilst providing an economic incentive to those deploying the new infrastructure (by risk premium only on FTTH), but it failed both because the implementation by Member States was scattered and also it did not provide a real and tangible incentive for the deployment of fiber networks.

The Recommendation on costing methodologies and non-discrimination (2013/466/EU) is a follow up of the NGA Recommendation and it has been published only in 2013: even if the use of a cost-oriented price model was reaffirmed, different exemptions have been mentioned on NGAN elements (in case of a shift from copper to NGAN, Equivalence of Input (EoI) is ensured, margin squeeze and replicability test are imposed) as well as an indication on copper LLU price that was higher than the EU average. Such measures have, in the EU Commission view, the scope both to reduce uncertainty for operators as well as to provide an incentive to invest in fiber network elements: an improvement but most of its effectiveness will depend on how it will be implemented at national level.

State Aids Guidelines, published in 2009 and then revised in 2013, made finally more clear (both to policy maker and operators) modalities by which a potential public intervention for the deployment of broadband NGN infrastructures might not be considered distortive of market competition: by both geographically segmenting areas and imposing obligations on financed elements, they provide to public authorities a framework to invest in market failure areas and to ensure access to competitors. By the 2009 version only digital divide projects (active equipment and backhauling) were funded but additional provisions for NGAN, present in the 2013 version, are improving conditions for the financing of upgraded infrastructures, even in areas where some connectivity is already present.

The Directive on reduction of broadband deployment costs is an interesting exercise whose purpose is both ensure access to passive infrastructure and to reduce deployment costs for operators, it has been published only in 2014 and its effectiveness can be measured only together with other measures. Same considerations are taken with the implementation of the CEF: even if these funds relax the financing of NGN broadband infrastructures, the amount is negligible to have any impact and it seems more like a sort of theoretical exercise undertaken by the EU Commission.

The opening up of electronic communication markets (Recommendation 2014/710/EU), with the compression of both markets and network elements essential for a competitive market and thus subordinated to regulation, underlines on the infrastructure "bottleneck" that according the EU policy makers must be available to competitors: physical and virtual local access (market 3a) as well as central and virtual access (market 3b) to electronic communication products. Even in this case, the implementation at national level might result with a different degree of effectiveness, according to the analysis undertaken by NRAs and the modalities by which national specific market conditions are tackled.



In conclusion, legislative acts has been keen to reduce deployment costs and define a wholesale market that would provide - in the EU Commission view - some incentive to invest, but markets are still defined at national level and the burden of obligations has been put mainly on incumbents: in fact, the SMP that would invest on NGAN would be obliged to let competitors use the infrastructure that, in turn, would pay (with a premium for risks undertaken by the SMP) only the part in which it is interested, while the one investing would still face the risk of the venture, without less stringent remedies (as geographic segmentation) that would incentive to invest in areas less interesting under economic terms. In concrete, it is not foreseen that the EU legislation presented pointed to provide real incentives to operators in order to invest in FTTH networks (which were the object of the NGA Recommendation), and the only indirect price incentive in order to foster the deployment of fiber elements seems given by setting of higher copper LLU prices (see 2013/466/EU). In fact, the new State Aids Guidelines allow the possibility to use of public funds in NGA, and this have an indirect impact on private investments, as according to the projects implemented operators might need to complement it with own funds or else private investments can be foreseen by operators as a consequence of potential public measures.

Last point is about the nature of acts proposed and the procedure to implement them: the EU Commission, in fact, to tackle this issue chose to publish non-binding legislative acts which might provide flexibility to NRAs in order to tackle national specificities, but on the other side it makes even longer the procedure to create and implement necessary measures (between 3 and 5 years), with the risk that might at the end result out-of-date.

**Table 10 Summary of EU regulation and factors addressed.**

Legislative act	Policy measure		Outcomes of measure	Factors addressed	
NGA Recommendation	Mandated access to	Existing civil infrastructures	cost oriented pricing	Obligation to provide access to competitors	Risk reduction: deployment costs (for access seeker), wholesale market (for provider)
		terminating segment of access network	cost-oriented pricing + risk premium		Risk reduction: deployment costs (for access seeker and provider), wholesale market (for provider)
		unbundled fiber loop (with FTTH networks)	cost-oriented pricing + risk premium		Risk reduction: deployment costs (for access seeker), wholesale market (for provider)
		copper subloop (FTTN networks)	cost oriented pricing		Risk reduction: deployment costs (for access seeker and provider), wholesale market (for provider)
		WBA	cost-oriented pricing + risk premium on FTTH networks		Risk reduction: deployment costs (for access seeker), wholesale market (for provider)
		lower/no risk premium for FTTN		Risk reduction: deployment costs (for access seeker), wholesale market (for provider)	

		Obligation to price oriented cost and + risk premium in case of FTTH networks for FTTN same risk as copper networks	Price obligation, corollary of access	Regulatory uncertainty. Risk reduction: deployment costs (for access seeker and provider), wholesale market (for provider) Regulatory uncertainty
		Long term access pricing (period and volume discounts) are permitted	Operators have the incentive to promote long-term deals for infrastructure access	Risk reduction: wholesale market (for provider). Regulatory uncertainty.
Rec on costing methodologies		NGA wholesale access products Equivalence of Inputs (Eol) basis	Equivalent access to competitors	Regulatory uncertainty
		NGA wholesale access pricing BU LRIC + with cost adjustments for copper networks elements	Price obligation, corollary of access	Regulatory uncertainty. Risk reduction: deployment costs (for access seeker and provider), wholesale market (for provider)
		No BU LRIC + if gradual shift to NGA civil engineering elements are deemed as non-replicable LLU prices are considered stable		Risk reduction: wholesale market (for provider)
		Copper LLU prices should fall within a band of 8-10Euro/month If not, BU LRIC+ on copper elements		
		On NGA, no BU LRIC+ if Market 4-5 Additional conditions on market 4 Eol Ex ante margin squeeze Technical and economic replicability test on NGA wholesale products copper network of SMP is under cost-oriented methodology infrastructure competition in the retail market		
	BB Communication and EDA Broadband targets (by 2020) 30Mbps to all 100Mbps for 50% EU households			
	Cooperative framework with EIB for PPP Connecting Europe Facility (CEF) - 1,2bln Euro			

State Aids Guidelines	Procedure to allow public subsidy in areas with market failure (white and grey) as long as conditions are met.	Possible different types of public intervention: direct intervention/management of the network, PPP, subsidy.	Incentive to deploy infrastructures in rural/remote areas	Risk reduction: deployment costs, wholesale market, financing.
		In black areas also possible, as long as there is a "step change"		
		Obligation: open and non-discriminatory wholesale access for at least 7 years Wholesale prices decided by NRAs Clawback mechanism	Obligation to provide access to competitors	
Directive on reduction of broadband costs	Any network operator (utilities) has the duty to offer access to its physical infrastructure for the deployment of NGA upon reasonable request and under fair terms and conditions, including price  Network operators must negotiate coordination of civil works with telecom providers, and they are obliged to meet reasonable requests if those works are financed by public means (and provided that additional costs are covered by the applicant)		Access to physical infrastructure to telco operators	Risk reduction: deployment costs
CEF	171 mInE for BB networks 20mInE for pilot bonds		Funds for network deployments	Financing

Source: own elaboration.

## 4 Benchmark and assessment of national policies in the EU for the development of NGN infrastructures.

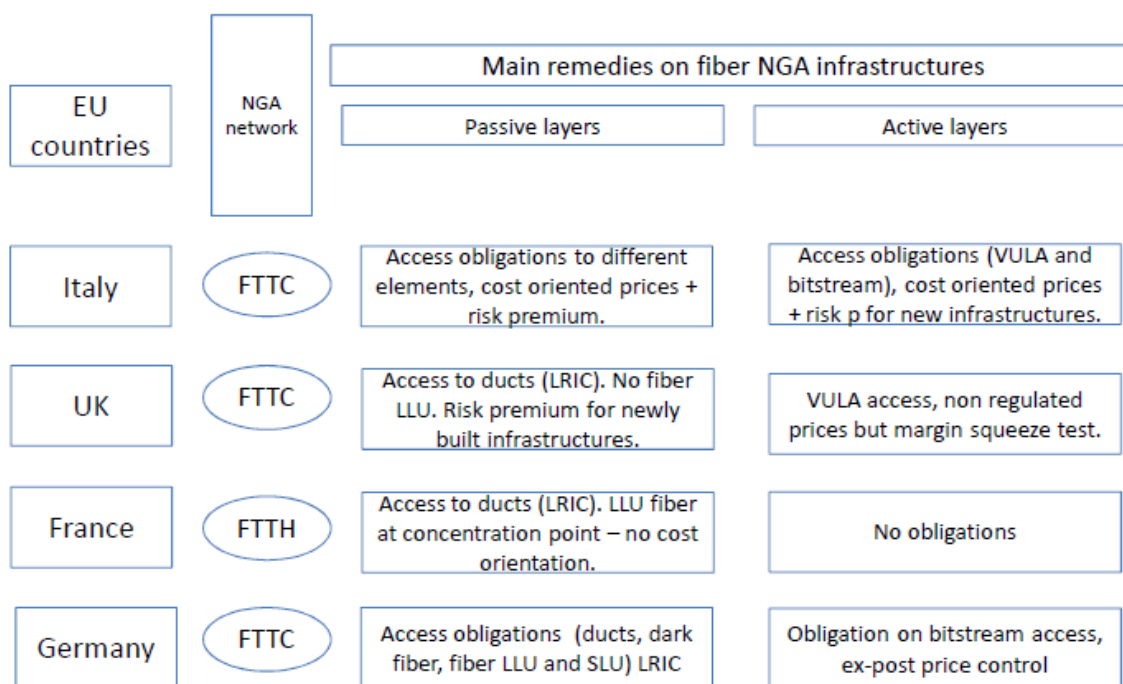
In this Chapter it is developed a benchmark of national policies in some EU countries for the development of NGAN: Korea has been taken as a model for a wide coverage but other best practices are available as well. European countries, accordingly with the policies fostered by the EU Commission, have adopted important rules on the development of NGN.

It is presented the most recent regulation: as new markets were decided by the EU in 2014<sup>69</sup>, with the exception of Italy (where the market analysis was published in 2015), in all the other countries considered it is still applied the 2007<sup>70</sup> review.

National legislation differs according to operators' deployment strategy and targets foreseen by NRAs:

- France has an approach based on setting competitive conditions to build up more proprietary infrastructures (so called infrastructure-based competition);
- UK, Italy and Germany instead, in different modalities, implement remedies with the scope to ensure competition between services (so called service-based competition).

**Figure 19 EU Main remedies on fiber NGA infrastructures in selected EU countries.**



Source: own elaboration

<sup>69</sup> 2014/710/EU

<sup>70</sup> 2007/879/EC

#### 4.1 FTTC case of UK and OFCOM regulatory approach

In 2009 the UK Government intended to finance the deployment of a FTTN network by a tax on fixed lines called “Next Generation Fund”. It followed the announcement of BT to invest 1,5 bln £ to cover with NGN 10 millions of households, in a market where cable technology is present and Virgin Media aimed to deploy DOCSIS 3.0 to 9 millions of households, with an investment of £ 700 mln (cable covers around 50% of population in main cities).

The new Government modified this strategy: if the service-based competition approach was unchanged (see OFCOM regulatory strategy), stakeholders’ targets were the following:

- BT: FTTC Ethernet + FTTP in pilot areas, to reach 66% of population by 2014 (with an investment of £ 2,5 bln). The operator believed that FTTC technology was a step towards the deployment of FTTH and, according its analysis, it will return its own investment in a 12-14 years timeframe. On a total of 85000 cabinets, at that moment BT offered FTTC services on 20000, for 11 mln of families;
- UK Government: with an investment of £ 530 mln, BDUK (Broadband Delivery UK) programme is a notification for State Aids to the EU Commission<sup>71</sup>: by this project, it is meant to cover around 24% of population, mainly in “grey” areas (according to the definition present into the State Aids Guidelines), through tenders financed 50% by Councils (which, in turn, will finance them with EU funds on rural development). 10% more of total population will be covered, instead, using a mix of mobile technologies.

It is important to remind that, in UK, network infrastructure is functionally separated from the wholesale unit of BT (and currently OFCOM is debating about the possibility to fully separate the ownership of the network): in the BT undertaking obligations<sup>72</sup> there is an obligation to provide the so called “*Equivalence of input*” – EoI (covering then all elements, price and non-price, of services offered to competitors).

BDUK is a framework notification (SA 33671 - 2012/N) approved by the EU Commission in 2012 with the aim to coordinate broadband local initiatives in UK that, at moment, are around 50<sup>73</sup>. A similar notification was presented from Italy<sup>74</sup>, and approved in December 2012. The target of such initiative is the diffusion of NGN technologies in the so called “market failure” areas, “white” ones both for broadband and NGA and “grey” ones for broadband<sup>75</sup>, defined following a public consultation with operators. The notified programme creates a centre of competence for the support of local initiatives (which might be undertaken both from local entities or cooperatives) and a main support modality (“*investment gap funding*”), but it leaves some flexibility on intervention's modalities that might be undertaken: in many cases local authorities will assign to an operator a subsidy (direct incentive) in order to build, operate and commercialize the new broadband NGN infrastructure.

In case local authorities would like to operate directly into the market, it is specified that such intervention must be limited to market failure areas. It is forecasted that subsidy intensity

<sup>71</sup> SA33671 (N/2012)

<sup>72</sup> As Art. 9 in Regulation 1/2003.

<sup>73</sup> <https://maps.google.co.uk/maps/ms?msid=202405357373084260711.0004c0a24c8574593fb79&mssa=0&ll=53.709714,-2.768555&spn=7.417298,14.0625>

<sup>74</sup> Progetto BUL MISE SA34199 – 2012/N

<sup>75</sup> According the definition in Guidelines 2013/C 25/01

would be, on average, about 2/3 of the total project (BDUK and the part on local promoters) but it is not specified a threshold: within the selection of the most economically advantageous offer are considered both the quantity of aid required and the number of access products offered to third parties once the project is implemented. Furthermore, more stringent wholesale access obligations to infrastructures are defined (see point n. 53 of the Decision), compared to those already set up by OFCOM at national level, due to defined wholesale cost-based prices, to physical access to ducts or to dark fiber and to VULA and SLU where it is technically feasible.

**Figure 20 Wholesale access obligation for FTTC networks, BDUK project.**

<p>Fibre to the cabinet/node (FTTC/N)</p>	<ul style="list-style-type: none"> <li>• One point of physical access: i.e. either duct access or dark fibre on new subsidised infrastructure</li> <li>• One point of active access: i.e. VULA equivalent</li> <li>• Other wholesale access if mandated by Ofcom as a regulatory remedy</li> <li>• SLU if sub loop deployed as part of subsidised project</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple points of physical access, e.g. both duct access and dark fibre</li> <li>• Cabinet space and power</li> <li>• White label</li> </ul>
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Source: Commission notification letter for the BDUK project (SA 33671 - 2012/N)

FTTC available options are then:

- Bitstream service directly from BT Wholesale;
- Access to dark fiber ("*Generic Ethernet Access*") in the segment between the local exchange and the cabinet, and access to the copper network between the cabinet and the customer: this has been the modality of access chosen by Sky, 02 and TalkTalk as they have an infrastructure until the local loop and they can use the fiber segment to offer ADSL2+ to their customers;
- The competitor install its own network up to the cabinet, and from there it accesses the copper segment to the customer (SLU, *Shared (o non) Metallic Path Facility*): this option has been chosen by Digital Regions projects and few other small operators, like Rutland Telecom, given the strong investments required to the operator to build and manage its own infrastructure.

#### **4.1.1 Regulatory policies in UK (OFCOM)**

With its last analysis OFCOM has included all services provided by copper network, on cable and on fiber for business and domestic customers in one market and proposed four distinct geographic submarkets, differentiated according the incumbent's market share and number of players in the area concerned: in two submarkets, BT had been identified dominant. Within each of them, when the prospect of competition at wholesale level is limited, OFCOM proposed to impose on BT the full set of remedies under the Access Directive (Articles 9-13), including the obligation of cost orientation for wholesale prices. In the submarket with a sufficient degree of competition at wholesale level, instead, OFCOM considered appropriate to impose, on the SMP operator (BT), general obligations like access, non-discrimination and transparency: the regulator adopted an approach to promote investment, but at the same time acknowledged that it is necessary avoid the risk that, if these investments do not take place,

prices reach an excessive level. To this end, OFCOM considered that the adoption of a stringent price regulation is not compelling proportionate to the aims and proposed, instead, to leave a degree of freedom in setting prices in an interval based on a general obligation of cost orientation.

According to the regulator, in principle, investments with a higher risk (like investments in NGN) need to be treated differently from others: for this reason, it imposed on BT generic obligations, like access, non-discrimination and transparency.

OFCom has therefore imposed on the SMP operator to provide the following services:

- *Virtual Unbundled Local Access* – VULA. According to the NRA, this will be the principal instrument for the development of competition on NGA networks;
- *Physical Infrastructure Access* - PIA;
- Disaggregated access to the secondary network (*Sub-Loop Unbundling* - SLU), which is marginal in the UK.

VULA is a virtual connection that allows operators to provide alternative services on the NGA infrastructure of BT, with a dedicated link to customers and the possibility to control the provision of services like if it was with physical access: this kind of access is provided by BT on all access facilities, on the basis of the "*equivalence of input*" principle already mentioned. OFCOM noted that, although VULA is a service utilizing active electronics, like in the case of bitstream, its main features (interconnection at local level, ability to support different types of services, dedicated capacity available to final users, connection control) make it more similar to services included in access local market (market 4) rather than to those included in broadband access market (market 5). According to OFCOM, this service will stimulate on NGA the same competition now obtained through unbundling of services and functional separation of the copper infrastructure.

By PIA (the remedy for areas where BT does not intend to invest), competitors can develop their own alternative access network (in FTTC technology) using BT passive infrastructure: both SLU and PIA service prices are oriented to costs (LRIC) with a mark-up for the recoupment of common costs as well as a risk premium differentiated according to the fact such facilities are existing ones, new ones but intended only for VDSL services or else new ones but dedicated to the provision of NGA products. OFCOM considers PIA will also foster competition and investment in NGAN, removing a significant barrier to the development of infrastructures and putting competitors at the same level of the incumbent.

Following OFCOM requests<sup>76</sup>, BT Openreach has modified SLU prices, diminishing those SMPF and increasing those MPF – *fully unbundled*, as this latter technology allows more freedom to competitors in the supply of services and, according to ISPs, it is the best choice to incentive long period investments.<sup>77</sup>

Initially price regulation was not considered proportionate to the scope: in February 2015 OFCOM regarded that there was a risk that BT could set prices in such a way that there would be an insufficient margin between its wholesale VULA product and the corresponding retail

<sup>76</sup> Disputa Digital Regions/Thales, giugno 2011.

<sup>77</sup> <http://www.ispreview.co.uk/story/2011/09/06/bt-toys-with-sub-loop-unbundling-prices-for-uk-rural-broadband-isps.html>

services, thus in March 2015 it decided to impose a margin squeeze test on BT's VULA product. The test compares a portfolio of residential fiber based retail broadband products and it is based on an adjusted equally efficient operator (EEO) test, it uses the LRIC+ standard to assess the costs of BT with adjustments for OLOs lower average customer lifetimes and for scale advantages that the SMP enjoys in terms of its unit costs.

OFCOM has also consulted to include access to dark fibre (but not ducts) as a remedy in the market for leased lines (4/2014) but the decision will be public only in 2016.

**Table 11 Regulatory policy in the UK.**

Market	Product	Geographical	Operator with SMP	Remedies	
				NGA Price	Copper Price
1	WLR	UK excl. Hull area	Market effectively competitive	No remedies imposed	
4	Ducts and dark fiber	UK excl. Hull area	BT	PIA (Physical Infrastructure Access - ducts and pole access only when it is used to deploy BB networks serving multiple customers)	PIA (Physical Infrastructure Access - ducts and pole access only when it is used to deploy BB networks serving multiple customers)
	Terminal segment			Cost oriented LRIC + risk premium	Cost oriented LRIC + risk premium
	Fiber unbundling			Fair and reasonable terms. Ex ante margin squeeze test.	
	copper LLU			full access	RPI-X
	SLU			shared access	Cost oriented LRIC + risk premium
				Non discrimination (EoI) Transparency, publication of RO and SLA Accounting separation	CCA FAC



5	WBA	Areas covered by LEX where there are 2 principal operators or BT has more than 50% market share	BT	VULA (virtual unbundled access)	Fair and reasonable terms. Ex ante margin squeeze test.	Bitstream	LRIC CPI-10,7%	
				Non discrimination (Eol)	Non discrimination (Eol)	Transparency, publication of RO and SLA	Transparency, publication of RO and SLA	Accounting separation
		Areas (90% of UK) covered by LEX where there are 3 or more principal operators and BT has less than 50% market share	Market effectively competitive	No remedies imposed				

Source: own elaboration.

## 4.2 The regulation of NGN in France

In France the activity on NGAN is driven both through increasing users' demand and plans developed by stakeholders. Different actors (operators and local entities), heterogeneous in size and reach, has been willing to deploy and operate FTTH infrastructures in different areas (rural and urban): according to last statistics, the incumbent (FT) has connected 2,3 millions households in FTTH, Free (competitor) 3,6 millions and SFR (competitor) 1 million with the same technology; France is also covered by cable technology (5 millions homes). FTTH has been recognized as the best solution to trigger innovation on the retail market for broadband: new services have been launched on LLU basis and operators show a strong scepticism about the possibility for virtual access products (like VULA) to provide functionalities equivalent to passive access products; from the NRA point of view, there is a need to guarantee openness of NGAN by specifying conditions on network architectures ahead of roll out.

The path followed for the definition of legal and regulatory framework has seen both the Government and NRA (ARCEP) to adopt an integrated set of laws and regulatory measures: the Government issued the "*Law for the Modernisation of the Economy*" (776/08) and, in

2009, 3 decrees<sup>78</sup> dealing with the installation of fiber networks within new buildings, the right to bandwidth and the promotion of agreements between telecom operators and property owners on installation, operation, maintenance and replacement of fiber lines in buildings. The Economic Modernization Act of 2008 has identified in the administrative simplification, in stimulus to co-investment and in both regulatory clarity and certainty the conditions for a rapid development of fiber networks on national scale. To this end, this law provided an obligation to share fiber infrastructures inside buildings, at reasonable, transparent and non-discriminatory conditions, on a local connection or else to the concentration point ("*point de mutualisation*") placed outside of private property, unless otherwise decided by ARCEP.

The NRA, in supporting the development of fiber networks and encouraging investment and innovation, in line with the investment scheme already defined by the Government (France Numerique 2012<sup>79</sup>), adopted a scheme with the aim to achieve competition on infrastructures rather than on services. With Resolution n. 1106/09, ARCEP regulated the access to fiber lines and to the related infrastructures, with particular attention to the final stretch. To this end it identified the "operator of property", that can be any entity that plans to lay fiber inside buildings, or has control of the terminal segment of access network.

On March 2015 Orange announced that it will invest 4.5 billion Euro up to 2018 to extend its FTTH coverage, with a target of 12 million FTTH lines by 2018 and 20 million lines by 2020, reaching by then 60% of households.

The Law of August 6th, 2015 states that, once a first-to-building fibre operator has completed its fibre deployment in a specific area, it can request the Ministry of Economy to designate the area as a "*fibred area*". This will trigger a set of measures supporting end user migration from copper to fibre networks in that area, including:

- financial incentives by public authorities to help end-users to connect themselves to the fibre network;
- higher wholesale prices for copper local loop unbundling, in order to push operators to promote fibre-based offers and migrate their client base;
- remove obligations to connect new buildings to the copper network.

Furthermore, building permits delivered from July 2016 will require to install in-house fibre cabling ready to be connected to a high-speed fibre communications network.

#### 4.2.1 Regulation in place

Due to the willingness of operators to roll out their proprietary FTTH network and the need to maintain them, ARCEP decided to notify to the EU Commission on May 2014 a combination of regulatory tool: a mix of symmetric and asymmetric obligations that are complementary. A consistent approach, in fact, is needed between these two instruments.

#### Description of asymmetric regulation

##### *Market 4/2007*

- Orange is designated as having SMP for the next three years;
- Orange must provide access to its passive infrastructure (ducts and poles) at cost oriented prices, despite it is used for copper or fiber networks;

<sup>78</sup> 52, 53, 54 of 2009

<sup>79</sup> <http://www.ladocumentationfrancaise.fr/rapports-publics/084000664/index.shtml>

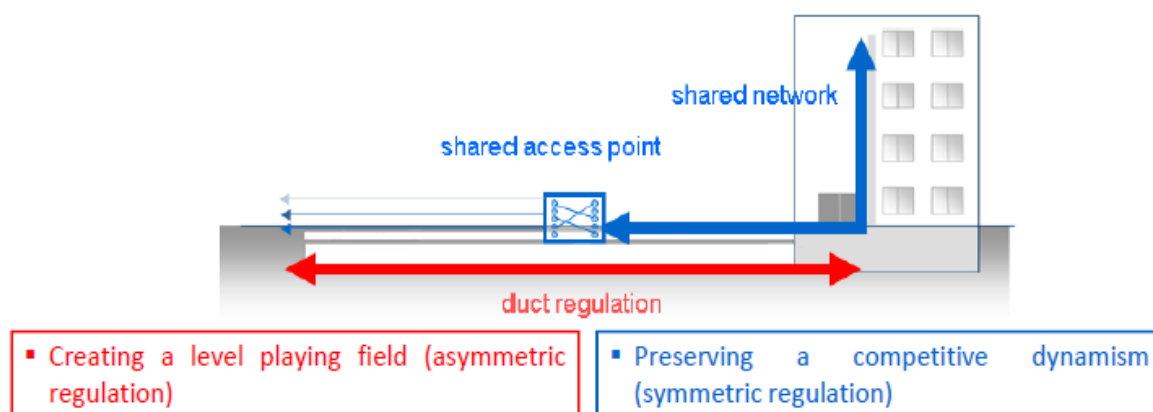
- Orange must provide unbundled access to copper LLU and SLU at cost oriented prices, allowing alternative network operators (ANOs) to differentiate their offers for customers based on quality of service criteria (f.eg. guarantees on speed and fault repair);
- Orange must provide dark fiber to connect remote and smaller local exchanges (LEX) to extend the geographic coverage of unbundling;
- Conditions for accessing local loops, including collocation and backhaul links to the local exchanges (LEX), must allow alternative network operators to offer audiovisual media services under similar conditions (volume and timeframe) as Orange;
- Orange must perform an ex-ante technical replicability test demonstrating that ANOs can compete with the incumbent at retail level based on available wholesale services.

ARCEP does not propose fiber unbundling as a remedy because it is convinced that access to the SMP infrastructure, in combination with a symmetric regulatory framework for access to fiber networks, is sufficient for competitors to deploy NGAN in a competitive environment.

#### Market 5/2007

- Orange is designated as having SMP for the next three years;
- Orange must provide WBA over its copper network but not over its fiber access network;
- Orange must provide services allowing alternative network operators to offer, in the short term and with reasonable economic conditions, non-linear audiovisual services;
- Orange must perform an ex-ante technical replicability tests and coordinate the provision of several regulated wholesale products to reproduce its own retail services.
- ARCEP imposes cost oriented prices only in areas where Orange is the only provider of standard WBA (i.e. excluding specialized WBA products for business market). No price regulation in other areas.

Figure 21 Symmetric and asymmetric regulation in France.



Source: Arcep 2014

#### 4.2.2 Symmetric regulation and geographic segmentation of measures

Rather than a one-way choice from ARCEP, symmetric regulation was adopted to accompany the operators' willingness to roll-out their own FTTH networks on the wider possible scale. Symmetric obligations applies to all operators deploying FTTH networks: the incumbent, the

alternative ISPs and local authorities. Cable operators, when terminating their network up to the customer premises with fibre, are also subject to this same symmetric regulation.

Regulation impose on operators deploying the last segment of the network the following obligations:

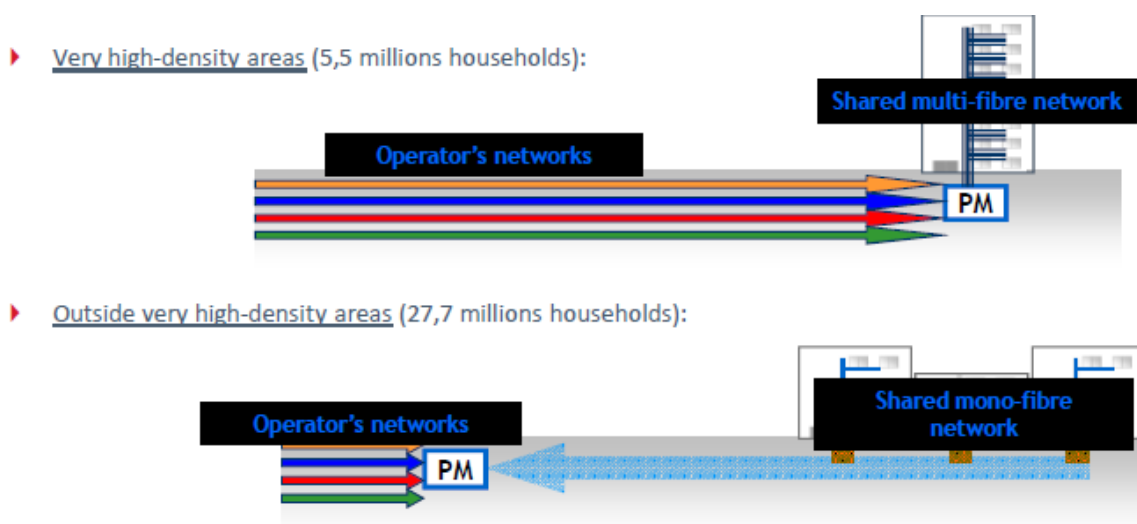
- provision of passive access to the fibre from a concentration point up to the subscriber's premises;
- publication of access offer conditions, including co-investment and line rental options schemes;
- access prices are based on principles of non-discrimination, objectivity, relevance and efficiency but not cost orientation (but ARCEP plans to recognize a risk premium over the investment of property operators);
- structured exchanges of technical information with commercial operators are made mandatory.

ARCEP has classified the territory according population density and then identified areas "densely populated" which include municipalities where the development of infrastructure competition is planned, due to the fact that density population, potential demand for services and the availability of ducts make the deployment of proprietary fiber networks economically viable for operators. In these areas, ARCEP imposed access obligations different from those already applied nationwide:

- nationally, in fact, the operator owning a fiber infrastructure should provide access only to the passive distribution point, at reasonable and non-discriminatory terms.
- in densely populated areas, property operator is obliged, if another operator request to join the investment, to install more fiber in every building concerned and to ensure the installation of a switchboard in the distribution point: these obligations allow the competitor to choose if to adopt a point-to-multipoint or point-to-point architecture, in respect of technological neutrality.

In areas not densely populated, instead, the Government decided to invest more than 2 billion Euro, while rules set by ARCEP defined that the point of distribution should be localized in a way, outside the private property, to collect at least 300 final users.

**Figure 22 Network topologies according areas.**



Source: Arcep 2014

In dense areas, the mutualisation point is located at the foot of the building and 4 fibres are rolled-out to the individual premises. Outside those areas, it is necessary to share a longer part of the network: the mutualisation point is located further from the premises and only one fibre is rolled out (see Figure 22 above).

In all areas, the operator deploying a network is required to consult beforehand with other operators that might want to co-invest. This consultation can lead to a cost sharing agreement with several operators under different schemes depending of population density of the area:

- In very dense areas (5,5 million households), costs are equally shared between co- investing operators;
- Outside very dense areas (27,7 million households), it is possible to buy only a share of the lines according to the co-investors' need;
- For later entrants, line rental scheme is possible at a higher price to take into account the investment risk taken by the operator deploying the fibre network.

These obligations also define constraints on network architectures (f.eg, minimum sizes for access points) to ensure that NGA networks can be accessed in the most effective manner by operators who do not build the fibre network (that is through passive access), and effectively enable co-investment schemes, allowing operators to share costs on the wholesale market. ARCEP monitors implementations' conditions (without imposing them), and each operator is incited to be “reasonable” since it might be offering or else granting access according to areas.

In order to both harmonise access conditions and limit the increase of interoperability costs, ARCEP adopted in July 2015 technical and operational rules on access to FTTH networks:

- facilitating access to relevant information for all market players, with the publication of a reference offer as well as first-to-building fibre operators must notify, within one calendar day, all necessary information to enable other operators to make access request;
- guaranteeing non-discrimination in the provision of wholesale access, with the application of the equivalence of output (EoO) principle<sup>80</sup>, the publication of KPIs<sup>81</sup> for processes, penalties for non-compliance, a consultation before implementation of fibre deployments in a specific area and the first-to-building fibre operator must wait 3 months before marketing its own retail services once an access point is available;
- ensuring efficient management of the access network.

**Table 12 Regulatory policy in France.**

Market	Product	Geographical	Operator with SMP	Remedies	
				NGA Price	Copper Price
1	WLR	France	FT		Access and use of specific network facilities Cost orientation based on REO

<sup>80</sup> the products the operator offers to other operators and its own retail business are comparable in terms of functionality and price, although different systems and processes may be used.

<sup>81</sup> Key performance indicators.

								non discrimination transparency	
4	Ducts and dark fiber							Access to ducts and passive infrastructures to concentration point (different according population density of the area)	Access to ducts and passive infrastructures to concentration point (different according population density of the area)
	Terminal segment							cost orientation LRIC and no predatory pricing	cost orientation LRIC and no predatory pricing
	Fiber unbundling	France		FT				Access to the fiber from concentration point to consumer premises (different according population density of the area) - <b>symmetrical obligations to passive infrastructures</b>	No cost orientation
	copper LLU								full access shared access
	SLU								SLU cost orientation LRIC and no predatory pricing
								Non discrimination Transparency, publication of RO and SLA Accounting separation	
5	WBA	France		FT			Exclusion of fibre networks from the scope of regulation	WBA at sub national level where available	<b>In areas with infrastructure competition, no cost orientation, in other areas, LRIC cost orientation</b>
								at parent switch level at distant switch level transport service between distant nodes at IP node level	

		Non discrimination Transparency, publication of RO and SLA Accounting separation
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Source: own elaboration

### 4.3 NGN Regulation in Italy

The Italian territory does not present cable technologies and operators, with the exception of Milan and few other cities, have been investing on FTTC:

- Telecom Italia (TI) covering around 25% of population, in the main 40 cities;
- Fastweb covers through FTTC 7,5% of population in the main 25 cities, and Vodafone has an overlapping network with other competitors.

Since the 2006 the debate on the deployment of NGN infrastructures affected both business and institutions. One of the most important contributions has been the “Caio report”, in 2013: it predicted that copper network will not be able to support the growth of demand, so delaying investments will provoke problems in the future, when demand will be present while an NGA infrastructure will not be ready. According to the analysis, it was unlikely that the incumbent (TI, hampered by a huge debt) will accelerate its NGAN plans, due to demand and regulatory uncertainty: thus, investments directly set by public actors needed to be in place.

Italy had been lacking a national comprehensive strategy, so regions have undertaken their own plans to deploy NGN broadband infrastructures in targeted areas (f.e.g. industrial zones) or else to fill the digital divide in rural ones. The Government decided then to coordinate regional efforts and notified a State Aids case (BUL-MISE project<sup>82</sup>) to the EU Commission in order to supervise local initiatives on NGN through its public company, define the juridical framework and potential modalities of intervention, so to avoid the duplication of projects' notification to the EU. Local projects were supposed to be published in a website to ensure transparency in the decisional process and a database with both infrastructures and services available should have been published in order to optimize future investment plans.

The territory was mapped according local exchange areas and the notification targeted only the deployment of NGAN in white NGA areas (primary and secondary network). Regions financed those investments through EU funds as FEASR and FESR.

Three types of intervention were possible:

A. Direct intervention (two-steps)

1. The region selects a company that will develop a new infrastructure with public funds: the network will be owned by the public entity that commissioned it;
2. The region tenders the selection of a concessionaire for the commercial use of the network and the operator guarantees a fair and non discriminatory access to competitors.
  - i. these requirements needed to be met: most economically advantageous offer, maximum coverage in terms of band, innovative technologies,

<sup>82</sup> SA 34199 - 2012/N

low environmental impact, maximum extension of coverage related to the auction.

#### B. PPP

1. Tender for a partnership that realize and manage the new infrastructure. In the offer it is necessary to specify:
  - i. the typology of network and its costs;
  - ii. the amount of participation required to the public partner;
  - iii. these requirements needed to be met: most economically advantageous offer, maximum coverage in terms of band, innovative technologies, low environmental impact, maximum extension of coverage related to the auction, amount of co-financing, company organization, experience in the management of wholesale services.

#### C. Incentive (all local projects presented were under this type of intervention)

1. assignment of a public subsidy to a commercial operator chosen by a public competition. The promoter contributes with at least 30% of investments, and it specifies operative costs, infrastructural investments needed, both expected revenues and penetration;
2. the beneficiary keeps the ownership on the financed infrastructure;
3. intensity of aid: maximum 70%;
4. these requirements needed to be met: most economically advantageous offer, maximum coverage in terms of band, amount of co-financing and transparency plan.

All regional projects had to ensure wholesale access to the financed network for a period of, at least, 7 years, to different levels (both passive and active), and obligations were extended also to already existing infrastructures that are part of the project. Access to passive elements had to be guaranteed without time limit and network architecture had to follow a proportionality principle: in densely populated areas must allow all access technologies, while in rural areas it is possible to undertake other solutions, like VULA. As defined in the Guidelines<sup>83</sup>, access prices were defined by AGCOM and there was a claw back mechanism to re-invest potential extra profits to extend the coverage of the network.

In 2015 the Government has issued a new national broadband policy (NBP) until 2020, which comprises two separate but related strategies:

- *broadband strategy*, with coverage targets by 2020 (100% with 30 Mbps and 85% with 100 Mbps), and interim targets of 75% and 40% respectively for 2018; and
- *digital growth strategy*, aiming at a higher level of usage of digital services, proposing demand-side measures in particular for the public administration.

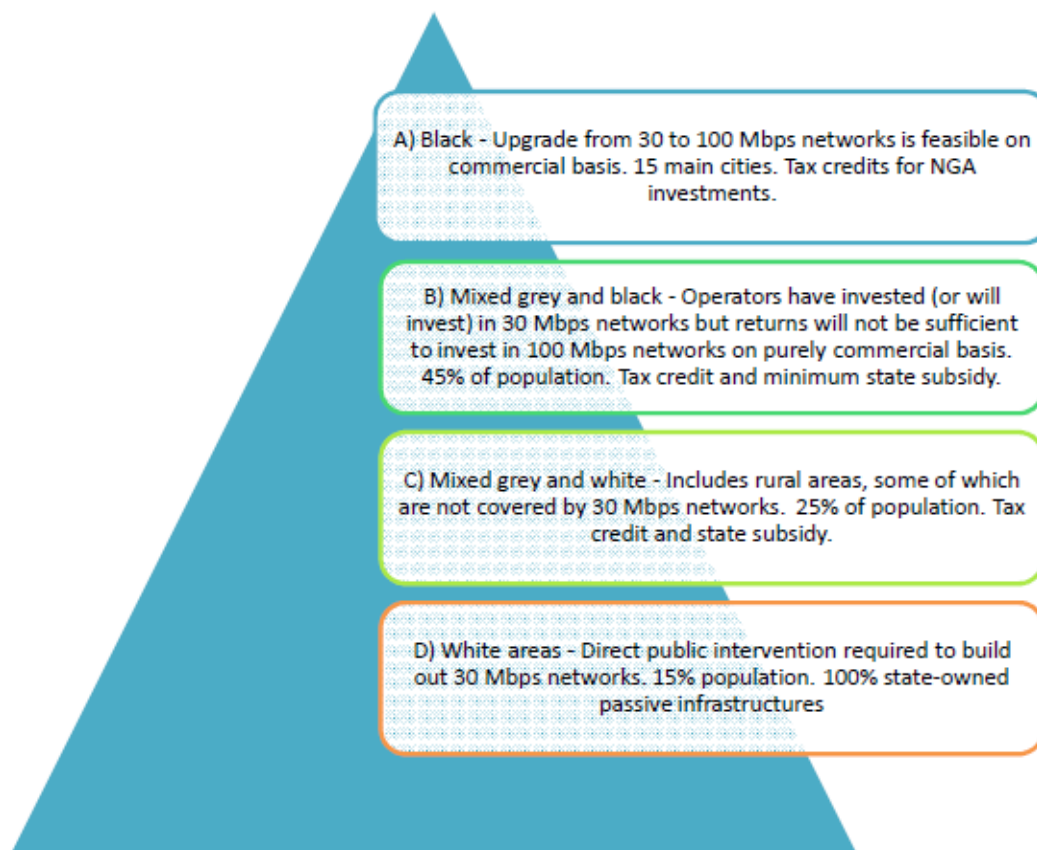
The new NBP is consistent with BUL-MISE project, and ensures continuity of the measures that are already still under way. The new strategy divides the country into 94,000 geographic units, each grouping a number of administrative census areas. These units have then been allocated into four "*clusters*" based on population, business density, geographic characteristics and the presence of high-speed broadband networks. The NBP allocates 6 billion Euro of public funds which should stimulate private investments worth the same amount, in addition to operators' investment plans.

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<sup>83</sup> 2013/C 25/01



**Figure 23 Cluster areas of the Italian broadband plan.**



Source: own elaboration

### 4.3.1 Regulation in place

With Delibera 1/12/CONS, AGCOM approved a normative for access services in NGAN: given the obligation to provide disaggregated access to networks (where technically feasible, and considering the effective take-up of market), the SMP operator (Telecom Italia - TI) must present an offer for:

- passive services as disaggregated access, as well as unbundled "end-to-end" services, to fiber, to its elements and access to ducts and poles, given the current network topology, at cost-oriented BU-LRIC prices with risk premium for new infrastructures;
- active services, *bitstream* (WBA) at different segments and VULA at local exchange level (LEX) with cost oriented prices (BU LRIC) and risk premium in areas without infrastructure competition.

With Delibera 238/13/CONS and 42/15/CONS, AGCOM consulted operators for the analysis of markets 1, 3a and 3b<sup>84</sup> and, with Delibera 623/15/CONS is now imposing the following obligations, both nationwide and on Telecom Italia as SMP:

<sup>84</sup> Recommendation 2014/710/EU

- Access both to ducts and dark fiber in different concentration points between the LEX and the customers as well as to unbundled "end-to-end" services on fiber;
- LLU on copper and fiber unbundling at ODF level where it is technically possible;
- SLU at cabinet level (on copper), at around 2/3 of LLU price;
- Co-location at LEX and street cabinets;
- Bitstream services:
  - On copper only in the LEX where layer 2 Ethernet product is not available;
  - on fiber (VULA) at local level and feeder nodes;
- Cost oriented BU-LRAIC+ prices with risk premium (differentiated according technology implemented) for new infrastructures;
- Non discrimination obligations based on the Equivalence of Output (EoO) model, with
  - introduction of stricter SLAs and penalties;
  - introduction a new set of quality of service key performance indicators and objectives (KPIs and KPOs);
  - reducing some differences in the provisioning processes, e.g. allowing ANOs access to the same network and customer address databases as TI (*"equivalence of network information"*);
  - allowing the provision of some ancillary services, and
  - carrying over the current ex-ante replicability (price squeeze) test.

By Delibera 538/13/CONS, symmetric obligations have been also imposed in the terminating segment (with BU-LRIC prices), in case FTTH-B is deployed.

**Table 13 Regulatory policy in Italy.**

Market	Product	Geographical	Operator with SMP	Remedies	
				NGA Price	Copper Price
3a	Ducts and dark fiber	Italy	Telecom Italia	Unbundled provision of access to ducts in access segments between LEX and building demarcation point Unbundled provision of access to dark fiber in the splicing of different network segments (to the building) Co-location at concentration points	Unbundled provision of access to ducts in access segments between LEX and building demarcation point BU LRAIC+ cost orientation + risk premium (1,2% for FTTC and 3.2% for FTTH) for new infrastructures only. Co-location at concentration points

Terminal segment	Access to terminating segment (incl in-building wiring) - <b>symmetric obligations</b>		
Fiber unbundling	TI must offer physical fibre unbundling at the local exchange level " <i>where technically feasible and taking into account the actual market and network development</i> "  Provision of "end-to-end passive infrastructure access" – consists of bundled provision at the local exchange level of all different elements of passive infrastructure access		
copper LLU		full access  shared access	BU LRAIC+ cost orientation
SLU		SLU full access	2/3 LLU price
	Non discrimination (EoO)  Transparency, publication of RO and SLA  Ex ante economical replicability price squeeze test  Accounting separation	Non discrimination (EoO)  Transparency, publication of RO and SLA  Ex ante economical replicability price squeeze test  Accounting separation	Ex ante economical replicability price squeeze test  Cost accounting

3b	WCA	Italy	Telecom Italia	Virtual unbundled local access (VULA) in the form of generic Ethernet access at LEX level. provision of Ethernet bitstream at parent node level	BU LRAIC+ cost orientation + risk premium (1,2% for FTTC and 3.2% for FTTH) for new infrastructures only.	Bitstream access with ATM technology in LEX where layer 2 Ethernet products are not available.	BU LRAIC+ cost orientation + risk premium (1,2% for FTTC and 3.2% for FTTH) for new infrastructures only.
				bitstream at distant node level		Bitstream at distant switch level	
				Non discrimination (EoO)		Non discrimination (EoO)	
				Transparency, publication of RO and SLA		Transparency, publication of RO and SLA	
					Ex ante economical replicability price squeeze test		Ex ante economical replicability price squeeze test
				Accounting separation	Cost accounting	Accounting separation	Cost accounting

Source: own elaboration

#### 4.4 German approach to NGN.

In Germany, main technologies used by the incumbent (DT) are ADSL at MDF level as well as VDSL from the central street: LLU is widely used by OLOs (9.4 million lines) while the number of lines used in SLU is approximately 150,000. DT, in December 2012, announced a 6 billion Euro investment to connect 65% of households with FTTC and VDSL2 technology. OLOs are investing in FTTB-H through partnerships, and in rural areas there are several local projects covering 2.3 million households with FTTx or vectoring. There is also cable, which connects 55% of the population at a speed of 1000Mbps: main operators are KDG (covering 15m households, with 2m customers) and Liberty Global (covering 12.6 million households, with 2.6m customers).

BNetzA's market definition comprises, amongst other forms of access network technologies:

- full unbundling of the copper loop either at the main distribution frame (MDF) or at an access point closer to the end user;
- line sharing of the copper loop; and
- unbundled access to the fiber loop (FTTH for mass market) for PON or P2P networks, depending on the technology deployed by the FTTH operator.

BNetzA designated Telekom Deutschland as having SMP.

The following obligations have been imposed:

- Access to ducts and to dark fiber in the feeder segment (between the central office and the street cabinet);
- Unbundled access to copper and fiber wires at the MDF: for copper, ex-ante price control based on cost orientation (BU LRIC) while, for fiber, ex-post price control is applied;
- Shared access (WDM) and co-location;
- Symmetric obligation on the provision of WBA/vectoring (on copper, fiber and cable) but no price control obligation:
  - Definition of a "Vectoring List", where operators declare the investments on such technology. These investments are protected by the regulator, in order to encourage the growth of this infrastructure (in case both the incumbent or else competitors make such commitment);
  - In case vectoring is deployed by DT, the operator can deny access to physical infrastructure for the use of frequencies > 2.2 MHz (but it is obliged to offer SLU, access to ducts or dark fiber where these are not available, LLU access both on fiber and copper and co-location to the MDF or to the central street);
  - In case vectoring is deployed by a competitor, DT cannot use its own loop for VDSL (with the exception of areas with cable), but it must use the product of the operator that has invested (but competitors may continue to use the LLU at the MDF even if vectoring has been developed by DT).

No obligation are imposed on network elements as terminating segment and in-house cabling. BNetzA intended to extend the existing cost orientation obligation to fiber unbundling but it considered that competition from cable networks would prevent DT from charging excessive rates for access to its newly built fiber loops. For this reason it would only intervene ex post, in case of abusive pricing.

In February 2015, DT filed an application to change rules for vectoring in order to cover 5.9m additional households with bandwidths above 50 Mbps, proposing that it could be the only one to decide to deploy vectoring from a certain MDF. Under the current technical rules, VDSL2 must not be deployed from street cabinets closer than 550 metres from the MDF. In such areas, VDSL2 can only be used from the MDF, not from the street cabinet.

In 2015 BNetzA has started a new round of market analysis (with DT as SMP), notifying to the EU Commission the following two markets:

- wholesale local access (3a/2014), defined nationwide, that includes unbundled access to:
  - the copper loop and to VULA either at the MDF or at a point nearer to the end user (including SLU at the street cabinet),
  - hybrid fibre-copper networks,
  - mass-market FTTH networks (including PON and P2P);
- wholesale central access (3b/2014), defined nationwide, with 2 sub-markets with handover at layer 2 (Ethernet) and 3 (IP) where in the latter, after a detailed analysis of geographically different market conditions, it suggested deregulation in 20 cities.

On market 3b/2014, BNetzA proposed to the Commission to impose on DT a full set of remedies:

- access and provision of collocation at appropriate handover points in the aggregation network (layer 2) and the core network (layer 3);
- non-discrimination based on equivalence of output (EoO);
- provision of key performance indicators (KPIs) on a monthly basis;
- cost accounting;
- publication of reference offers for layer 2 and layer 3 products;
- ex ante price control based on margin squeeze tests for the layer 2 product; and
- ex post price control for the layer 3 product.

On June 2015 the EU Commission has also approved a 3bn Euro scheme<sup>85</sup> proposed from the German Federal Government to support NGAN rollout: the measure consists in financing the construction and operation of an NGA network by a private operator in "NGA-white areas" and the financing for the construction or use of passive networks (civil engineering works, ducts, cabinets and network termination equipment) owned by public or private bodies that will be operated by private entities in NGA-white areas. The selected operator will provide open and non-discriminatory wholesale access to the subsidized infrastructure: in areas where physical unbundling is technically or economically not feasible (due to vectoring technology), the subsidy is conditional to the availability of VULA equivalent to physical unbundling.

The German Government adopted on October 2015 new guidelines on the State Aids scheme, which will support:

- the construction and operation of NGA networks by private operators;
- or construction of passive networks (installation of ducts with or without dark fibre, civil engineering works), which will be owned by public or private bodies and used by private operators.

The subsidised new infrastructure must provide at least 50 Mbps to 95% of households in the area, with a downstream speed of at least twice of the current one. The guidelines came into force immediately and will apply until the end of 2019: Federal Government will cover up to 50% of the eligible costs, another 40% may be covered by Landers and 10% must be carried out by municipalities. North-Rhine Westphalia, the largest Lander by population, announced on October 2015 that it intends to spend about €0.5bn Euro on broadband subsidies, most of the money to be used for projects covered by the national scheme.

Projects with the deployment of vectoring are not yet eligible for public subsidies: when the EU Commission approved the scheme, it insisted that vectoring can only be used in state aid projects when a suitable VULA product will be available. The details for it are unclear: at the moment DT already offers a layer 2 wholesale local access product with handover at the street cabinets (KVz-AP), but it is not sure if this will be the final product, once DT will complete its migration to NGAN. The Government will have to notify then VULA product details to the EU Commission before vectoring projects can be funded under this scheme.

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<sup>85</sup> case number SA.38348

Table 14 Regulatory policy in Germany.

Market	Product	Geographical	Operator with SMP	Remedies		
				NGA		Copper
				Price		Price
1	WLR	Germany	DT		Non discrimination Transparency with RO	Ex post price control
4	Ducts and dark fiber	Germany	DT	Access to ducts in access segments between central office and street cabinet Access to dark fiber if access to ducts is not available Co-location at street cabinet		Access to ducts in access segments between central office and street cabinet Access to dark fiber if access to ducts is not available Co-location at street cabinet
	Terminal segment					
	Fiber unbundling			DT must offer physical fibre unbundling - ODF Full and shared unbundling (WDM)	BU LRIC cost orientation - ex post price control	BU LRIC cost orientation - ex ante price control
	copper LLU				full access (at MDF) shared access	
	SLU			SLU full access (street cabinet) - unless there is infrastructure competition and VULA is offered, in that case SLU refused		SLU full access (street cabinet) - unless there is infrastructure competition and VULA is offered, in that case SLU refused
				Non discrimination Transparency, publication of RO and SLA Accounting separation	Non discrimination Transparency, publication of RO and SLA Accounting separation	

				Bitstream access with handover at layer 2 and 3	No cost orientation - ex post control	Bitstream access with handover at layer 2 and 3	No cost orientation - ex post control
5	WBA	Germany	DT	<b>symmetrical obligations, see Fig. 30</b> Non discrimination Transparency, publication of RO Accounting separation			

Source: own elaboration

#### 4.5 The National Broadband Plan (USA).

Different operators have announced plans for the development of both NGN fixed and mobile networks. In recent years, the US Telecoms market has experienced a steady growth of traffic. The current situation shows that 5% of households are not served by landline, while 82% of homes have the option to choose between two or more operators. Cable companies intend to update networks more quickly than other operators, covering in 3 years all households already reached by them with the DOCSIS 3.0 technology. Verizon and AT&T have already reached 50 million households with FTTN solutions.

The National Broadband Plan<sup>86</sup> was prepared by the Federal Communications Commission (FCC) with the target of developing NGAN within the US. In this context, the plan identified areas where there is an essential need of regulation:

- access policy (no price regulation) to protect competition and to foster incentives to investments;
- reallocation of a significant portion of the radio spectrum;
- reform of Universal Service.

Amongst the objectives of the Plan that are relevant to our analysis, the most important are:

- Encourage the deployment of a high-speed broadband network, by 2015, reaching at least 100 million households with 50 Mbps (in download) and 20 Mbps (in upload), and up to 100 Mbps in download and 50 Mbps upload, by 2020;
- Ensuring access to broadband through a ten-year plan funded by the Universal Service Fund;
- Connect public buildings, schools and hospitals at a speed of 1 Gigabit/s, and then create a public wireless network for public safety reasons.

<sup>86</sup> <http://www.broadband.gov/download-plan/>



For the development of NGAN, the FCC planned a policy harmonizing stakeholders' actions, facilitating the collection of information on building costs, physical availability of ducts as well as other facilities. Given that most of costs for the development of NGAN are digging operations, the FCC recommended that Federal Administration should set rules to facilitate the laying of pipelines within public existing infrastructures, encouraging the co-ordination with private operators ("dig once") and agreements between them (co-investment). Access to infrastructures must be fair, non-discriminatory and reasonable, and based on the principle of recovery of costs (cost-based). In addition, in order to promote a harmonious model of shared facilities, complementary to the fixed network, it is recommended the installation of wireless towers on federal properties.

Another recommendation set in the Broadband Plan is that the FCC should constitute the Connect America Fund (CAF) with the following tasks:

- Direct resources to areas where no operators would provide a convenient broadband service;
- In the above mentioned areas, subsidize the entry of a single operator, in order to minimize the financial burden;
- Respect the principle of technological neutrality;
- Ensuring transparency in the use of funds.

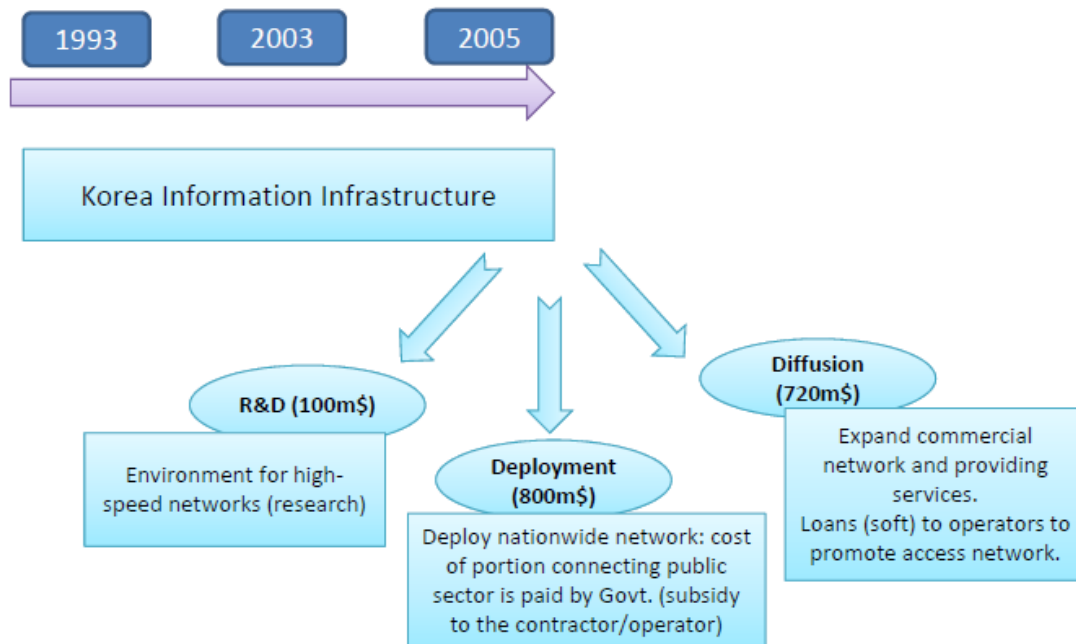
#### 4.6 *Korea (South) going broadband: an Asian model.*

With a policy boosting users' demand, South Korea became a world leader in NGAN. After the privatization of the state-run telecommunications provider (Korea Telecom, KT) and the opening of the market in the late 1990s, DSL and cable broadband services expanded rapidly: the Government provided substantial loans to support network deployment, funded public information technology training programs, and encouraged NGN broadband access. The first operator deploying a NGN network was a company called Thrunet: it used ducts leased from Kepco, the government-owned power company that possessed cable facilities but did not provide any service.

Over 80% of Koreans live in dense, urban areas, an arrangement that has produced significant economies of scale for the expansion of NGAN. Moreover, because landlords, rather than incumbent KT, own local loop facilities, alternative operators are able to negotiate with multi-dwelling unit owners rather than with the incumbent.

In 1987, South Korea approved the Framework Act on Information Promotion in order to support the development of information technology: this legislation established the National Information Society Agency (NIA) to oversee network construction. Since the 1990s, Korean broadband deployment strategy focused on the cultivation of a "knowledge-based society": in 1993, the NIA launched a plan for the Korea Information Infrastructure (KII) and, in 1995, it enacted a legislation to build up a national broadband backbone.

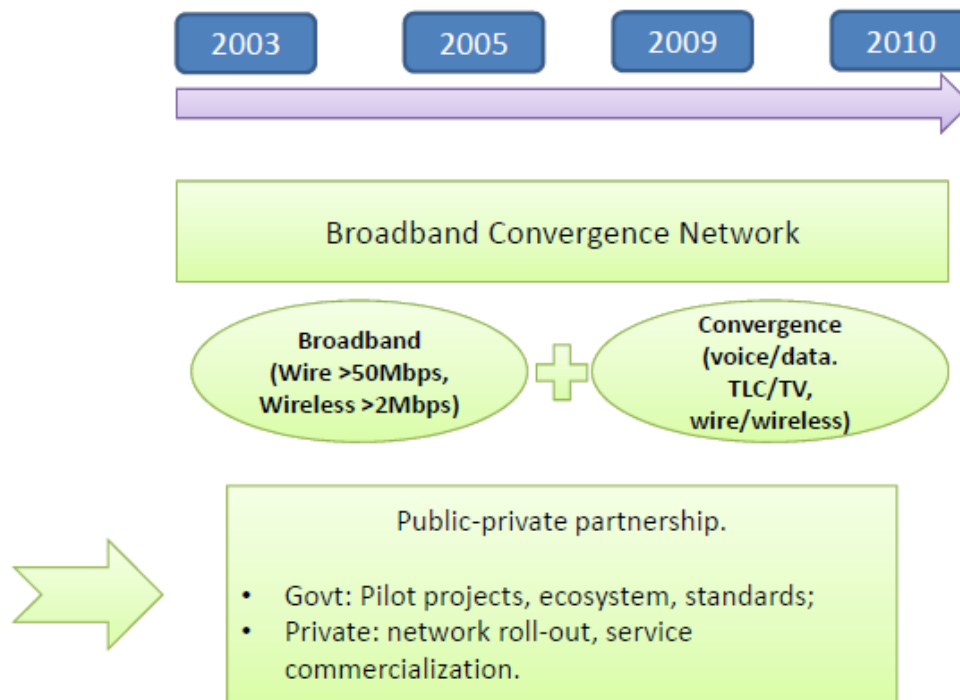
Figure 24 Korean broadband policy (Step 1).



Source: own elaboration

Korea has moved toward a FTTH model: although it has been slowed by high costs, ADSL, VDSL and Ethernet subscriptions continue to decline, while fiber services continue to grow in popularity. By the end of 2007, fiber NGN constituted one-third of all connections. After the KII, the Government implemented a series of 5-year programs to invest Government funds in broadband deployment: 77 million USD in preferred loans to facilities-based providers in 1999, an additional 77 million USD in loans for broadband deployment in non-urban areas, and then 70 billion USD in loans by IT839 and Broadband Convergence Network programs to service providers, which forecasted the convergence of wireline, wireless, and RFID networks to allow ubiquitous connectivity by a mix of devices. The combined plan called for a network aimed to support a list of eight services, three infrastructures, and nine growth engines. It provided also network build-out incentives and used public education projects targeting few demographic targets, like militaries, farmers and housewives, to bolster broadband demand and use.

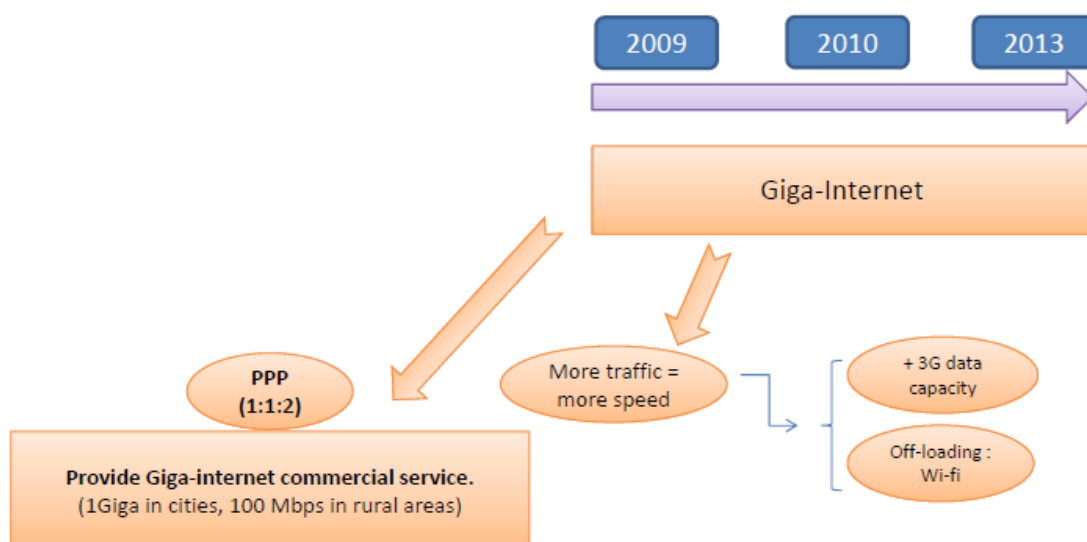
**Figure 25 Korean broadband policy (Step 2).**



Source: own elaboration

Since 2009, the Government has implemented the Giga Internet programme, aiming to cover via KT urban areas with an NGA network reaching 1GB of speed, while the rural area should be provided with a speed of "just" 100MB. Furthermore, the Government has provided tax breaks to companies that invested in broadband communications systems.

**Figure 26 Korean broadband policy (Step 3).**



Source: own elaboration

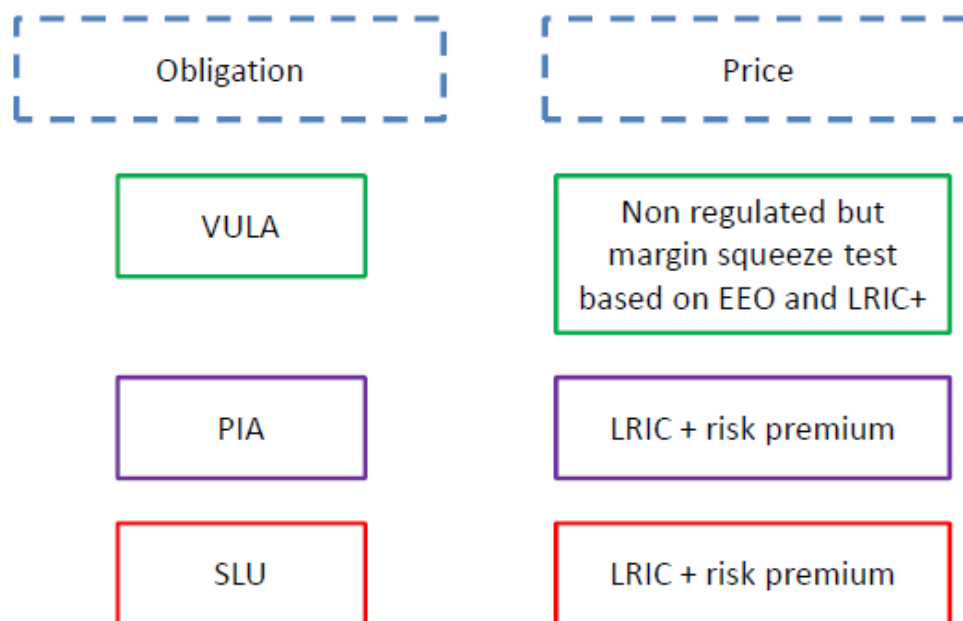
#### 4.7 Benchmarking of EU national policies on NGAN development.

UK has been the first EU country to define and implement a coherent policy for NGAN, both from Government and the NRA side, along with the incumbent strategy to deploy an FTTC in main cities. The public side has in fact chosen an approach based on such technology, with public funds in remote areas to incentive the deployment of NGA (BDUK programme), whilst operators play on a single infrastructure (service-based competition) owned by the incumbent through a separate branch (BT Openreach, obliged to provide equivalent services).

For this reason OFCOM imposed few and clear obligations (providing regulatory certainty as well) on the SMP, with the price test added recently to offset the risk of margin squeeze on other competitors:

- by PIA and SLU (imposed with cost oriented prices plus a risk premium), competitors have the possibility to commit in its own network while reducing deployment costs. On the other side, BT is also gaining from this measure, as providing these products to competitors it would recoup some of the investments undertaken, reducing market uncertainty;
- for competitors unwilling to deploy its proprietary NGAN elements, VULA allows the reduction of deployment costs by the provision of services to end-users with negligible investments on active equipments while, at the same time, the incumbent BT reduces its investment risk (by adding, to its own, the wholesale demand of competitors).

Figure 27 OFCOM remedies (product and price).



Source: own elaboration

The result of policies implemented in UK is the following: with the latest take-up figures (end of June 2015) BDUK projects have passed the 20% threshold, linked to the clawback clause and thus it requires BT to return part of the investment, which can be reinvested to improve

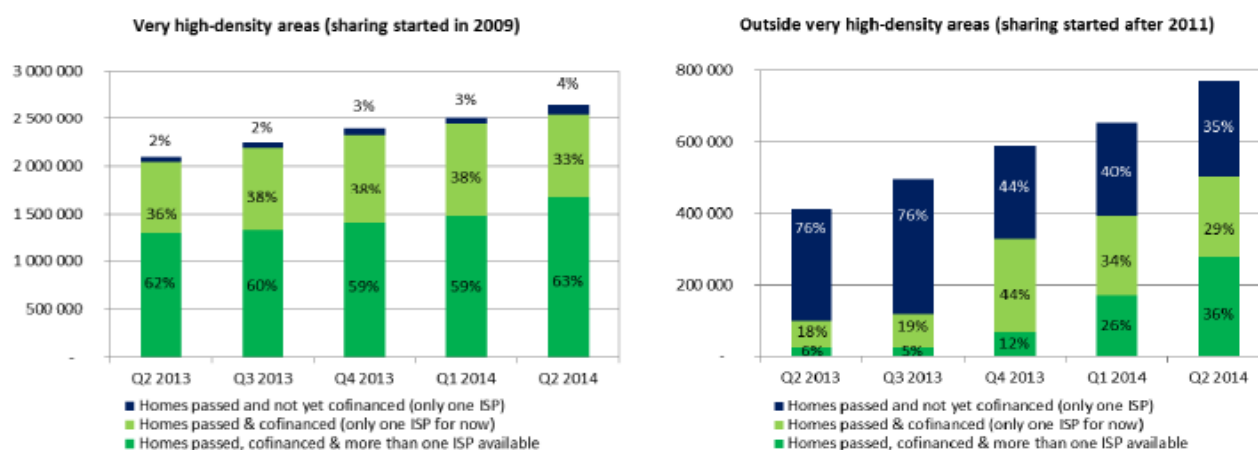
coverage. Data published by OFCOM in 2015<sup>87</sup> show that fiber FTTC broadband technology, delivered via BT Openreach, covers 79% of the population, while cable infrastructure covers almost half of it and FTTH just 1% of the total.

In France, due to the intention of private operators to roll out and operate FTTH (thanks also to the control of FT by the French Government and the presence, on the rural territory, of different local projects funded by the public side), ARCEP has developed a strategy based on the accessibility of the passive layer and the development of network elements by operators competing between them (infrastructure based competition):

- through the obligation, on FT, to provide access to ducts from the concentration point, alternative operators have reduced their deployment costs whilst, at the same time, such remedy has intervened as well on wholesale market uncertainty of the incumbent;
- through symmetric (as well as geographically differentiated) passive access remedies at the concentration point, by active access remedies (as WBA) on copper (but not on fiber, that could have reduced incentive on competitors to invest on passive elements) and thanks to the publication of co-investment and line rental options, instead, ARCEP has further decreased the risk of overlapping access networks (reducing deployment costs for all private operators), diminishing investments' risks for those investing while preserving a competitive dynamism between those willing to roll out their proprietary network elements on the access segment.

Outcome of these policies is a steady growth of FTTH deployment, both in dense (financed by FT) and remote areas (by public subsidies).

**Figure 28 NGAN deployment in France.**



Source: ARCEP, 2014

In Italy, instead, the public strategy has been late and incomplete: the BUL project had been proposed to the EU Commission almost when BDUK was approved and, even if it is an effort in that way, it relied on the limited capacity (and funds) of regions to define and implement local strategies on broadband and it was applicable only in market failure cases (white areas).

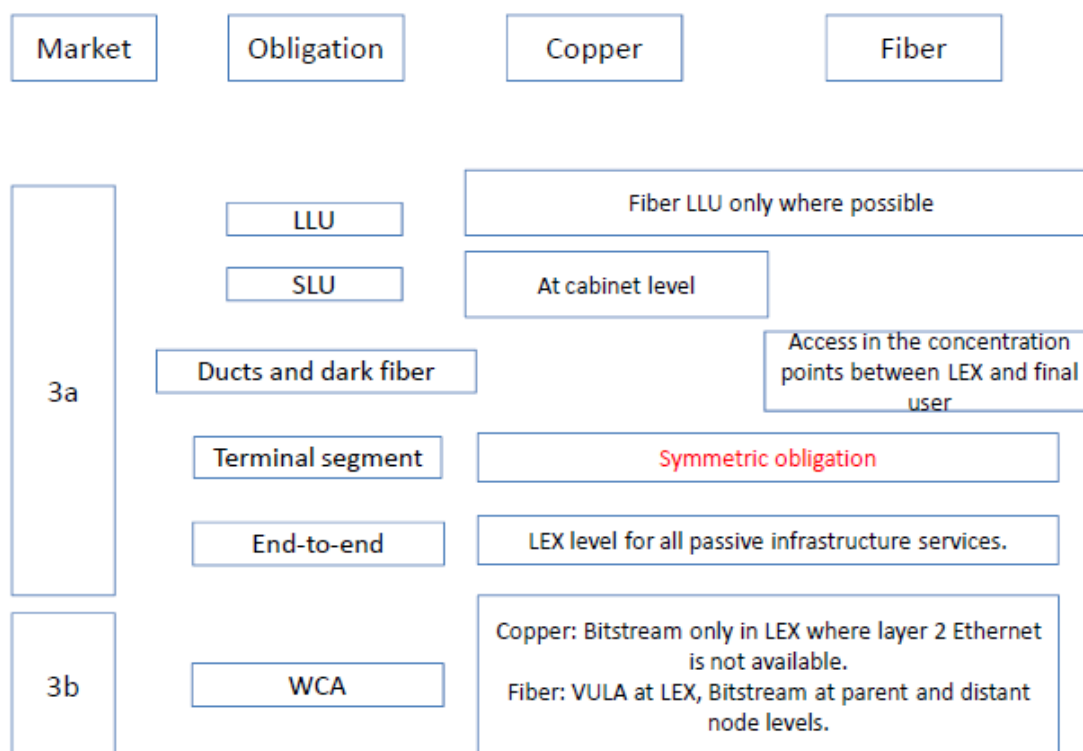
<sup>87</sup> International Communication Market Report

The new NBP, proposed in 2015, activate directly and indirectly more funds, but the way it is conceived and the segmentation in cluster presents criticism: in the most profitable areas (clusters A and B), defined through a public consultation, probably the EU Commission will object that subsidies will not be possible as they would otherwise outcast private intervention; furthermore, with the definition of 94000 areas, the result is a map with non homogeneous clusters (as market failure areas are present as well in suburbs, near the most profitable ones), scattering the economic convenience to intervene by private operators, that in cluster C areas have to intervene with 30% of the capital, and thus making difficult to reach the target with an unique method of intervention (call for tenders, as mentioned in §78 of the Guidelines 2013/C 25/01). It is recognized that investments' profitability is different according areas, but probably a less deep segmentation (f.eg. considering as areas of intervention municipalities or else the 10500 central areas) would fit better technical and economical logic for infrastructure development.

The strategy pursued by the Italian NRA has been, as well, both late and incomplete: in some parts, it seems inspired by the one implemented in the UK (about the imposition of VULA at LEX level) and, in part, to France (regarding the imposition of symmetric obligations on the terminal segment). The market analysis took over two years to be completed, with an impact both on the regulatory uncertainty and on market uncertainty faced by operators. After having clear that main operators (Telecom Italia and Fastweb) would have been investing mainly on FTTC technology, AGCOM has imposed fiber LLU where feasible, SLU at cabinet level and VULA at local level, following market conditions imposed by the operators. Previous market assessments proposed access to WBA products, but initially the regulator centred its policy objective to a network development based on FTTH (given the mandatory access to passive elements and to fiber, at disaggregated level too).

The outcome is that, in practical terms, operators were delayed by both the Government and regulator inaction (regulatory and thus market uncertainty chilled their investments) and then, when they have implemented their strategy, AGCOM could only set a policy fitting ex-post the existent (service-based competition market with the implementation of FTTC technology in main cities) whereas the Government policy has been late, partial and without a concrete initiative with the aim to lead investors' behaviour.

Figure 29 NGN regulation in Italy.



Source: own elaboration

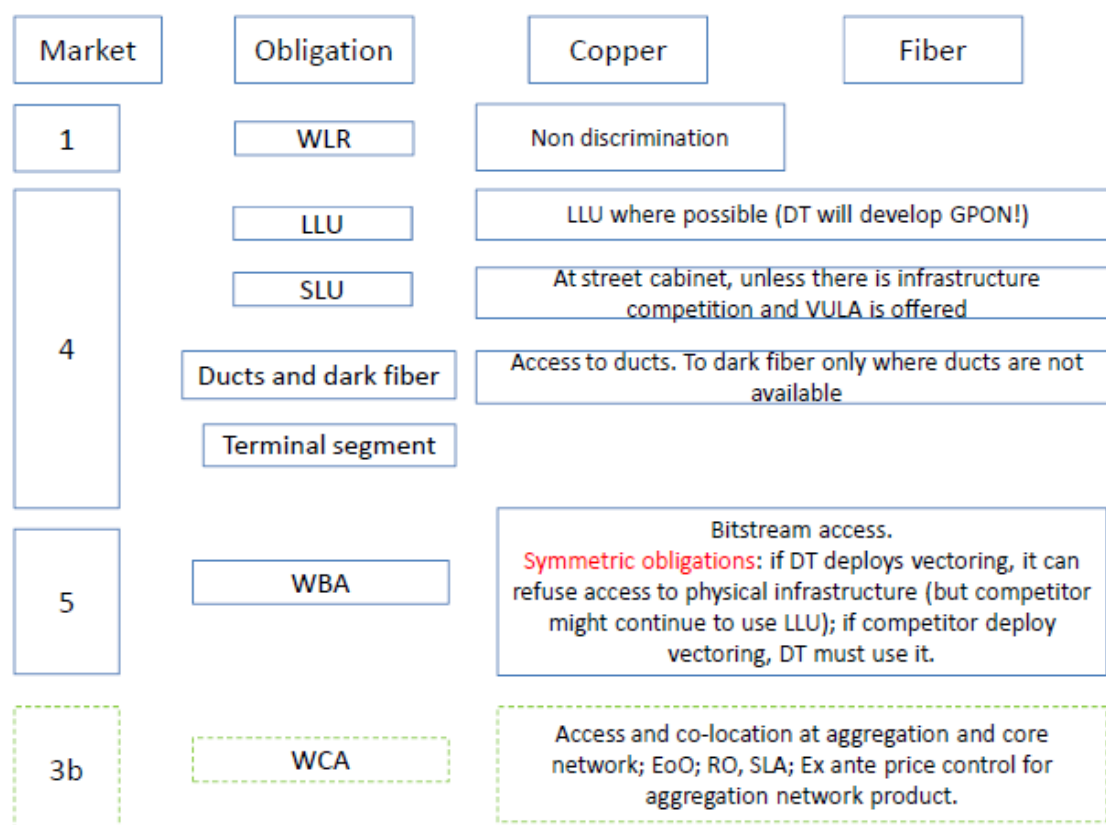
Germany instead has approached the issue mainly by regulatory means: local authorities have, in many cases, invested FTTC/H in remote and suburban areas, while the incumbent (DT) has invested in FTTC also in order to face competition by cable industry.

BNetzA has chosen a mixed strategy compared to those explained before and it imposed a set remedies, with relaxed price rules (ex post price control for fiber elements while later on, with proposed remedies on market 3b/2014, price control is limited to bitstream - layer 3 products) on active services, in order to allow the operator investing to freely decide how to recoup its investments. Furthermore, it has imposed limited access to passive elements (only to ducts, to dark fibre only if those are not available) and to SLU (except in the case there is infrastructure competition and VULA is offered) so it is intervening by reducing competitors' deployment costs thanks to access remedies as well as reducing market uncertainty for DT by allowing some investments' recoupment through incentives on active services where VULA have been implemented and, at the same time, by creating an incentive to operators to roll out their own part of access network (up to the cabinet).

By the symmetric obligations and the definition of a "list" about vectoring (if DT deploys it, access to physical infrastructure can be refused but competitor continue to have access to LLU; if an alternative operator instead deploys vectoring, DT must use it), the aim of the regulator is to reduce uncertainty on the wholesale market (both of the incumbent and of the competitors), with provisions to address other operators to compete by using that service. In the figure 30 have been mentioned (see green marks) remedies proposed for market 3b/2014 which, if accepted, will fit with those that will be proposed for market 3a/2014 in 2016.

The outcome of such policies is the development of an FTTC infrastructure owned by DT in main areas and the implementation of VULA services (with fringe competitors), while in rural/suburban ones the Government will subsidize the deployment of passive infrastructures (on which DT will, in practical terms, provide VULA services too).

Figure 30 NGN regulation in Germany.



Source: own elaboration

The outcome of this analysis can be, therefore, summarized in the benchmark (see Fig 31 below) of policies implemented in 4 EU countries on the development of broadband NGAN. South Korea is the forefront in this field, given the prompt of public involvement for the development of a nationwide FTTH network: the Government, in fact, financed (directly and indirectly) the building up of the network, provided clear regulatory and market directives and it pointed directly to a future-proof infrastructure. US took a different approach, not totally positive as we can see, where the provision of broadband NGN services is left to the market and the FCC has a role both in merely reducing deployment costs and creating the condition for an infrastructure based competition's market.



Figure 31 Benchmark of regulatory policies on NGN regarding countries considered.

Impact of national policies over factors to address			UK	France	Italy	Germany	US	S. Korea
Factors to address	Financing		🟢	🟢	🟡	🟡	🟡	🟢
	Uncertainty	Regulatory (Access and price obligations)	🟢	🟢	🔴	🟢	🟢	🟢
		(Wholesale and retail) market	🟢	🟢	🔴	🟢	🔴	🟢
		Deployment costs	🟢	🟢	🔴	🟡	🟢	🟢
		Technological progress	🟢	🟢	🟡	🟡	🟡	🟢
		Macroeconomics	🟡	🟡	🟡	🟡	🟡	🟡

Source: own elaboration

The policy framework present in Europe is absolutely different, and an intervention from the public side like the one implemented in South Korea would not be possible. Nevertheless, even in the EU, policies have reached different results. Best practices are, indeed, strategies implemented by both UK and France: even if outcomes are different (one lead to FTTC and to service-based competition while the other to FTTH and to infrastructure-based one), policies in these cases have been clear and consistent with the aim envisaged. The same cannot be expressed about the strategies described in Germany, where DT is determining the technology and coverage target while the NRA is setting consistent measures for that, and in Italy, where the public side did not provide any role and recent action have not been put into practice yet and, thus, cannot be object of this analysis.

## Conclusions

Given the non-replicability of the access network, incumbents might retain market power and foreclose the market to new entrants. As stated in Ch. 1, literature provides 4 main categories of competition problems that must be addressed through regulatory measures: vertical and horizontal leveraging, dominance and termination. Incumbents have the incentive to leverage vertically competitors in different ways, from refusing to supply as well as price and/or non price discrimination, thus deterring entrance into the market: in order to face it, policy options are mandating access to the infrastructure or services as well as regulating prices at different layers. Non-standard structural remedies (f.eg. structural or functional separation) are feasible to address the concern about potential discrimination of downstream competitors, and might be conceived according specific degrees: what is important to state is which components have to be separated and which rules have to be settled to manage transactions between layers.

Behavioural remedies to incentive the deployment of NGAN elements can be designed with different modalities, according to national specific market conditions, by obligations (access or price) addressed on one or more private operators (symmetric or non-symmetric) as well as on layers (passive and/or active), thus influencing the competitive dynamics of the market (in product and/or geographical terms). Regulators need to tackle incumbents' potential abusive behaviour, but must take into consideration opportunistic competitors' conduct too, providing incentives to invest in proprietary fibre portions: alternative operators might otherwise use incumbents' assets to provide retail services instead of replicating their access elements (the "make or buy" dilemma), discouraging overall investments. In case policy measures are not successful, other means to address such market failure is to involve direct public intervention into the financing or else the operating of such infrastructures (by State Aids and/or PPP).

By both the rise of competitive markets and the switch to fibre, it has emerged a bottleneck in the access section of the network. The deployment of fibre infrastructures is a nascent market that has to be treated differently from how it has been regulated recently. Each stakeholder have its own rationale and it is important to understand it so to address potential behaviours as well as to avoid bias: the intent of public actors, each in different terms, is the deployment of NGAN operating as much as possible through fibre elements, while private operators' interest is, as logic, the maximum return for their shareholders. In order to invest, for operators it is important to assess investments' recovery as revenues are influenced (both access and price obligations) by regulators. Investments in NGAN are influenced from the economic feasibility of copper network in place too, through replacement, wholesale revenues and retail-migration effects.

The methodology explained in Ch. 2, on which is carried out the qualitative analysis of policy measures present in Ch. 3 and 4, considered both national market specific conditions as well as a few factors affecting operators' incentive to invest: deployment costs, both regulatory and market uncertainty, market dynamics (f.eg. number of operators, deployment strategies of both incumbent and competitors, other facilities competing with negligible investments, etc). As stated, uncertainty plays an important role, and the reduction of it is important to incentive operators to invest. For this reason, measures must be clear and predictable as the perception of a potential change increases, *per se*, the risk over the commitment.

Initially, the EU regulatory framework for the development of NGAN infrastructures has been built up on the same legislation that was in place for the opening of electronic communication market, but there is no yet an infrastructure to be opened to competitors and regulation needs first to incentive operators to commit into the deployment of NGAN. The EU Commission then have recognized the necessity to tackle the issue with a different measures:

- The NGA Recommendation did not provide real incentives, but it identified different access elements to which competitors should have had access at cost-oriented prices, with risk premium for FTTH networks, with the aim to reduce regulatory uncertainty and to ensure access to competitors whilst providing an incentive to SMPs deploying fibre-based access elements;
- The Recommendation on costing methodologies and non-discrimination is a follow up of the above mentioned Recommendation: a cost-oriented price model was reaffirmed with different exemptions on access elements so to reduce uncertainty for operators as well as to provide an incentive to invest. As these measures are not directly applicable nor enforceable, its effectiveness will depend on the implementation at national level.
- State Aids Guidelines made clear modalities by which a potential public intervention for the deployment of NGN might not be considered distortive of market competition: by geographically segmenting areas and imposing obligations on financed elements, they reduce the risk to invest and ensure access to competitors. Additional provisions for NGAN in "black" areas are finally improving the conditions for the financing even in areas where basic broadband connectivity is already present.
- The effectiveness of the Directive on reduction of broadband deployment costs can be measured only in combination with the above mentioned measures, while CEF funds are negligible to have any impact.

In conclusion, EU measures has been keen to reduce deployment costs and define a wholesale market that would provide some incentive to invest, but markets are still defined at national level (while geographically segmented remedies would be a flexible mean to address specific market conditions arising at national level) and the burden of obligations has been put mainly on incumbents: in fact, the SMP investing on NGAN would be obliged to let competitors use the infrastructure that, in turn, would pay (with a premium) only the fraction in which it is interested, whilst the only price incentive seems given by setting of higher copper LLU prices. In this respect, State Aids Guidelines are important for the development of access elements, as they allow the involvement of public funds as well as incentive operators' investments before public measures are undertaken.

The opening up of the electronic communication markets, with the compression of network elements subordinated to regulation, state the "bottleneck" that according the EU Commission must be accessible to competitors: physical/virtual local access (market 3a) as well as central and virtual access (market 3b) to products. The result of implementation at national level have different degrees of effectiveness, according to the modalities by which both national specific market conditions and factors described in the methodology are tackled, both from regulators and Governments:

- the UK has implement a coherent policy, along with the incumbent strategy to deploy an FTTC in main cities. The public side has in fact chosen a service-based competition approach and the Government has funded the deployment of NGAN up to the cabinet in rural areas. OFCOM imposed few and clear obligations on the SMP, diminishing

both market and regulatory uncertainty in the market: by access obligations to physical elements of the network, competitors can invest with a sensible reduction of costs whilst the incumbent, at the same time, is recouping part of its investments; VULA allows, by adding wholesale demand of competitors, a reduction of market uncertainty for BT, while competitors might provide retail services with negligible investments on active equipments;

- France experiences the presence of the Government into the capital of the incumbent and a flourishing of local initiatives funded mainly by regions. Operators shown the intention to roll out and operate FTTH networks, and ARCEP has developed a strategy based on infrastructure-based competition: by the obligation, on the incumbent, to provide access to passive elements from the concentration point, reducing competitors' costs; by symmetric and geographically differentiated passive access remedies and by active access remedies on copper, instead, ARCEP has reduced the risk of overlapping access networks, diminishing investments' risks;
- in Italy the public strategy undertaken has been useless: the BUL project (State Aids) was limited in funding and could be applied only on "white" areas while the new one, under EU Commission scrutiny, present criticisms. The strategy pursued by AGCOM has been late and confused: operators were delayed by public inaction (regulatory and market uncertainty chilled their investments) and then, when they carried their strategy (FTTC to main cities), AGCOM set a policy fitting (ex-post) the existent;
- Germany instead has approached the issue by regulatory means: local authorities and the incumbent (DT) has invested in FTTC also to face competition by cable industry. BNetzA imposed relaxed price rules on active services and limited access to passive elements and to SLU, with some provisions to address operators to compete by using that VULA service in the areas where it has been developed, so reducing competitors' deployment costs and wholesale market uncertainty, at the same time by creating an incentive to operators to roll out their own part of access network.

Taking as measure policy incentives for the development of NGAN, South Korea is the "best practice" given the size of public involvement: the Government, in fact, financed a nationwide FTTH network, providing clear directives to the market. Within the EU, public policies have reached different results: best practices are strategies implemented by both UK and France, as policies have been clear and consistent with the aim envisaged, even if goals were different.

The analysis in this document has shown that different acts can be undertaken to incentive the deployment of NGAN and, even if approaches might be different, it is not possible to say that there are remedies *per se* more efficient than others. Together with "what" has to be applied, it is important "how" it is done: the outcome of measures on factors to be addressed (uncertainty above all) depends both on national market specific conditions and on the credibility of the commitment as well as of policy makers, therefore remedies have to be tailored according to the necessity and, at the same time, in order to be effective, private operators must have clear public goals as well as the intention to achieve the target by policy makers.

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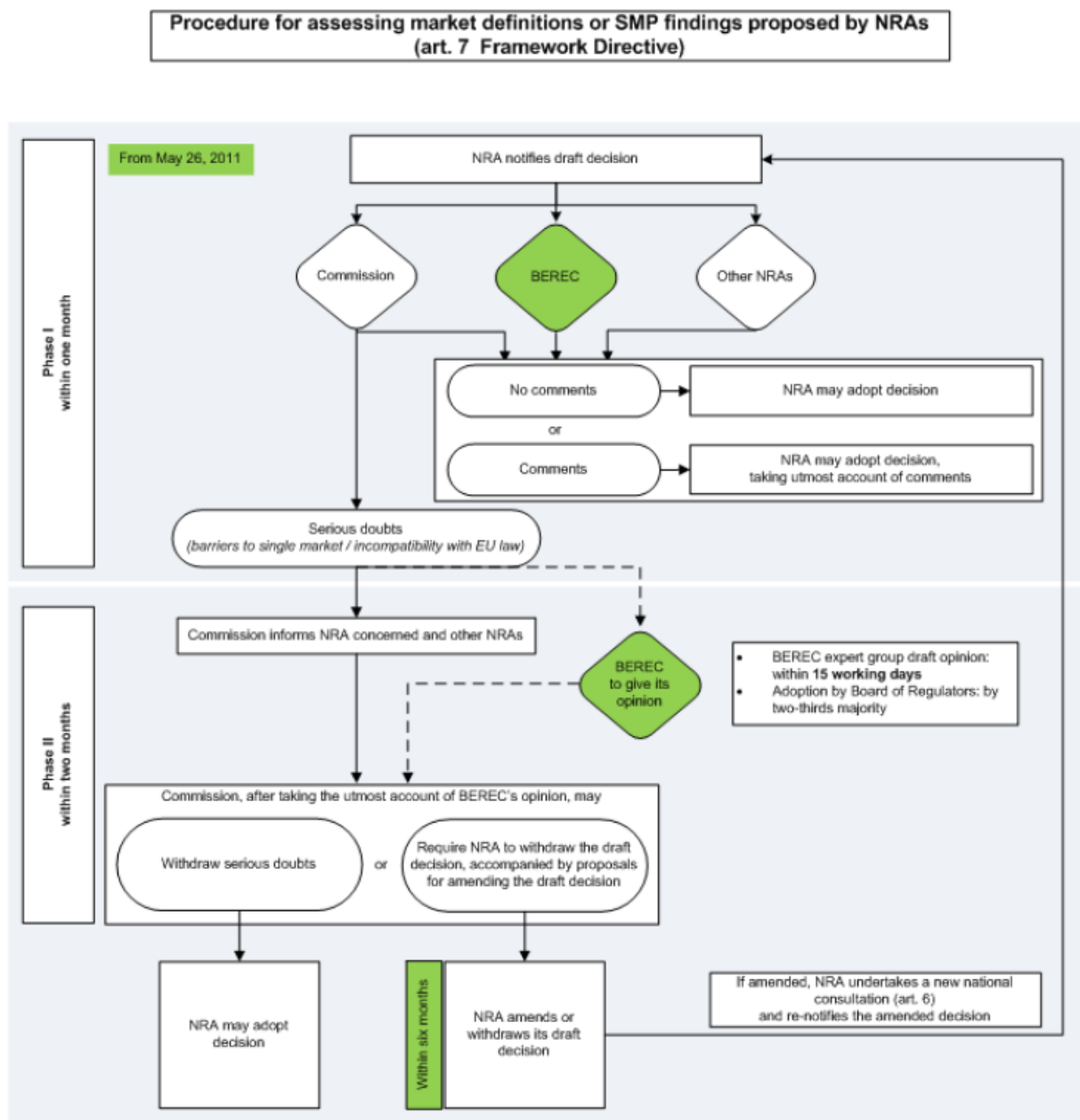
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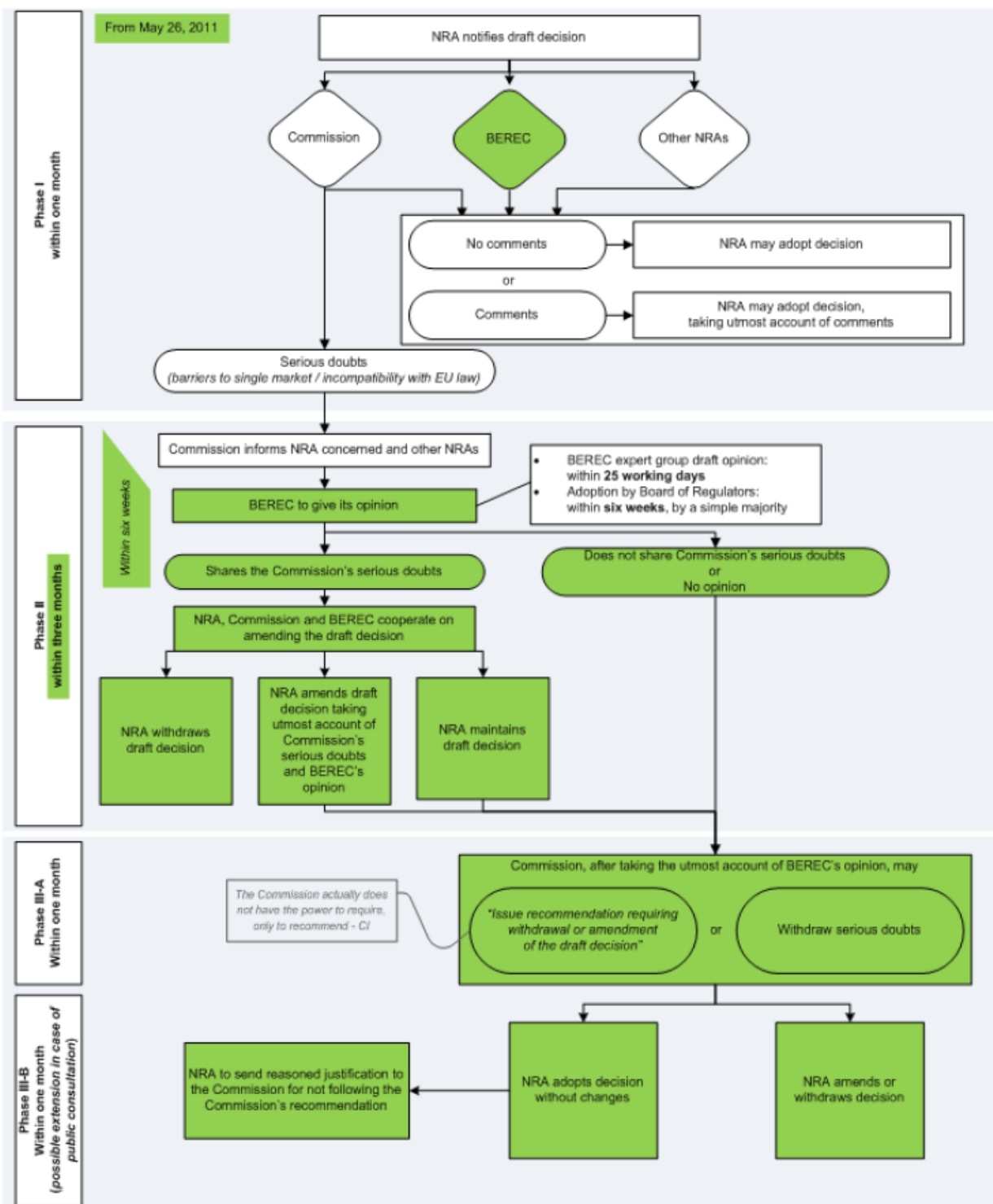
## ANNEX I

Figure 32 Art. 7 and 7a procedures.



Source: Cullen, 2015.

**Procedure for assessing regulatory obligations proposed by NRAs  
(art. 7a Framework Directive)**



Source: Cullen, 2015

## ANNEX II

**Table 15 Comparing operational (BT) and functional separation.**

Features of the separation	TI Operational Separation (2002 and 2008)	BT Functional Separation
Separation of the Functions	<p>Two operationally separate functions:</p> <ol style="list-style-type: none"> <li>1. TI retail &gt; serves end users</li> <li>2. TI wholesale &gt; serves OLOs</li> </ol> <p>First two distinct functions which serve both TI retail and TI wholesale without discriminating between them:</p> <p>TI Field services &gt; for service management.</p> <p>Strong application of non-discrimination thanks to computerized service provision management systems based on first in first out principle that does not distinguish between services required by TI retail and those required by other operators.</p> <p>TI Technology &gt; for network management.</p> <p>With undertakings, creation of Open Access (in charge of the access network), dealing with OLOs by TI Wholesale and dealing directly with TI Retail</p>	<p>-Functionally separated access services division:</p> <ol style="list-style-type: none"> <li>1. "Openreach" functionally separated" from the rest of BT: &gt; serves both BT retail units and other operators for supply of access services.</li> </ol> <p>&gt;controls and operates the assets of the physical layer (duct, fiber, copper and other non electronic assets)</p> <ol style="list-style-type: none"> <li>2. BT wholesale division: which provides other wholesale services including among them Bitstream service.</li> </ol> <p>&gt; controls and operates the transmission layer of BT's access and backhaul network as well as the core network assets.</p> <ol style="list-style-type: none"> <li>3. BT retail: provides all kinds of retail services to the end users.</li> </ol> <ul style="list-style-type: none"> <li>• Separation of the brand name for access service division.</li> </ul>
Non-discrimination Rule	<p>First "internal-external parity of treatment" consisting of the effective equivalent product provision of TI to its retail division and to its competitors by:</p> <ul style="list-style-type: none"> <li>➤ Providing network services to TI commercial units via specific agreement</li> <li>➤ Providing same level of service and assistance provided for network services to internal and external customers</li> <li>➤ Providing the same technical conditions for provisioning and same quality of service for the supply of network services for internal and external parties.</li> </ul> <p>With undertakings, "wholesale-like" phase of access – equivalence of output.</p>	<p>Equality of Access principle by:</p> <ul style="list-style-type: none"> <li>➤ Equivalence of inputs: stronger form of non-discrimination by providing an upstream input with same terms, conditions and same prices for all operators</li> </ul>

Separation of the employees	<ul style="list-style-type: none"> <li>➤ TI wholesale unit staff separated from the TI retail staff</li> <li>➤ Managements of separated units have its own incentive plans based on that specific business unit's performance only.</li> <li>➤ Physical separation of TI wholesale staff from the TI retail staff.</li> <li>➤ Code of conduct for employees for avoiding information flows between separated business units regarding confidentiality of alternative operators' commercial information</li> </ul>	<ul style="list-style-type: none"> <li>➤ Openreach staff separated from the rest of BT</li> <li>➤ Physically separated offices for Openreach staff</li> <li>➤ Incentives based on the performance of Openreach distinct from the rest of the company</li> <li>➤ Code of practice in place for compliance with the functional separation rules</li> <li>➤ Training programmes in place for implementing this code of practice</li> </ul>
Separation of Management	<ul style="list-style-type: none"> <li>➤ Separate management for TI retail and TI wholesale</li> <li>➤ Incentive systems based only on the performance of the each business unit.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Separate management for BT retail , BT wholesale and Openreach</li> <li>➤ Separate management Board for Openreach, independent of the Group</li> </ul>
Separation of information	<ul style="list-style-type: none"> <li>➤ separate information systems between network and retail units</li> <li>➤ Internal firewalls between information systems of TI retail, TI wholesale and TI network for shared databases.</li> <li>➤ Implementation of separate access systems via user access controls with three levels of password: wholesale, retail and supervisor</li> </ul>	<ul style="list-style-type: none"> <li>➤ Openreach shall have logically and physically separated information (OSS) systems from the rest of BT within a agreed period of compliance time.</li> <li>➤ Internal firewalls called "Chinese walls" to avoid the information flows regarding alternative operators between Openreach staff, BT wholesale staff and BT retail staff.</li> <li>➤ Implementation of separate access systems for these divisions built on the needs of information of the specific employee of each division</li> </ul>
Financial Separation	<ul style="list-style-type: none"> <li>➤ Accounting separation</li> <li>➤ TI retail and TI wholesale with separate budgets and business plans separated from each other</li> </ul>	<ul style="list-style-type: none"> <li>➤ Accounting separation</li> <li>➤ Openreach has a separate budget</li> <li>➤ Investment decisions regarding Openreach taken by Openreach only (except the strategic investments which have to be approved by BT Group Board upon the Openreach decision)</li> </ul>
Compliance & Reporting	<ul style="list-style-type: none"> <li>➤ Equal treatment Compliance report submitted to Agcom every six month which comprises quality of service indicators for services provided to competitors</li> <li>➤ Annual report submitted to Agcom on information systems separation compliance between TI retail and TI network</li> <li>➤ Code of conduct for employees &gt; in case of breaches the sanctions on TI foreseen.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Controlled by an independent monitoring and supervisory body " Equality of Access Board" (EAB) for the compliance of the BT with functional separation rules.</li> <li>➤ An annual summary report of EAB activities</li> <li>➤ Code of Conduct for employees diversified for BT Openreach, BT wholesale and the rest of BT.</li> </ul>

Source: own elaboration