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Co-investment and incentive-based regulation

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Content

1 The challenge of VHC networks

1.1 Impediments for larger scale investment in VHC networks

In an environment where the legacy copper networks are increasing their performance by technological innovations, it becomes a real challenge for incumbents as well as for altnets to invest in VHC networks to a large scale. This challenge exists despite the fact that fibre networks up to the customers premises (FTTH networks) are without any doubt the most reliable, best performing and most (and only) future-proof infrastructure technology. The most important challenges are the following ones:

(1) Demand uncertainty: In many countries the demand for services which can only be provided over VHC networks is limited. Currently, most user needs towards upload and download speed can also be provided by an upgraded legacy copper network. This makes demand for services provided over VHC networks at the market level as well as at the firm level uncertain and difficult to predict as long as the legacy copper network still is in place and operational. Demand uncertainty becomes a major impediment to invest if the degree of upfront investment is high compared to the level of investment which can be scaled according to actual demand.

(2) In most markets with a relevant level of VHC network penetration there is only a limited willingness of customers to pay higher prices for VHC services compared to previous broadband access services. It is also not so easy for operators to find mechanisms for price discrimination to make use of relevant variations of willingness to pay among customers.

(3) There is regulatory uncertainty about whether, to what degree and with what instrument VHC networks are regulated now and in future. The future regulatory regime is under discussion including a relaxation of regulation, but this debate is not settled in many countries and at the EU level. This means, a relevant risk which regulatory regime investors might face in the future, remains.

(4) The efficient deployment of VHC networks requires upfront investment to serve a city, a region or parts of a city or region. Only minor elements of the investment e.g. for inhouse cabling can be scaled according to actual demand. This implies that VHC network investments are mostly fixed and sunk. A high degree of sunk investment becomes a barrier to invest itself.

(5) Operators which have legacy copper infrastructure in place would cannibalize those by an fibre investment which duplicates infrastructure. They become less able to earn the high returns of a mainly depreciated infrastructure. Furthermore, they face a certain degree of cost duplication by operating two (competing) network infrastructures. The intensity of use for each infrastructure becomes less compared to a

scenario where only one infrastructure is operated. This raises profitability constraints in particular for new VHC infrastructures.

(6) Not all inherent external benefits related to VHC network can be internalized by the network operator or investor. These benefits often are service related and can be more effectively internalized by service providers operating over the top of the VHC network.

1.2 Risks of the investment in VHC networks

For an investment decision for investing in VHC networks operators usually reflect the challenges discussed in the previous sub-section in the risk premium to be calculated as part of the weighted average cost of capital (WACC). The higher the risk of a particular investment project the higher the capital cost (or requested rate of return) requirements of that project for achieving a viable business case.

The WACC used to calculate the return on capital allowed ex ante for investments into fibre-based VHC network represents the appropriate starting point. Only if there are systematic risks of VHC investments which are different to those of the copper network a supplement to the WACC may be justified. Furthermore, it is essential that this additional project-specific risk of VHC cannot be diversified away. We see potentially the following factors which may cause project-specific (or systematic) risks related to VHC investments:

(1) The risk of penetration.

(2) The risk of sufficient willingness to pay.

(3) Regulatory risks.

(4) Specific risks of certain business models.

The risk of penetration

Any efficient VHC investment roll-out is mainly supply- and only to a rather limited degree demand-driven. A fibre network cannot be rolled out according to a given customer demand at a given point in time building-by-building and/or household-by-household. Any efficient roll-out has to cover a certain district, city or region completely in the sense that the network passes all buildings and/or flats. The efficient deployment of the network is consistent with not serving certain districts or family homes so that only 80% or 90% of the potential customer base is connected to the network. In the case of FTTB all buildings of the coverage area have to be passed and connected and in the case of

FTTH all flats in a building should be connected or should at least get the capability to be subsequently connected in the short term.

It is not only the efficiency of the fibre deployment which requires a network coverage of usually at least 80% of a deployment area. It is hard to apply a successful marketing approach if the network is not capable to connect customers which are approached by the marketing measures and are willing to subscribe. Not only marketing itself would become inefficient in such a situation, provisioning processes and field service as well become more complex and expensive. Also the chain of self-supporting demand externalities is broken if interested and relevant customers cannot subscribe to the network.

The supply-driven investment path makes the penetration of the potential customer base a key factor to the profitability of the VHC investment and at the same time a key risk factor. The profitability of the network becomes higher the higher the take-up of the potential customer base is. If the penetration does not reach a certain threshold, the VHC investment may not even be profitable at all. The necessity of high penetration rates and high market shares also is the reason for the very limited degree of replicability of VHC networks as has been shown in many studies.[1]

Certain VHC scenarios generate different degrees of risk:

(1) If and when all customers of an SMP operator are migrated to the VHC platform, if there are no competing VHC fibre network platforms and if the degree of infrastructure competition by a cable network remains unchanged, then there is no penetration related risk associated to VHC which is higher than the one currently is associated with the copper network for ULL which NRA use to calculate ULL cost.

(2) As long as a new fibre VHC platform competes against a remaining copper network DSL platform, the risk of penetration becomes obvious. The existing broadband penetration, the demand for additional bandwidth, consumers' willingness to pay and the likelihood of alternative operators migrating their customers to fibre loops become relevant factors for determining penetration besides those as mentioned in scenario (1). These penetration related risk factors can be eliminated when the fibre network entirely replaces the previous copper network, which is the rational path to go anyhow following a given migration period. The last aspect underpins that the penetration related risk of VHC investment is to a large degree a risk which is only relevant for the migration period towards VHC. As long as the parameters of the migration path are totally under control of the SMP operator, one might even argue that there is no penetration related risk because it is up to the SMP operator when he wants to migrate the existing customer base (retail and wholesale) to the new VHC platform. It may in this context not be possible or even optimal to migrate the customer base in a very short period of time. This situation may be regarded differently if for instance the NRA determines the path of migra-

1 See for example Elixmann, Ilic, Neumann, Plückebaum (2008).

tion, e.g. by defining certain rules and restrictions how and when to dismantle the remaining copper network. In this context, NRAs can best replicate this 'SMP operator'-driven migration decision by offering the option for SMP operators to set a migration period of their choice if they in parallel migrate competitors to fully equivalent wholesale products which do not strand or otherwise compensate for any stranding of competitors' assets.

The risk of sufficient willingness to pay

The profitability of an VHC network roll-out depends on revenues which can be generated from using the fibre infrastructure. If only the current set of retail services, the current level of ARPU for each service and today's mix of services will be representing demand of the future, only a limited degree of FTTH deployment will be profitable. If on the other hand new retail services requiring enhanced network quality requirements in terms of speed and quality are developed which can only be delivered over fibre, an additional willingness to pay for these new services may emerge. The same holds if telecom operators will become able to sell a larger share of higher valued multi-service bundles like triple play, the level of ARPU compared to current levels may increase. If the FTTH deployment and coverage is rolled-out with the assumption of a higher ARPU level in the future, it remains a considerable risk whether the higher level of ARPU materialises in due time. VHC investments are mainly sunk once the investment has been made. This will make market exit rather costly if future demand for new services does not turn out as expected. If the business plan of the investor entails revenue assumptions which do not represent current demand but a higher willingness to pay (on a per-line basis) in the future, then the investor bears a project-specific risk which is reflected in his cost of capital and therefore has to be reflected in his return on capital.

Regulatory risk

Given the long-term nature of VHC investment, regulation may also be a risk factor for the VHC investor. If there is unpredictability of regulatory behaviour, regulation can generate a risk attached to the investment. Regulatory risk like any other non-diversifiable risk increases the cost of capital and requires a higher return to make an investment profitable. There are potentially four factors of regulatory uncertainty an investor might be facing:

(1) It is first of all the question whether a certain VHC investment would face access regulation at all or whether the investor can make its approach on whether and when it provides wholesale services to competitors on pure commercial considerations, terms and conditions.

(2) Regulation may or may not have an impact on the amount of investment expenditure if and when regulation makes obligations towards the VHC architecture to be deployed by the investor.

(3) The investor may face uncertainties about the regulatory obligations attached to the infrastructure he is investing in. In case of price regulation even the general principle of cost-based pricing (for wholesale services) may be applied in quite different forms and with different implications: The regulator may calculate costs on a current or a historic cost basis, investment expenditure may be depreciated straight-line or economically. Costs can be calculated using regulatory accounts, top down or bottom-up modelling tools. Wholesale prices may be determined from time to time using one of the measures or instruments mentioned above or may be determined by a more dynamic regulatory instrument like price caps.

(4) A further regulatory risk factor is the uncertainty about the regulatory regime and the change of parameters of regulatory instruments over time. It is less the potential change of regulatory regimes or parameters which generates a systematic risk. It is more the discretionary change which is not correlated to predictable economic parameters, like on SMP position, which generates uncertainty and risk.

All the factors mentioned above do not generate a regulatory risk increasing the cost of capital to the investor over the whole lifetime of the investment. Some risk factors only depend on single regulatory decisions to be taken. One example is the regulatory decision whether the SMP operator would have to face a certain type of access regulation or whether obligations apply to the VHC architecture. If such regulatory decisions are taken prior to the investment, they generate by definition no regulatory risk at all because the investor knows the relevant regulatory regime before he actually commits to the investment. Only when such decisions are subject to change ex post a regulatory risk may remain. Usually investors are only committed to or can commit themselves to a certain period of time and the risk of change in relevant regulatory parameters remains. It is important to mention here that the baseline of regulatory risk of regulated entities is already reflected in the company-specific risk of the operator.

NRAs have it mostly in their hands to manage the regulatory risk and to limit or reduce it to a socially optimal value. By managing the regulatory risk of the investor properly, NRAs contribute to keep the capital cost of the investor, the incumbent operator as well as its competitors, low. By drawing up principles of VHC related regulation in due time, NRAs provide greater clarity. Specifying in advance to the investment the principles of tariff regulation that will apply to unbundled fibre access by an SMP operator constrains regulatory risk related to price control significantly.

Theoretically, a NRA could eliminate the risk of changing the parameters of its approach towards price control totally, if it fixes the parameters of the price control formula for the whole period of the economic lifetime of an NGA investment. This approach vests the

greatest possible certainty in regulatory conduct and therefore eliminates the regulatory risk. A multi-year tariff regulation lowers or eliminates uncertainty for SMP operators and for access seekers. Both market parties face more predictability for their respective business plans. Alternative operators can make more rational and efficient decisions on their choice of make (invest in their own infrastructure) or buy (using wholesale services of SMP operators). SMP operators or investors can maximise operational efficiency. The crucial point, however, is that this approach could maximise the risk of erroneous regulatory intervention, if we are, for instance, talking about a 20 year regulatory period. If the market dynamics or technological developments change, however, too long a regulatory commitment can cause errors and inefficiencies. The Netherlands' NRA OPTA, concludes on this trade-off in a way which we share and support: "*Advance specification of the framework governing how potential future intervention will take place, without setting out the precise details of that regulation reduces the risk of erroneous intervention. At the same time investment incentives will not be prejudiced*."[2] For this reason it is socially not optimal that the NRA commits itself for an unreasonably long regulatory period. Therefore, the attempt to eliminate the regulatory risk has an opportunity cost and is not a value in itself. This can be shown by taking the analogy to an investor's business case. If major market parameters have changed, it is not rational and efficient for an investor to orientate its decisions to the original business plan made prior to the investment. If the changes are strong enough, it becomes more rational to adapt the business plan to the new market environment.

Risk management

We mentioned already that the equity risk premium covers only the diversifiable risk. We discussed several risk factors which might generate systematic project-specific risks of VHC investments that probably will not be covered by the efficient capital market hypothesis in the equity risk premium. These project-specific risk factors may be covered by supplements to the "normal" equity risk.

It is, however, worth mentioning that there are other measures at the disposal of the company itself to manage systematic risks. Among the measures regarding a positive management of risk are optimal use of resources, achievement of a high growth rate and maintaining long phases of profitable growth. Besides the positive risk management there are also measures to decrease risk like hedging, insurance, and selection of a capital structure that takes account of this risk. Project-specific risks can also be reduced by sharing or transferring parts of the risk to end-customers, access seekers and vendors. Another factor reducing the risk of FTTH investment for an incumbent is the cost saving gained by the reduction of ongoing OPEX compared to copper based networks, together with more short term capital benefits if exchange buildings can be sold.

2 OPTA (2008), p. 20.

Risk and business model

The project-specific risk of VHC investment depends on the business model. First of all, the systematic risk depends on the asset-specificity of the VHC investment. According to this criterion, investment in non-replicable physical assets such as civil engineering infrastructure is less risky than investments in certain VHC architectures. Because of non-replicability such investment has a bottleneck nature and generates a relevant first mover advantage against competitors. Furthermore, these physical infrastructures like ducts can be used for other purposes than VHC. The European Commission even concludes that civil engineering investment is not specific to the deployment of VHC networks and would therefore not generate a systematic VHC related risk which would have to be compensated by an VHC risk premium where access obligations are imposed on SMP operators.[3]

Major parts of the FTTH investment on the other hand are VHC specific. Therefore, there may be a higher risk attached to the deployment of FTTH. These risk factors relate to penetration, customer willingness to pay and take-up of new services. FTTH could entail a risk, particularly in areas where increased ARPU assumptions are required for the business plan to be viable, which are not balanced by compensating OPEX reductions.[4] In these circumstances, access to the unbundled fibre loop should be calculated on the basis of a cost of capital which includes an VHC specific risk premium.

Jay et al. (2013) have calculated that the investments for deploying FTTH are four to five times higher than the investments for deploying FTTC. Investment into FTTC is more a partial upgrade of the existing access network than investment into a new VHC architecture. There is less uncertainty involved about demand for bandwidth delivered via VDSL Vectoring. These VHC investments should therefore have a significantly lower risk profile than investments into FTTH.[5] FTTC investments are not only less risky than investments into FTTH. There are even doubts whether there is a VHC specific risk to be compensated via a risk premium when calculating the cost of WBA based on VDSL at all. The same holds for access to the copper sub-loop.

As in the broadband market today it should also be expected for VHC that the relevant retail markets are (significantly) more competitive than the corresponding wholesale markets (WBA, fibre ULL, ducts). Furthermore, there are VHC related risk factors that are relevant to the retail business but not to the wholesale business. Therefore, the VHC specific risks of an integrated retail/wholesale business model are higher than the systematic risks of the wholesale-only business model. For calculating the appropriate

3 EU Commission (2009), Rec. 13 and Annex I, Nr. 2.
4 FTTH networks compared to copper based networks imply a lower OPEX level which mainly results from the higher share of passive equipment in the FTTH case. Generally, the maintenance and operating effort is lower for passive equipment than for active equipment.
5 Only the weaker competitiveness of VDSL against cable compared to FTTH works in a different direction.

risk premium for the costs of the wholesale service, NRAs should not derive it from an integrated business model or should exclude the retail related risk factors.

Final evaluation of the risk of VHC investment

Our analysis and findings on the risk of VHC investments can be summarised as follows:

(1) It is only the systematic NGA specific risk and which is not diversifiable which might need to be compensated by a risk premium as part of the capital cost of fibre investments.

(2) Relevant for determining VHC specific risks are the risk of penetration, the risk of sufficient willingness to pay, the regulatory risk and specific risks of certain business models. Risk increasing factors should be balanced against risk decreasing factors like capital benefits and OPEX reductions resulting from VHC deployment compared with existing copper access infrastructure.

(3) The risk of penetration is closely related to the supply-driven nature of any efficient fibre network deployment. The profitability of any VHC roll-out and/or the degree of profitable coverage depends on the penetration of the potential customer base. If and as soon as the whole (retail and wholesale) subscriber base of an SMP operator is migrated to the (new) VHC platform, the penetration related risk is close to zero. If and as long as a new fibre VHC competes against the (remaining) DSL platform, there might be a remaining penetration risk.

(4) The risk of penetration will be lower if the operator offers wholesale access, due to the stimulating effects of competition on retail demand.

(5) The profitability and the degree of profitable coverage depends on the average revenues per access line to be generated. If the business plan of the investor entails revenue assumptions over and above the current level of revenues, the investor bears the risk to meet these demand and willingness to pay expectations.

(6) Given the long-term nature of fibre investment, regulation can be a relevant risk factor. There is no regulatory risk related to decisions to be made before the investment is actually made. It is more the change of the regulatory regime and of regulatory parameters over time which defines a regulatory risk. NRAs can manage this risk and keep it low. It is, however, socially not optimal, to eliminate it totally. The baseline of regulatory risk is already reflected in the company-specific risk of regulated entities.

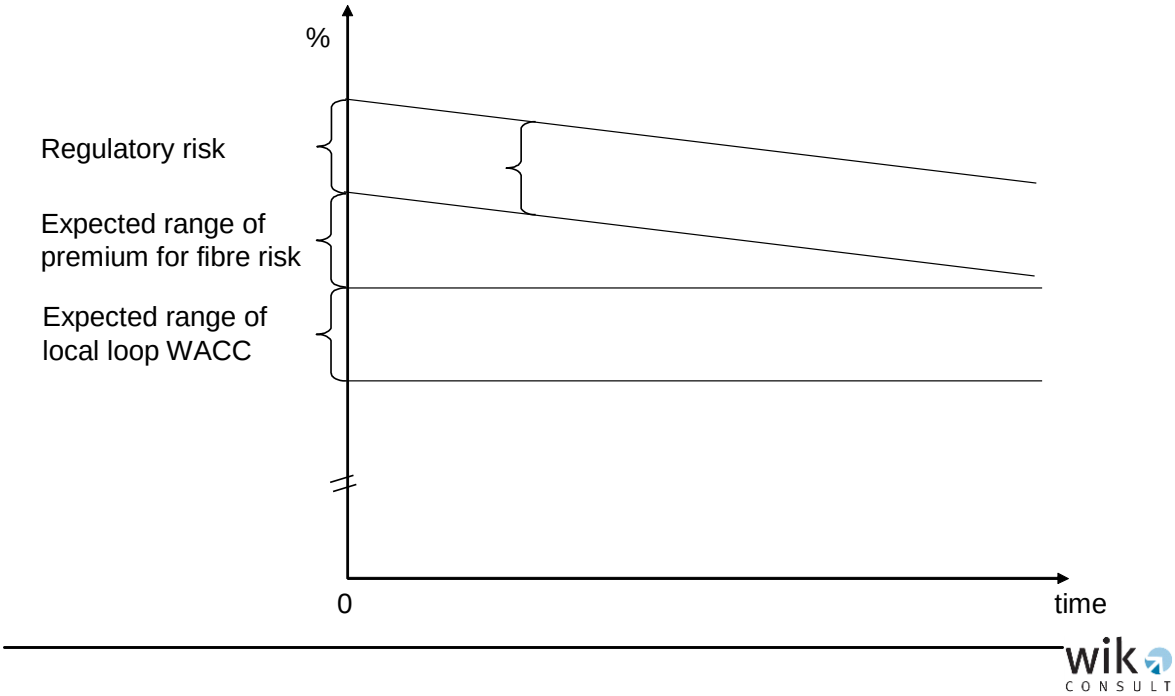
(7) Because there is a retail-specific risk in VHC, the risk of an integrated wholesale/retail business model is higher than the risk of the wholesale-only business it-

self. It is only the latter one which should be taken care of in calculating the access prices.

(8) The risk of investment will be lower for an incumbent, since he could sell parts of its existing MDF buildings and potentially other assets used in the former copper based network and use this income for effectively reducing the FTTH investment. This option does not exist for other companies so that he faces higher risks of investment. The altnet also has to consider disadvantages due to its lower market share compared to that of the incumbent. Furthermore the capital costs of altnets usually are higher than those of incumbents.

The project-specific risks of VHC investments can be illustrated by the following diagram, which represents the so-called "all risk WACC", which OPTA (2008) has applied for fibre access.

Figure 1: Elements of the project-specific risk of VHC networks



Source: OPTA (2008)

The base line is the WACC applicable to the existing copper local loop, which is relatively stable over time. The second element is a premium to the WACC representing the demand related risks of penetration and willingness to pay. This risk is expected to be higher at the beginning of the investment and decreases gradually over time. The third element takes account of asymmetrical regulatory risks.

2 The economics of co-investment

2.1 Mechanisms of risk sharing

Investors can limit or reduce their risk attached to a certain investment when they share the risk with other stakeholders. Investors in FTTH can limit their risk when they shift parts of the investment to the users of VHC networks. They might do it via a wholesale business model, so that altnets market the incumbent's infrastructure. VHC investors may go into co-investment arrangements with one or several of their (potential) competitors to share exposure to risk. Furthermore, VHC investors may diversify the investment risk by certain access pricing regimes for access seekers and/or long-term contractual arrangements with access seekers.

It is often assumed that risk-sharing arrangements automatically limit or reduce the project-specific risk of investment. The ERG for instance argues in an NGA report: "*Co-investment and risk sharing arrangements have as purpose to limit the risk of investment and as a result lower the cost of capital for investments*."[6] This is, however, not the case, at least not necessarily and not in each particular case. In many cases risk sharing arrangements do not reduce the overall (or social) level of risk attached to a certain VHC investment. The nature of such arrangements only means to redistribute a given investment risk to other market participants. The overall or remaining risk of the investor will nevertheless be decreasing due to the reduced capital committed by each party.

Investment sharing between the user and the investor

In the very end it is the user of a telecommunications infrastructure who finances and pays for the investment. The mechanism by which this transposition of the financing of investment usually happens is through the "user cost of capital" (depreciation plus interest) calculated as part of the product price on a pro rata basis in terms of quantity and timing of use. Over the lifetime of the infrastructure (or a bit earlier in case of a profitable investment), the user actually pays for or refinances the infrastructure investment of the investor.

This common transposition mechanism of the market interaction between the user and the investor can also be organised in a different way regarding the timeline of such payments. Telecommunications has a long history from its beginning that the user directly contributes to the investments of a (new) network. Why should this model not be activated in the context of VHC networks, which is in case of FTTH by far the largest investment the telecommunications industry has ever made? This model has particular relevance for those part(s) of the investment which are specific to a single user or a

6 ERG (2009), p.22.

dedicated group of users. In the context of a VHC network (as in any other fixed-line network) the directly user dedicated part of the investment relates to inhouse cabling and the drop cable as the connection of a building from the street.

The sharing of investment between the user and the network operator can take two forms: Either the user takes responsibility of the investment into these network elements himself or he makes an ex ante financial payment to the operator in the amount of the user specific investment. Both approaches have specific comparative advantages and disadvantages which we do not want to analyse here in detail. Both approaches, however, are suitable approaches to reduce the investment exposure of the network operator and are reducing the risk of the investment. The user de facto makes a lump-sum payment at the beginning of the use of VHC services and has to pay lower monthly rentals (in case of competition) because the user cost of capital for using the service is lower. At the same time this mechanism of investment sharing leads to a sharing of risk between the user and the network operator.

This model of risk sharing is competitively neutral because under a cost-based pricing regime the wholesale price is calculated on the net investment costs of the SMP operator. These net costs reflect the savings in investment costs which are due to the direct investments of the end-user or its financial investment contribution. This risk sharing approach is, however, not competitively neutral against other platforms (eg. cable, mobile). Because the user is directly investing in platform-specific network elements, he has a sunk cost related to this platform. This generates switching costs to other platforms.

In the main part of this section we will focus on risk sharing between investors or competitors.

2.2 The nature of VHC co-investment arrangements

Certain characteristics of the deployment of VHC facilitate or indicate the cooperation of stakeholders or competitors in the market such that these potential competitors jointly arrange the infrastructure investment, share the cost and the risk of the investment:

(1) FTTH networks are in most relevant cases not replicable such that the parallel deployment of end-to-end fibre network infrastructures is an unrealistic scenario.

(2) The high level of investment required for a major coverage of the fibre network in a country may even overburden the cash flow assets of an incumbent operator. Sharing of the investment cost can make it easier to participate in the network roll-out at all and can reduce the exposure of any single operator but does not reduce risk overall per se.

(3) Diversifying the risk of fibre deployment on several shoulders by some form of investment and risk sharing may lead to a more timely and faster deployment of VHC networks.

(4) Co-investment of several market players will reduce or eliminate the first-mover position of a single VHC investor and put co-investors in a more equal position in the retail market competition.

(5) All operators in the market including the incumbent face at least some level of financing constraints. Co-investment arrangements could potentially at least help to overcome such financing constraints.

(6) Under appropriate non-discriminatory rules of access to the jointly invested network infrastructure cooperation can both reduce penetration risks for the joint investors in FTTH and support competition.

Potentially there may be numerous forms of co-investment arrangements. Fundamentally, they can be grouped around the following three models:

(1) Two or more partners jointly undertake the investment in a certain region, city or district. Under such build and share arrangements the partners jointly own the network infrastructure usually arranged through a joint venture entity in which the partners take all (or most) of the equity shares (the "joint venture model"). The investment arrangement then has to define rules under which the partners get access to the capacity and rules on sharing the investment and operating cost of the network. The arrangements also have to address the access opportunities for third parties which do not take equity shares in the joint venture.

(2) A single investor may also set up co-investment arrangements with partners (the "investor model"). Under such arrangements the investing operator takes the decisions on the investment and the ownership rights in the network infrastructure. Prior or after the investment decision and the roll-out, the investor grants his co-investment partners rights of capacity use usually in the form of indefeasible rights of use, unbundled access or bitstream access. A typical model of this type is the cooperation agreement Swisscom is offering in Switzerland.[7] The fibre network is rolled out in a multi-fibre approach. Partners would get access to their own fibre to the home at the distribution point and receive indefeasible rights of use to this part of the infrastructure. Investment and operating costs are usually intended to be shared on either equal sharing rules or some more sophisticated rules which take care of retail market success and/or prior commitment of capacity.

(3) Two (or more) investors agree in which areas (regions, cities or districts) each of them is deploying independent from each other a fibre network. Under the cooper-

7 The details of this model are elaborated in Section 3.3.

ation agreement the partners agree on the deployment area of each partner and the swapping of capacity using rights in each others deployment area (the "swapping model"). Rights of use can be based on a multi-fibre approach, on unbundled access to fibre loops or on bitstream access.

All co-investment arrangements have to address answers to the same questions. The most prominent ones are:

- Who makes decisions on investments, costs and roll-out?
- What is the technical mode of access for cooperation partners?
- What are the rules of sharing the investment cost?
- What are the conditions of access for third parties which do not take a stake as co-investors?

The models mentioned above do not by themselves indicate certain predetermined answers to these questions but favour certain outcomes.

The pure joint venture model gives each co-investor equivalent rights to make decisions. The symmetry of partners here only depends on the equity shares in the joint entity and the distribution of rights according to the equity positions. In the joint venture model, providing no operator maintains overall control of the co-investment vehicle, the usual dichotomy between the role of the investor and network owner on the one hand side and the role of the access seeker on the other hand side become rescinded.

In the investor model the distribution of rights is much more asymmetrical. The investor is the dominant decision maker in this model. Its position is even stronger if the investor is the SMP operator in the market. If the cooperation partners join the investor prior to the investment their influence on network roll-out, network architecture and costs of investment is larger.

By nature the swapping model looks like a rather symmetrical model. Each investor has decision autonomy in its own deployment areas and has incentives to minimise costs. In practice, symmetry may be distorted by different areas which the cooperation partners intend to deploy with fibre. If the areas are of different size and different costs, the arrangements may have to foresee financial compensations besides swapping of capacity.

The technical mode under which the cooperation partners can access the fibre infrastructure are not predetermined by the form of the cooperation model. In all three models access to capacity can be arranged in a multi-fibre approach, via single fibre unbundling or through bitstream access. The multi-fibre approach which we analyse in detail in Section 2.5 offers the deepest level of end-to-end control for a cooperation partner. At

the same time it requires a relevant amount of unshared own investment if the access is handled at the distribution point. The swapping model tends to an unbundling or bit-stream access approach amongst the swapping parties.

Under symmetrical circumstances the swapping model may work without cost sharing or other forms of financial compensation between the investor in a region and the access seeking partner. The typical cost sharing rule of the joint venture and the investor model splits investment costs on equal shares. This sharing rule can, however, cause very severe competitive asymmetries. Under such a sharing rule costs per customer served will depend on the market share distribution between the cooperation partners.[8] This may imply that one partner due to retail competition will become a profitable entity and the other one a loss making entity. For becoming viable and stable, more intelligent sharing rules may be needed to make such cooperation work in the long-term. To solve the symmetry problem related to market share dependent costs, the cost shares have to be more related to the effective market shares partners actually achieve. On the other hand, if the cost allocation is managed ex post, the risk sharing mechanisms in the cooperation model may not materialise. A possible solution may be a cost sharing according to capacity commitment which may be adapted to actual market success to a certain degree.

From a regulatory but also from a certain business perspective cooperation arrangements cannot work as closed shop agreements where only the cooperation partners would get access to a bottleneck infrastructure. Otherwise, the cooperation arrangement would be a collective foreclosure agreement. There is a natural tendency and incentive that the investor and under a cooperation arrangement the cooperation partners jointly are looking for more favourable conditions to use the infrastructure and to compete in the retail market at more favourable conditions compared to third parties.

Under the perspective of effective competition a regulator should check that the internal pricing conditions imputed to the downstream arm of an SMP operator within a co-investment arrangement reflect those available to third parties. Such checks should include internal prices reflecting long-term commitment discounts where permitted and undiscounted prices. In both cases, pricing should be consistent and no margin squeeze should apply.

2.3 Incentives for incumbents to engage in co-investment

The full potential of co-invest can only be materialized if the incumbent operators participates in the co-invest arrangements. Usually, the incumbent represents the largest single broadband market share. If he is not using the new VHC infrastructure either as a co-investor or as a wholesale access user then it might become difficult if not impossible to run a positive business case for the VHC infrastructure. This strong economic

8 For details see Section 2.5.4.

position also gives the incumbent a strong negotiation position. The negotiating position of the incumbent is further strengthened because he owns the legacy copper infrastructure. This can either be used to aggressively compete against a new VHC infrastructure or it might be decommissioned as part of an VHC co-invest arrangement, just to refer to the two extreme cases. Furthermore, the duct system of the legacy copper infrastructure can be an important resource to build the VHC network most efficiently.

Given this strong starting position of the incumbent what could motivate him to engage in a co-investment model instead of building the VHC network on a stand-alone basis and potentially renting parts of the capacity on a wholesale basis to downstream competitors?

If the incumbent engages in a co-invest with one or several of his fixed-line competitors he would only face a very limited risk of becoming overbuild by a competing second VHC infrastructure. This reduces the firm-specific risk significantly and lowers the cost correspondingly by a more intense use of the infrastructure. Compared to the status quo the extent of network coverage would be larger in a co-invest scenario. This will make it easier to internalise externalities from services and applications which are only provided if the fibre network coverage is large enough to generate corresponding incentives for service providers to make use of the VHC network's capabilities.

Depending on the number of co-investing partners and their degree of participation the incumbent would have to provide a lower degree of CAPEX for the same or even extended network coverage compared to a stand-alone approach of investing. Given the balance sheet constraints of most incumbents they are capital constrained for larger scale fibre investment programs. Co-invest helps to overcome such constraints.

If co-invest is organized in a wholesale-only structure this model supports a more competitive market structure at the downstream level. Anti-competitive discriminatory practices may become less likely to occur. This would make it easier for regulators to relax regulatory obligations and to commit some longer-term rules of regulation than under the status quo SMP regime. We discuss this context in more detail in Section 4.

2.4 Altnet's incentives to engage in co-investment

Some of the reasons which motivate incumbents to engage in co-invest arrangements also hold for altnets. There are, however, some major differences in the motivation. Lowering the risk of deployment, an extended network coverage and avoiding capital constraints also hold for altnets. Avoiding or minimizing the risk of overbuild is an even stronger motivation for altnets than it is for incumbents. The risk of facing overbuild is larger for an altnet than it is for an incumbent.

Partial ownership of the VHC infrastructure provides altnets a benefit which they cannot achieve under the status quo: They are much better protected against discriminatory

use of the infrastructure as in the role as an access seeker. The incumbent and the altnets effectively use the infrastructure in an co-invest environment under equal terms and conditions. In particular they are no longer facing asymmetric information on strategic depolyment decisions. There is more a level playing field than the currently regulatory framework can provide it. This holds in particular for non-price discrimination in the provision of wholesale services.

On the other hand, by co-investing with the incumbent altnets loose their opportunity of 'wait and see' if the investment pays as they have it under the current framework and they do not have to commit themselves up-front. They only have an incentive to give up these current options if they have sufficient assurance that the governance structure of the co-invest model effectively prevents discrimination. This assurance might be critical in the (usual) case that the incumbent will take the largest stake in the co-invest structure and will be its largest customer.

In many cases co-invest is the only option for altnets to participate in the infrastructure level of the business. They could not realistically undertake large scale network deployment in the access network on their own. Co-investing in several areas may also be an opportunity to avoid some of the risks associated with VHC investment in a particular area.

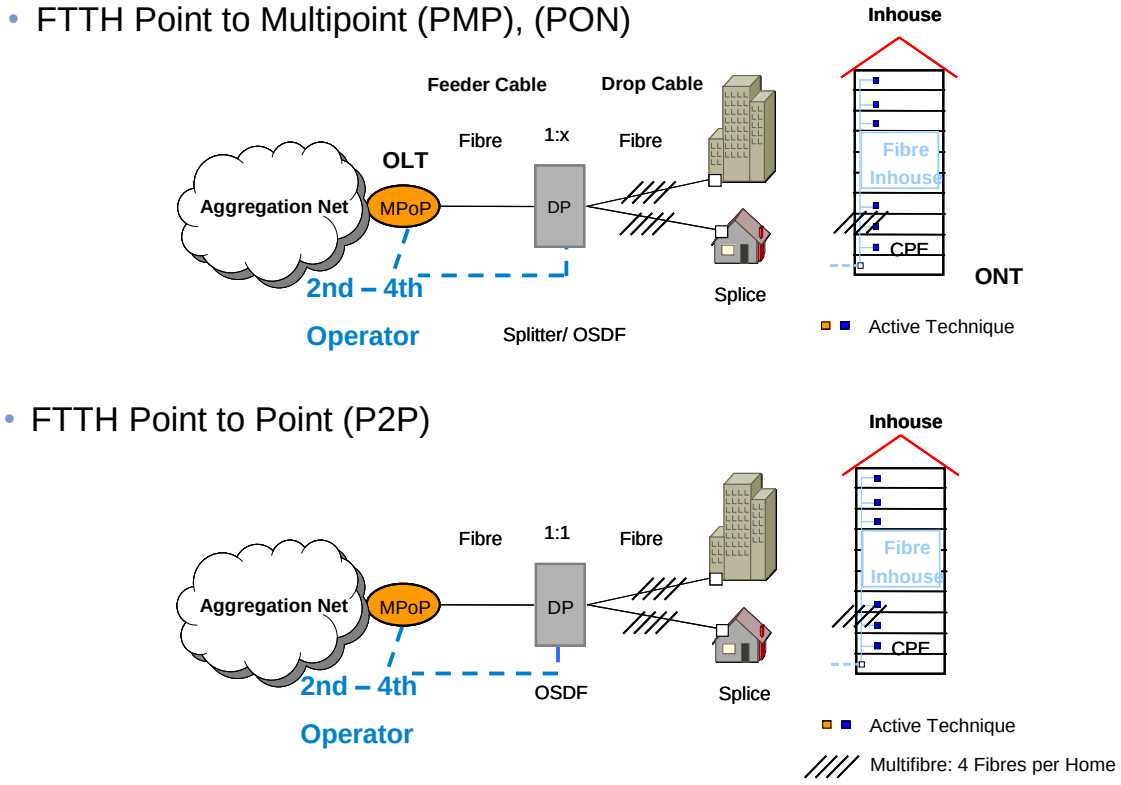
2.5 The multi-fibre approach as a specific form of co-investment

2.5.1 Basic characteristics

The P2P FTTH architecture establishes a direct fibre connection between the customer home and the Metro PoP (MPoP), which offers high capacity connections without any electromagnetic interference or cross talk noise and not being affected from major attenuation problems like in FTTC VDSL architectures or, to a lesser extent, in cable TV networks. Thus these networks allow to offer a homogenous bandwidth in the area, not being dependent from the copper sub-loop length.

The nowadays relevant two FTTH architectures are fibre point-to-point (P2P) and Passive Optical Network (PON). With fibre P2P there is an individual fibre connection from each home to the MPoP, while PON concentrates an amount of fibres from the homes (up to 128) to one single fibre using a splitter in the Distribution Point (DP). Administering the multiple use of the single fibre by an GPON OLT causes a bandwidth limitation for the commonly used downstream signals to 2,5 Gbps and for the upstream signals to 1,25 Gbps. P2P in contrast only is limited by the port speed of the end systems in the customer home and the MPoP, thus offering 1 Gbps per home – or even more - in a symmetric manner.

Figure 2: FTTH architectures



Multiple-fibre architectures deploy more than one single fibre per home, e.g. four, in the drop cable segment and (optionally) in the feeder cable segment, in order to enable several operators in parallel to get access to the same end-customers and thus offering the end-customers a wider choice – on the infrastructure level limited to the four operators. The investing operator connects at least one fibre per home to its ongoing feeder network up to the MPoP. The second to fourth operator each shares fibres in the drop cable segment to the end-customer homes and in principle has the choice to connect these fibres to its own separately ducted feeder network (e.g. local power utility ducts) at the Distribution Point or to also share fibres in the feeder infrastructure up to the MPoP and collocate there.

Comparing multi-fibre with a fibre unbundling approach at the DP or MPoP one will not find differences in quality for the transmitted signals but may identify less process risk in switching on and off new services, because the fibre has not to be changed between the operators and providing a new service could happen in parallel to an existing one, which then might be switched off later. The operation of the fibre is done by the investor in the multi-fibre case and by the incumbent in the fibre unbundling case, thus normally by a third party from the view of an access seeker. If both the investor respectively the

incumbent equally operate the fibres, the process between the access seeker and the fibre operators for failure analysis and repair have to be synchronised and performed in the same manner and therefore do not differ from each other.

2.5.2 Examples of multi-fibre

There are three slightly different multi-fibre approaches implemented or under discussion in Europe: the approach of ARCEP in France, the approach of Swisscom in Switzerland and the approach of the EU Commission in the NGA Recommendation. Each of them has different economic impacts.

The ARCEP approach defines a multi-fibre infrastructure to be implemented by the first investor in a mandatory manner (building-by-building on demand of competitors) in very densely populated areas which are explicitly listed. The distribution point may be within the building or very close by. Thus, the shared part of the network (inhouse network up to the distribution point) is relatively short. A distribution frame in the distribution point has to be provided on demand, an alternative option is a fixed splice of the fibre. Sharing of the feeder infrastructure is not foreseen. The assumption is that very densely populated areas may allow several separate feeder infrastructures to be economically viable.

The Swisscom approach is a voluntary unregulated attempt to achieve mutual agreements between competitors in Switzerland addressing a region, a city or a district.[9] The investor is installing four fibres per home being concentrated in a manhole as the distribution point. The distribution point comprises a larger amount of buildings and is located outside of the buildings in the street. Thus the shared part of the network seems to be larger than in the ARCEP approach. The multi-fibre areas are not restricted to very densely populated areas, rather the approach is intended to be used in major parts of the country. The distribution point only houses splices between the fibres to the homes and the feeder networks of the different operators. Distribution frames are not planned. There is an option to also share the feeder infrastructure up to the MPoP. In this option access is provided at the MPoP.

The EU Commission's approach is a voluntary approach, but may be an obligation on SMP operators in the drop cable or terminating segment, if that is feasible from a regulatory and legal perspective. It defines a distribution point comprising several buildings with an amount of homes which enables a viable access opportunity for competitors to collocate. The distribution point in any case houses a distribution frame enabling easy mutualisation of the drop fibres. Standard element of the Commission's approach also is the investment sharing of the feeder infrastructure up to the MPoP, thus enabling a major part of the network investment to be shared between the operators.

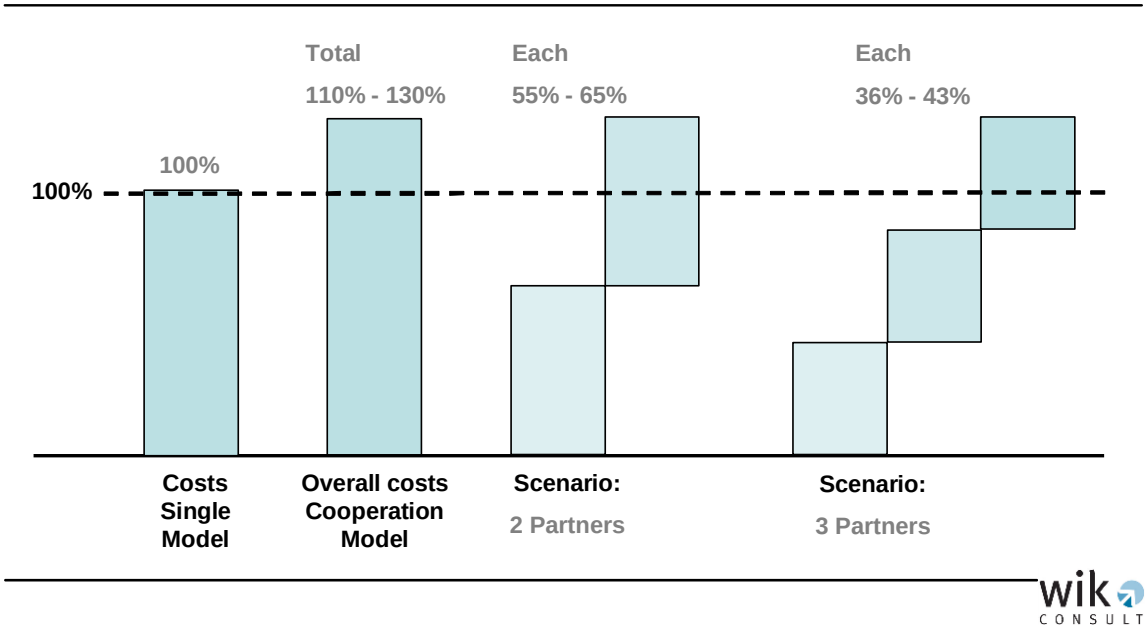
9 We reflect the Swiss multi-fibre case in more detail in Section 3.3.

Multi-fibre with hand-over at the MPoP is the only multi-fibre architecture which allows one or even all of the participating co-investment partners to offer a wholesale unbundled fibre local loop service to (other) access seekers. A fibre hand-over at the DP implies wholesale sub-loop unbundling only.

2.5.3 Cost comparison between a single fibre and a multi-fibre architecture

There are not too many cost modelling approaches which compare the investment cost of a single fibre with a multi-fibre architecture. Swisscom assumes the total investment cost to increase by 10% to 30%.[10] Figure 3 shows the impact of the sharing assumptions on the distribution of investment cost. Compared to the single fibre architecture, the investor has to bear only 55% to 65% of the total investment. The same holds for his investment partner. Both partners can reach 100% of the potential customer base at a lower investment than on a stand-alone investment case.

Figure 3: Potential investment cost distribution in the multi-fibre model



In a detailed cost modelling exercise for the Swiss NRA BAKOM Ilic et al. (2009) have calculated the investment cost for a nationwide fibre network in Switzerland under various architecture assumptions. An operator which deploys the fibre network with multiple (e.g. four) fibres to the individual end-customer faces the following additional cost compared to an architecture which only deploys one fibre per household:[11]

10 See Gromard (2009).
11 See Ilic et al. (2009), p. 65ff.

(1) Inhouse cabling: More fibres per customer requires cables with more fibres and additional splices within the building.

(2) Manhole: A manhole is needed as the point of interconnection between the co-operation partners. In addition slicing is needed at this point of interconnection.

(3) Drop cable: If properly dimensioned the standard trench meets the capacity requirements of the additional fibres without additional cost.

If the point of interconnection is not the distribution point (close to the customer) but the central office at the MPoP additional incremental cost occur in the feeder segment of the network:

(1) Manhole: Four splices are needed for each household for interconnection at the MPoP.

(2) Feeder cable segment: The feeder cable now leads four fibres per household instead of one. This requires larger cables and more important larger trenches.

(3) MPoP: Each fibre terminates at the network related port. Single fibre only needs one port per potential customer, multi-fibre needs four ports.

This analysis already shows that the additional cost of multi-fibre depend on the location of the point of interconnection between the networks where the individual networks are connected to the shared part of the network. In case of access at the MPoP a larger part of the network will be shared and needs to be overdimensioned accordingly. Therefore, the additional costs are higher in case of access at the MPoP. Nevertheless, in an overall efficiency consideration access at the MPoP leads to less network duplication and therefore to less overall network costs if the combined network cost of the cooperation partners are being considered.

There is another structural costing result which is of importance: The additional cost of multi-fibre depend on density. In the more denser (or lower cost) areas the additional investment cost are relatively higher than in the lower density (or higher cost) areas.

In quantitative terms, Ilic et al. (2009) generated the following results: The investment cost of multi-fibre exceed those of the single fibre architecture in case of access at the distribution point between 11,6% in the highest density cluster and 2,2% in the lowest density Cluster 16. In case of access at the MPoP the additional investment cost vary between 26,3% (Cluster 1) and 11,5% (Cluster 16).

These additional investment costs also have an impact on the profitable coverage with fibre. In case of multi-fibre with access for two operators at the distribution point, FTTH can be deployed profitably for 42% of population in Switzerland. In the single fibre case the profitability boundary amounts to 60% of population.

2.5.4 Access-based competition by unbundling and infrastructure based competition by a multi-fibre model

In this sub-section we will discuss comparative advantages and disadvantages of an unbundling and a multi-fibre approach. For didactical purposes we assess the two approaches against each other. From a regulatory policy perspective, however, we do not see the relationship of the two approaches as mutually exclusive. Instead, as we will show, the greatest economic efficiency benefit is achieved, if both options are regarded as complementary to each other such that operators have a choice between them. Operators should have the opportunity to make their choice unconditional such that one operator can choose a multi-fibre approach and another one the unbundling approach. In the same way one operator should be able to prefer the multi-fibre approach in one particular area and unbundling in another area.

The multi-fibre model has the following advantages:

(1) The multi-fibre model generates competition at the deepest level of the network and provides a relevant model of replicability of the fibre at lower costs than the end-to-end infrastructure duplication.

(2) If the SMP operator as the investor finds partners for this model, he may have a stronger investment incentive and may expand the scope of coverage of the FTTH roll-out compared to a single fibre approach.

(3) The altnet has a better end-to-end control over his network infrastructure.

(4) The altnet(s) as well as the SMP operator has significant sunk cost investment and can therefore not engage in destructive hit-and-run competition. As, however, the complementary investment to be made by the altnet in the unbundling approach directly has a similar effect, but of course the overall amount and share of sunk investment becomes significantly larger under the multi-fibre model.

(5) The multi-fibre model allows for a competitive scenario where the user can get different services from different operators. In case of full unbundling (and no infrastructure competition) the user only has access to one single access line to his/her home and has to receive all line-based services from one operator, whom he/she might of course change from time to time

(6) The multi-fibre approach potentially can contribute to solve the termination monopoly problem. A user could for instance subscribe to different termination services from different operators.

(7) In cases or scenarios where the multi-fibre approach actually has achieved effective competition, regulation may become obsolete.

Besides these advantages the multi-fibre approach is also characterised by a relevant amount of disadvantages:

(1) The significant higher requirements of sunk investment generate a significantly higher barrier to entry for non-SMP operators.

(2) The number of competitors is determined by the market in the unbundling model. In a multi-fibre model unconstrained by regulation, the maximum number of competitors is determined ex ante by the investor and his decision on the number of fibres to be deployed. It is fair to say, that this restriction may be overcome by a secondary market of fibre lines, e.g. on the basis of unbundling.

(3) The overall investment costs are 13% to 23% higher in the multi-fibre approach compared to a single fibre approach. There are also some additional wholesale-specific investment costs related to the unbundling model (billing, reporting, …). But they are negligible compared to the incremental investment costs of the multi-fibre model.

(4) Depending on the distribution of market shares, the multi-fibre model can cause significant asymmetries in per customer costs and can therefore result in unsustainable competition.

(5) Although the multi-fibre model increases the replicability of the infrastructure, in most relevant cases the number of competitors is, however, limited to two, with the exception of co-investment by four operators with similar scale in dense areas.

(6) The dynamics of the multi-fibre model either tend to unsustainable competition or to a symmetrical market position with strong incentives for both partners to (explicitly or implicitly) collude.

Besides these comparative aspects of the unbundling model mentioned so far, there are some specific advantages of this model which still need to be mentioned:

(1) The unbundling model has a proven track record in the EU as an effective access-based competition model.

(2) The risk of market entry is lower. This is of particular relevance when a new entrant is entering the market or when the current market share in the broadband market is significantly lower than that of the SMP operator.

The major competitive asymmetries caused by the typical cost sharing rules of a multi-fibre model can best be demonstrated by a numeric example. Let us assume that the investment cost in the multi-fibre approach are 20% higher than in the single fibre network. Two operators co-invest and share the investment cost on an equal basis. Let us

further assume that the (capital) cost per line and month is 10 € in the single fibre case. Table 1 shows the resulting cost per line under various market share scenarios. The figures only relate to the shared part of the investment, which is representing around 80% of total investment.

Table 1: Cost per line in single fibre and multi-fibre network

Single fibre + unbundling	**Incumbent**	**Market share**	100%	80%	60%	50%	40%
		Cost per line	10	10	10	10	10
	Altnet	**Market share**	0%	20%	40%	50%	60%
		Cost per line	0	10	10	10	10
Multi-fibre case	**Incumbent**	**Market share**	100%	80%	60%	50%	40%
		Cost per line	6	7.50	10	12	15
	Altnet	**Market share**	0	20%	40%	50%	60%
		Cost per line	∞	30	15	12	10
	Assumptions: (1) Only shared investment considered (80% - 85% of total invest) (2) Two cooperation partners considered (3) Investment multi-fibre model = 120% investment of single fibre model (4) Sharing rule: 50:50 (5) Numbers are for illustration purposes only						

In the single fibre case under cost-based LRIC pricing the incumbent and the altnet always face the same cost per line. Furthermore, the cost per line and under cost-based LRIC pricing also the price for the wholesale service is independent of the market share distribution between the incumbent and the altnet. It is only the total number of lines sold in the market which determines cost.

In the multi-fibre case and an investment cost sharing rule it is no longer the total lines sold in the market which determine the cost for each operator. Instead, it is the share in the investment cost which determines the cost per line for each operator. To reach the same level of cost an operator has to achieve a market share of at least 60%. In this case the cost of the competing operator are higher by 50%. In case one operator only achieves a 20% market share it has a cost disadvantage of 300%.

Besides these differences there are also some very relevant commonalities of a competition model based on unbundling and one which is based on a multi-fibre approach.

(1) The overall project-specific risks of the fibre investment are not too different from each other. The lower risk for the SMP operator in the multi-fibre approach results simply from the shift of parts of the investment risk to the cooperation partner(s). In sum, the investment risk remains more or less the same. It might even be higher, if the SMP operator does not find a cooperation partner. In the latter

case he has to cover the higher investment costs on his own which may limit the market expectations of NGA.

(2) There are similar incentives to discriminate against access seekers and cooperation partners. Therefore the multi-fibre model is unlikely to be effective without intervention from NRAs.

We have shown that there are areas where the multi-fibre approach has advantages over an unbundling approach, because certain features of the competitive model cannot be reproduced by unbundling. This is mainly the possibility of having access line-based services by several operators. In most other areas it is more the issue of comparative advantages or disadvantages of both approaches which have to be evaluated against each other. In any case, the advantages of the multi-fibre approach not only have to outweigh its disadvantages. It has to have a significant relative advantage over the unbundling approach, because there are relevant incremental costs associated to the multi-fibre approach in terms of additional investment expenditure.

There seem to be some competitive advantages of the multi-fibre approach. On the other hand barriers to entry increase, which means that the potential for competition and market entry decreases. The unbundling model is open for a variety of market structures and supports the search for the most efficient market structure; the multi-fibre model on the other hand tends apart from some specific circumstances in dense areas to a duopoly market structure including a tendency towards collusion.

The multi-fibre approach may seem to lower the investment risk and therefore to incentivise more investment. However, this evaluation should be questioned. If the major VHC-specific risk is the risk of penetration and the risk of willingness to pay of users, this risk does not seem to be affected by the multi-fibre model. In both models operators (the investor and its competitor) have to work on penetration and on willingness to pay of users. It is not only that the investor is able under the multi-fibre model to shift parts of the investment risk to one or more altnets. The risk which is now reduced to the (primary) investor is increased for the altnet who also becomes a (secondary) investor in that model accordingly. We have shown that the risks for altnets are higher than under the unbundling model. This can mean and imply that the participation of altnets to develop the VHC market is lower under the multi-fibre model compared to the availability of unbundling. In areas where the multi-fibre approach does not find demand from altnets, the investment risk of the investor is even increasing because he has to generate higher revenues or a higher penetration compared to a single fibre architecture to make the investment profitable. To some degree this argument also holds in case there is demand for the cooperation model inherent in the multi-fibre model.

Given that a multi-fibre cooperation model can lead to less competition and to higher risks than an unbundling model (depending on relevant scenarios), it is not very likely

that the (potential) benefits of this approach outweighs the additional cost of this model in terms of higher investment.

When we have to recognise that there is no overall dominance of the multi-fibre model over unbundling, but there might be certain scenarios where this economic competition model might have advantages over unbundling, is it possible to have the option of getting the best of both worlds? The best of both worlds would mean to ensure that the multi-fibre model can be used in areas or scenarios where it has the greater comparative advantages and that the unbundling model can be used where it has greater advantages. For that reason both approaches have to be regarded as complementary such that an unconditional choice is available for competitors.

Generally, it should not be the NRA which should pick a successful business model. This should be the task of market players and/or the outcome of the competitive process. If altnets have the choice between an unbundling access and a multi-fibre business model, they can choose the most efficient model for competition. This choice may not lead to the same outcome in each fibre deployment area. Generally, a multi-fibre model may have comparative advantages in areas where an altnet already has its own comprehensive feeder and backhaul network infrastructure such that, where such circumstances are fulfilled, the altne will likely look for access at the distribution point and share the drop and inhouse cable segment only. This may be a business model for a utility. Another positive prerequisite for a multi-fibre approach from an altnet perspective is a high market share in the broadband retail market. Altnets with high market shares would not suffer from the asymmetries associated with the cost sharing rules of the multi-fibre model. Furthermore, the multi-fibre model is the more attractive the lower the critical market shares for profitability are. This condition is met in the lower cost high density deployment areas.

This analysis proves that the multi-fibre model may have advantages in certain scenarios. A fibre unbundling model rests on the regulatory obligation and availability of unbundled fibre access. The multi-fibre model either requires an investor who is offering this model of access to interested market players or a group of investors (but may require regulatory intervention) which jointly develop such a model in the framework of a co-investment arrangement.

Multi-fibre and unbundling can be complementary if the investing operators provide access to their network to access seekers via unbundling. Multi-fibre provides the unique opportunity of getting competition at the wholesale level. Competition would be optimized if the co-investing operators only follow the business model of wholesale-only operators. Then both have an incentive to fill their network without cannibalizing any retail margins. Such a market structure should be able to provide an efficient wholesale and retail competition market if the network operators do not collude.

If a non-SMP altnet acts as a co-investor it might also choose an integrated or a wholesale-only business model. If he chooses a wholesale-only model only providing unbundling to ISPs he might be able to win the major part or even all of the altnet demand to his network.

3 Practical examples of co-investment and regulatory intervention

In this section we present five case studies of co-investment and discuss the extent to which regulatory regimes may have affected the outcomes, with reference to presentations and questionnaire responses given by some of the companies concerned.

3.1 Portugal

FTTP competition and investment

Portugal is characterised by very high coverage of FTTP networks with coverage reaching 75% by 2015.

Competitive pressure from the cable company and alternative operators was a key factor in driving these high deployment levels. The cable operator NOS became a major challenger to PT in FTTx deployment, following its divestment from PT in 2007. [12] The third mobile operator Optimus and Vodafone further increased competitive pressure in dense urban areas with a fibre co-investment plan agreed in 2010.

Regulatory regime

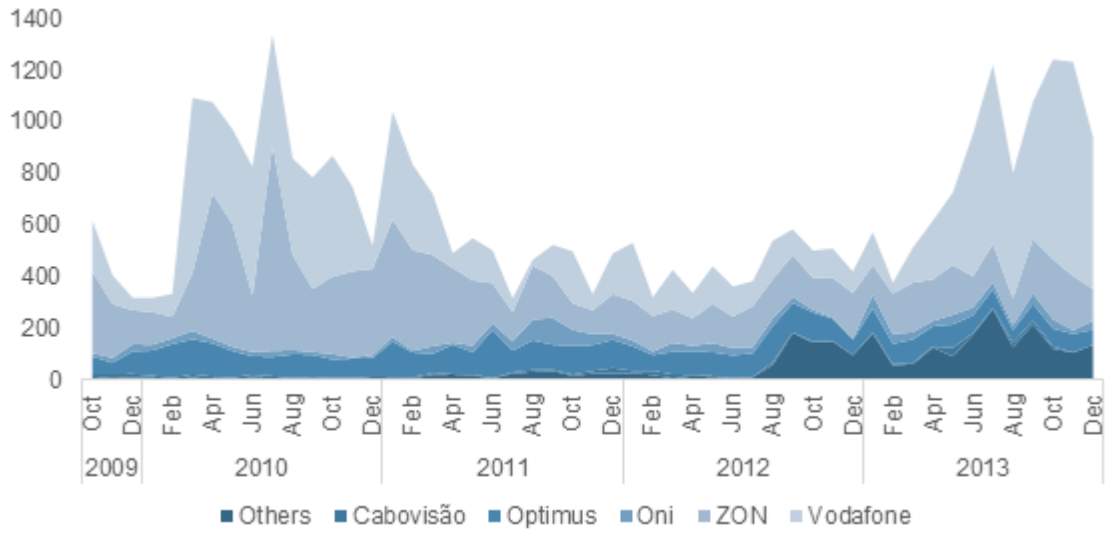
The main enabler for infrastructure competition has been the availability of access to PT's duct and pole infrastructure[13] at regulated rates alongside symmetric regulations which ensure access to 'in-building wiring' at multi-operator access points.[14]The figure below shows requests to access PT's ducts from the starting period of FTTH/B deployment. Vodafone and ZON provided the majority of these requests.

12 See ZON annual report 2008 https://www.nos.pt/institucional/EN/investors/corporate-governance/Documents/ZONCorporateGovernanceReport2008.pdf

13 Portugal Telecom benefits from a very high proportion of re-usable ducts built in the 1980s

14 For more details, see WIK (2017) Best practice for passive infrastructure access http://www.wik.org/fileadmin/Studien/2017/best-practice-passive-infrastructure-access.pdf

Figure 4: Installation requests for duct access from PT



Source: ANACOM

Detailed regulation governing access to ducts (and to a lesser extent poles) has been coupled with a deliberate policy since 2009 of forbearance on regulation of NGA wholesale access.

Co-investment

The incumbent and cable operators are each party to separate voluntary bilateral co-investment arrangements with Vodafone Portugal to extend the reach of fibre deployment.

Vodafone began its FTTH deployments in Portugal initially through a partnership with the fixed mobile converged operator Optimus. This partnership involved a 10 year mutual agreement in 2010 to provide bitstream access at the Central Office covering 200,000 lines.[15]

However, following the 2013 acquisition of Optimus[16] by Portugal's leading cable operator ZON (originally owned by the incumbent but spun off in 2007), Vodafone announced in July 2014 that it had signed a fibre sharing deal with the incumbent Portugal

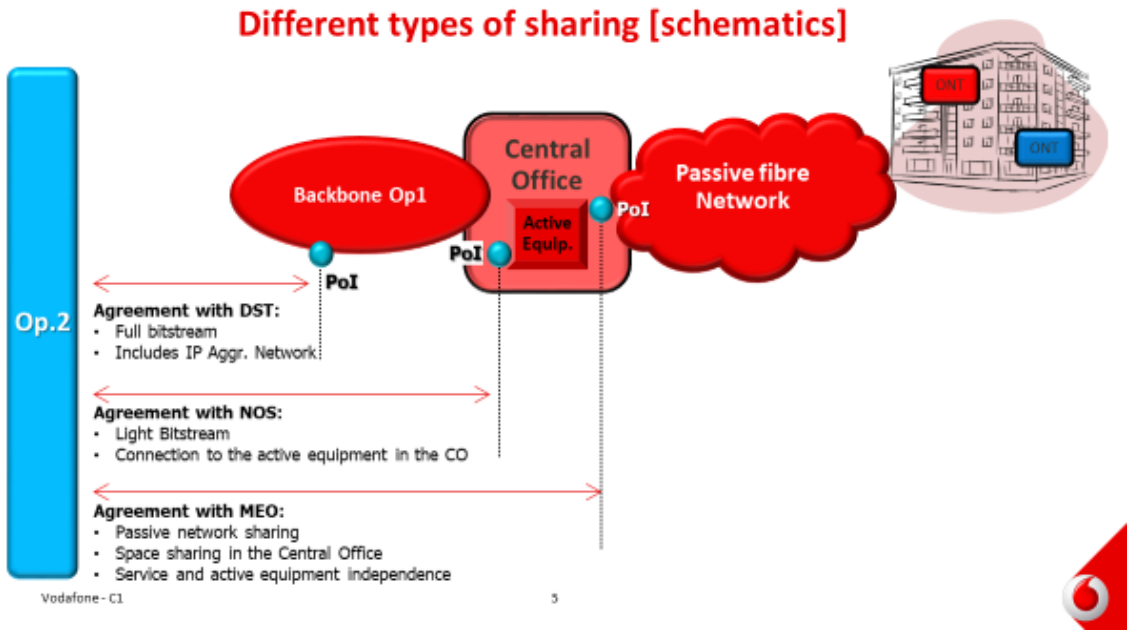
15 See https://www.vodafone.com/content/dam/vodafone-images/public-policy/reports/pdf/co-investment-commercial-offers-100417.pdf

16 http://www.reuters.com/article/zon-optimus-idUSL6N0AQEVJ20130121

Telecom.[17] The agreement provides for an infrastructure swapping arrangement covering 900,000 households. Interesting aspects of the arrangement are that:

- Vodafone and Portugal Telecom are deploying fibre in different areas, but deploy extra fibres which are made available for the exclusive use of their partner
- The agreement has been made on the basis of a 25 year contract for Indefeasible Rights of Use (IRU)
- Fibre is shared at the passive layer, and full autonomy has been kept over retail services

The different technical characteristics of the Vodafone co-investment agreements in Portugal is shown in the diagram below.



Following its acquisition by Altice in 2015, Vodafone contended that PT had resisted extending the co-investment agreement beyond 900,000 households.[18] However, in its market analysis, the NRA noted that PT had made available a wholesale commercial offer for passive access to FTTP.

Reasons for the co-investment

17 http://www.vodafone.com/content/index/media/vodafone-group-releases/2014/vodafone-portugal-fibre-sharing.html

18 http://www.jornaldenegocios.pt/empresas/telecomunicacoes/detalhe/fibra_optica_desacordo_de_partilha_da_rede_entre_meo_e_vodafone

Like Vodafone, MEO/PT may have been attracted to the potential for co-investment to enable increased coverage at lower costs. MEO was also in an unusual position compared with other incumbents in Europe in that it faced strong competition from its recently divested cable network, which had coverage of nearly 80% in 2015 and was able to deploy infrastructure using MEO's own ducts. The change in strategy concerning co-investment following PT's acquisition by Altice may signal a renewed confidence by Altice in its ability to maximise coverage in the absence of financing from other parties.

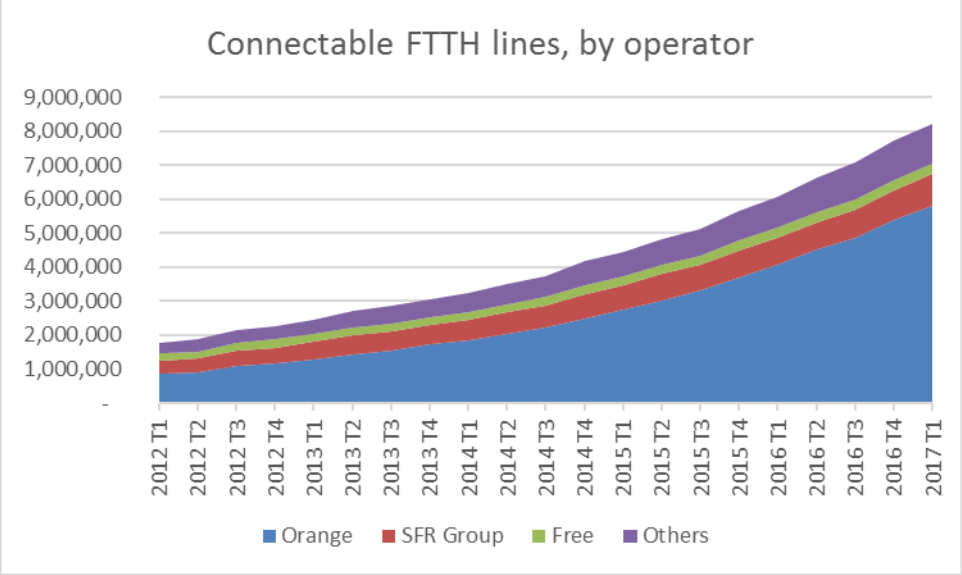
For its part, Vodafone noted in a response to a questionnaire that in most parts of the country it is not economically viable to duplicate fibre because the cost of investment is too high in relation to the potential result. Thus only sharing the costs though co-investment would enable competitive access to high speed networks. As Vodafone has a lower broadband market share than NOS or PT, it would also have had greater incentive to engage in co-investment arrangements as a means to extend its network reach while minimizing costs.

3.2 France

FTTP competition and investment

FTTP deployment in France started relatively early (from 2006), but has proceeded at a gradual pace – reaching 16% in 2015[19] – below the EU average.

The number of homes connected by the largest commercial network operators is shown in the diagram below. Incumbent Orange has served the highest proportion and plans coverage of 36% households by 2018, reaching 60% by 2022.



[19] IHS/VVA for EC

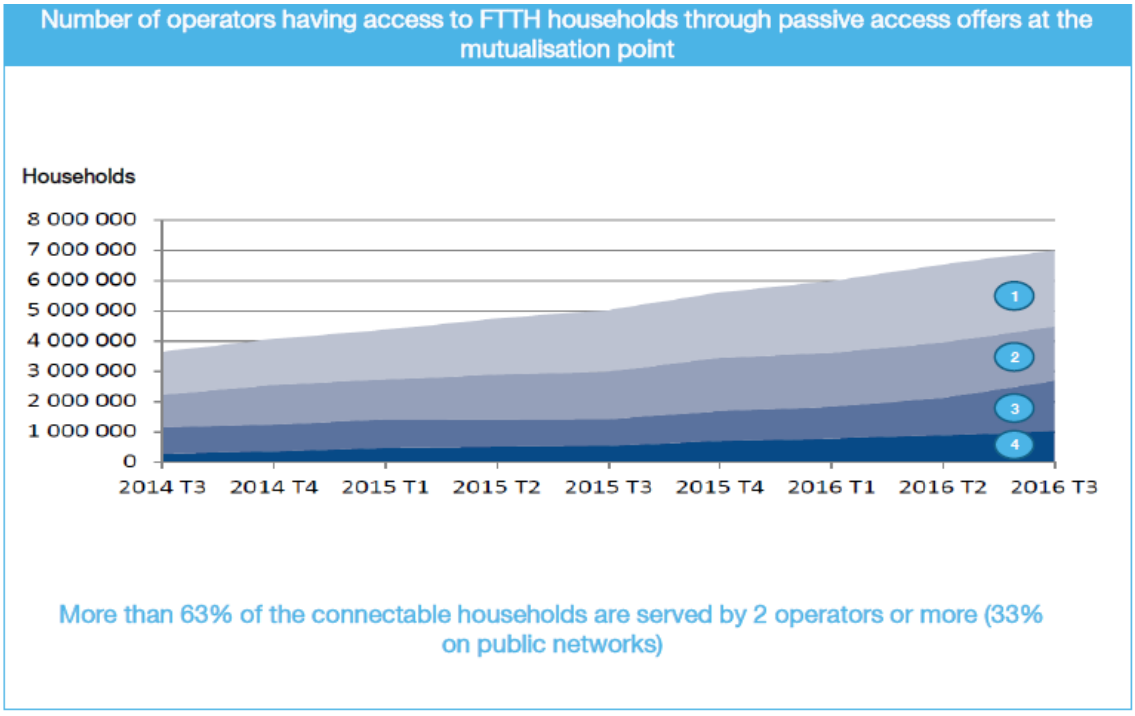
Source: WIK based on ARCEP

The main commercial infrastructure-based alternative operators in France are

- SFR/Numericable, which operates Docsis 3.0 infrastructure alongside FTTH/B. SFR/Numericable also serves a high proportion of broadband customers through ADSL over Local Loop Unbundling. SFR/Numericable has stated its intention to cover 80% of the French territory with end-to-end fibre by 2022 – extending to 100% by 2025.[20] Investments will also involve the conversion of the last segment of its cable infrastructure to fibre.
- Iliad/Free which has its own FTTH infrastructure in certain areas and offers basic broadband based on LLU; and
- Bouygues which has a more limited fibre deployment and makes use of wholesaling arrangements on the cable network of Numericable/SFR as well as LLU

All four of the main broadband infrastructure providers are MNOs and are active in the provision of TV. Bundled (triple or quad-play) products are standard in the French market.

Although Orange has been responsible thus far for the greatest deployment of FTTH lines, as a result of the regulated co-investment regime described below, a significant proportion (more than 63%) of the connectable households are served by 2 or more FTTH operators.



20 http://www.linformaticien.com/actualites/id/44528/sfr-veut-fibrer-80-du-territoire-sur-fonds-propres-d-ici-2022.aspx

Regulation and the co-investment regime

Co-investment in the fibre terminating segment (limited to in-building wiring in very dense areas) alongside line by line access rental is mandated on all operators through legislation and regulation.

ARCEP adopted its initial FTTH decisions in 2009-10 on the basis of a specific national law developed for this purpose. The regulatory rules concerning fibre access and co-investment apply equally to all operators installing FTTP – i.e. they are symmetric.

The regime distinguishes between high-density and lower density areas. ARCEP defined the very dense zones (which include Paris) in Decision No. 2013-1475.[21] Within the high-density areas low-density pockets are differentiated from the rest of the area.

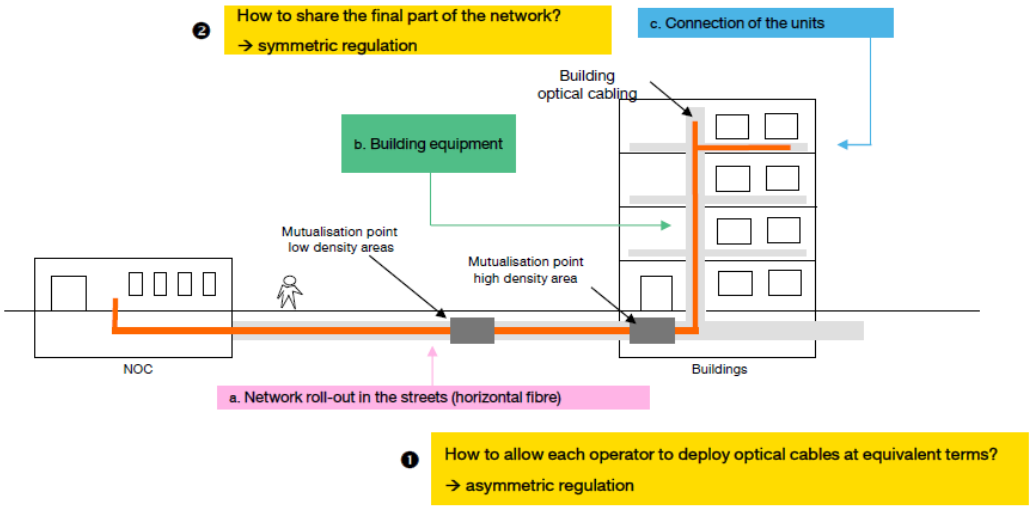
The regime provides that that in high density areas, all operators deploying FTTH must provide access to in-building wiring at a connection point which lies at the base of each building, or at a concentration point aggregating 100 units, where buildings contain fewer than 12 residential or business units.

In less dense areas, operators deploying FTTH must deploy networks in a manner[22] which enables them to offer access to fibre terminating segments[23] at connection points which aggregate at least 1,000 households (either through point to point connections or through point to multipoint involving the aggegation of 300 lines and backhaul to 1000 lines. Fibre installers must offer both 'co-investment' in the fibre terminating segment and monthly rental.

[21] A list of the high-density areas can be found under: http://www.arcep.fr/fileadmin/reprise/dossiers/fibre/annexes-2013-1475-liste-communes-ztd.pdf

[22] Through point to point fibre connections in the final segment

[23] Equivalent to a fibre subloop



Source: Orange

Terms and prices for co-investment are intended to be commercially agreed, but the NRA may step in to resolve disputes. ARCEP settled the terms of co-investment agreements between the largest operators at the time – Orange, SFR and Iliad – around 2011.

In practice, outside very dense areas – where only in-building wiring is shared – operators pay up-front for the right to use a portion of fibre terminating segments (in increments of 5%) through IRU of 20 years+.

Under guidelines developed by ARCEP, charges are intended to be related to cost, but reflecting risk involved. Actual charging levels vary depending on the timing of the co-investment (whether the IRU is purchased before or after the investment takes place) and the size of the co-investment, with discounts for larger slice. The purchase of line by line access rental involves the least risk on the part of the access seeker and is the most expensive option.

Duct access and dark fibre backhaul mandated as SMP remedies on Orange, the incumbent operator, via the market analysis process, provide an essential complement to the 'symmetric' terminating segment regulatory regime, enabling alternative operators to invest in FTTH up to the building or connection point for the terminating segment.

There are no downstream active access obligations on FTTH networks under the SMP regulatory regime.

Reasons for the co-investment

The fact that co-investment agreements have been made amongst all major operators on similar terms with a common structure is unique amongst the cases considered and

clearly results from the regulatory requirements. It is possible that in the absence of regulation, voluntary co-investment arrangements might have emerged (especially amongst smaller providers), but it is not possible to definitively confirm this.

3.3 Switzerland

Competition and investment

Switzerland is the most prominent case of deploying FTTH in a co-investment approach within a multi-fibre architecture. Nearly all of the fibre roll-out which is covering nowadays about 30% of the population was conducted in this model.

Broadband competition in Switzerland is mainly dominated by the competition between the dominant fixed-line incumbent Swisscom and the cable companies with UPC (Cablecom) as the major player in this segment. Fixed-line competitors have a much weaker position in the market than in most EU Member States. Their service offerings basically rely on bitstream access and resale; to a lesser extent access to the unbundled copper loop, which was introduced rather late (in 2007), (so far) only plays a minor role. Due to the strong competition by cable companies, Swisscom followed a powerful VDSL deployment strategy aiming at a nationwide coverage 2006 to 2008. Since the end of 2008, 75% of all households in Switzerland have access to this VDSL network.

As a response to some local utility plans to roll-out fibre networks in some major cities, Swisscom stopped the further roll-out of VDSL in 2008 and announced a far reaching FTTH network roll-out. 100,000 apartments (3% of all households) shall be connected through FTTH by the end of 2009 and 33% of population by 2015 at an investment of 2.8 billion CHF[24] to be extended to 50% coverage up to 2018.

Co-investment

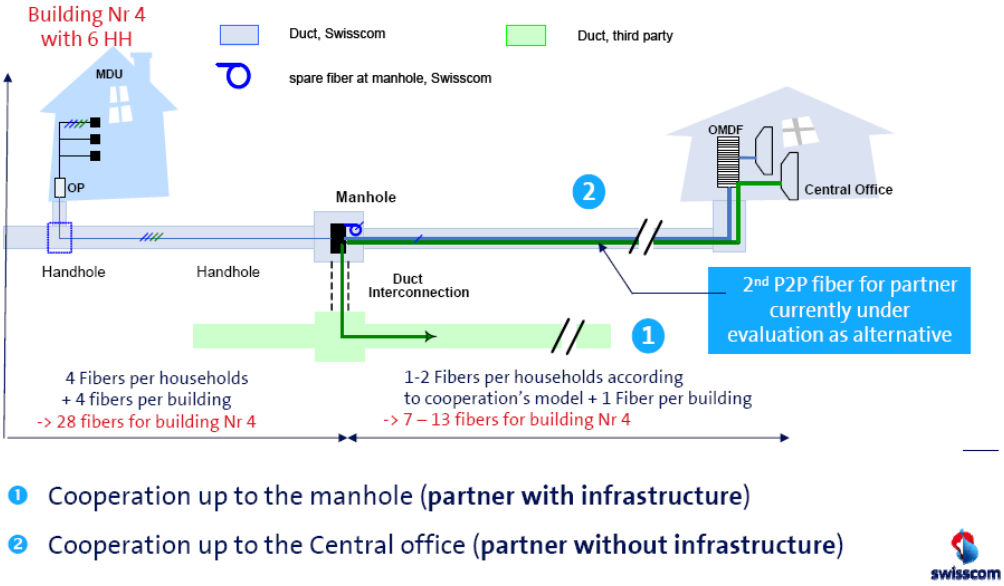
Swisscom deploys a FTTH P2P network architecture. Swisscom is connecting each home in a multi-fibre approach with four fibres from a manhole into each home. On the basis of cooperation models with other operators or utilities, Swisscom negotiated co-investment arrangements to swap fibres and to share the terminating fibre segments with these partners. Swisscom signed the first letter of intent for a multi-fibre co-investment arrangement with the local utility Group E in Fribourg in March 2009.[25] On that basis Group E and Swisscom constructed a multi-fibre FTTH network in the Fribourg area. Both partners deploy the network in different areas and swap the fibre capacity to each other. Each operator lays four fibres from each apartment up to the manhole in each area. Fibres will then continue up to the constructing operator's ODF and through duct connection at the manhole to the partner's ODF.

24 See ERG (2009), p. 171.
25 See ERG (2009), p. 171 f.

In about 20 cities Swisscom has negotiated further cooperation agreements with local utilities on a similar basis. In cities where Swisscom had no cooperation agreement, it, nevertheless, started laying four fibres in order to allow for possible further cooperations.

Technically, Swisscom's cooperation model is described in Figure 5. Each home in a building is connected with four separate fibres, all ending in a standardised plug. At the other side all fibres of a building end in a manhole close to the building. At this distribution point at least one fibre per home is directed through the distribution cable to the Optical Main Distribution Frame (OMDF) of Swisscom (resp. the constructing operator), the other fibres may be accessed by competitors running their own infrastructure down to the manhole, where they connect to the shared fibre end lines.

Figure 5: Build and share cooperation model of Swisscom



Source: Crausaz, Débieux (2009)

If alternative operators do not have ducts or fibre for their own feeder cable, Swisscom provides alternative operators access to the fibre at its OMDF/MPoP. This type of cooperation model comes closer to a fibre unbundling access model. The main difference, however, still is that the altnet has to commit itself for a comprehensive region, city or district where the commitment in the unbundling case only relates to one single line.

There are some more interesting details of the cooperation model important to be mentioned:

(1) The cooperation arrangement proposed is always related to coherent regions, cities or districts.

(2) The cooperation partner receives indefeasible rights of use (IRUs) which define the exclusive use of the particular fibre.

(3) The sharing of investment costs follows the model to be applied for international undersea cable contracts: The first partner pays the investor 50% of the investment cost plus a margin to cover the project-specific investment risk. A second partner has to pay 33% of the investment cost plus the margin mentioned above. The payment of the second partner will be shared between the investor and the first partner.

(4) In the (symmetrical) swapping model there is no financial compensation, because both partners are investors. Instead, they grant each other IRUs for one fibre in their respective roll-out area.

3.4 Spain

Competition and investment

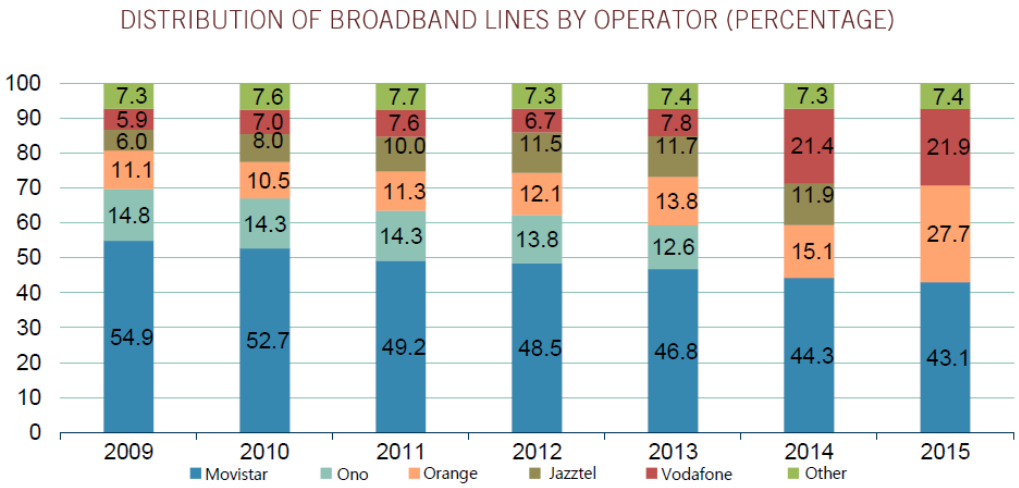
FTTP deployment in Spain has accelerated in recent years and reached 53% in 2015.[26] The incumbent Telefonica has announced that it intends to achieve nearly full coverage of FTTP by 2020.

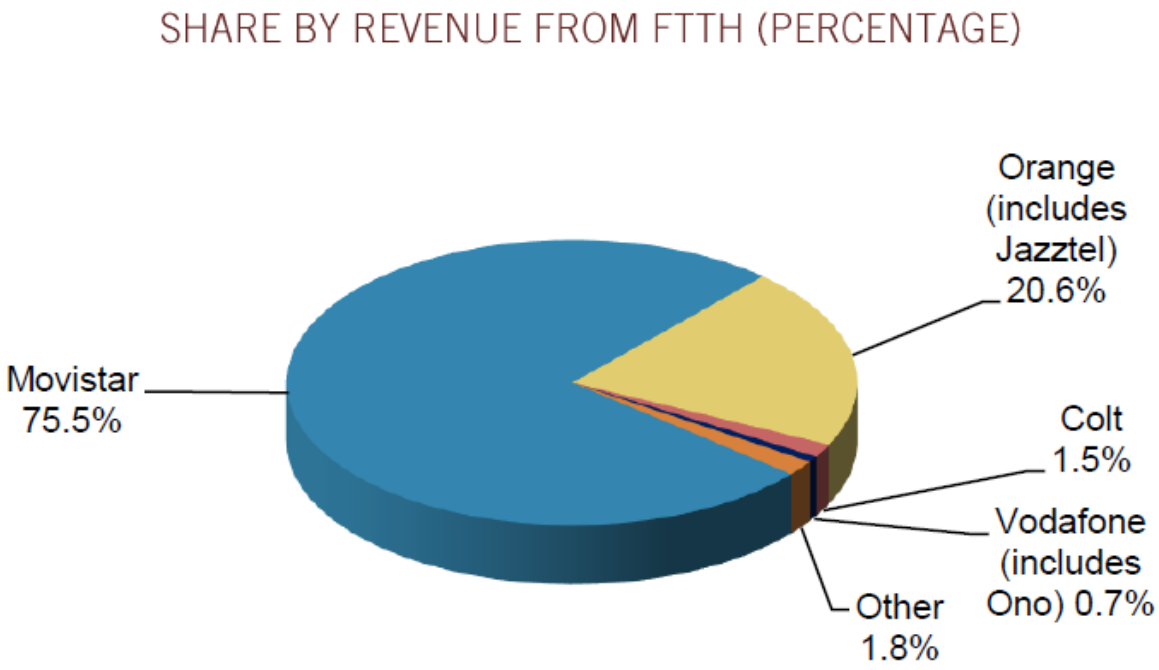
Following a round of consolidation that occurred from 2014 onwards, competition to provide electronic communication services, especially to residential customers, is currently **centred around three large nationwide fixed mobile converged operators** (Telefónica, Vodafone-ONO and Orange-Jazztel). The operators control 85% and 95% of the retail markets for mobile and fixed broadband services respectively. Másmóvil, previously focused on the mobile market, has consolidated its position as the fourth convergent operator through the acquisition of competitors (Yoigo and Pepemobile) and part of Jazztel's FTTH network. Másmóvil also signed a commercial access agreement to the Orange fixed network.[27]

Although Telefonica's share of the overall broadband market has been in decline, falling to 43% of customers in 2015, it has significantly greater strength in FTTP provision with 75% of revenues from FTTH, according to CNMC's 2016 annual report.

[26] IHS/VVA for EC

[27] *Europe's Digital Progress Report – 2017*





Source: CNMC Annual Report 2016

Regulatory approach towards FTTP

CNMC's primary focus in NGA wholesale access regulation since 2009 has been to foster infrastructure-based competition in NGA (primarily FTTH in practice). As such it has aimed to incentivise entrants to climb the ladder of investment by focusing wholesale access regulation on duct access and in-building wiring.[28] Regional FTTH Ethernet bitstream (termed NEBA) was also mandated[29] in its 2009 decision. However the CNMC aimed to incentivise investment by *forbearing from mandating the provision of*

28 Both mandated on the basis of cost-orientation
29 In the context of market 5 of the former EC Relevant Market Recommendation

bitstream access above speeds of 30Mbit/s.[30] Additionally, for the FTTH Bitstream wholesale product available at speeds of up to 30Mbit/s, CNMC addressed perceived risk through the application of a *mark-up on WACC* within a cost-oriented[31] price to account for project-specific risk.

In November 2016, the CNMC issued a Decision[32] in which it modified its approach to NGA regulation to reflect differing competitive constraints in different regions, while continuing to incentivise NGA investment. Regulatory forbearance on NGA wholesale access was maintained in an area in which infrastructure competition was expected to develop – the obligation to supply NEBA was also withdrawn in this area. However, beyond this region CNMC lifted *forbearance on speeds above 30Mbit/s* and a new VULA product[33] which is required to be provided on the basis of Equivalence of Input, with flexible pricing, subject only to margin squeeze tests.

Co-investment

FTTP deployment in Spain has involved two significant co-investment initiatives between the commercial providers. However, the only arrangement which involved sharing fibre access lines was between alternative operators.

In 2013 Vodafone entered into an FTTH partnership (access swap) arrangement with Orange, in order to meet the competitive challenge of the incumbent Telefonica. However, the arrangement was scaled back in 2014 following Vodafone's acquisition of cable operator ONO.[34] The current arrangement still involves each operator building FTTH in separate areas and sharing access, but also provides for Vodafone to grant Orange access to one million homes via the ONO cable network. Access in the Spanish case is on the basis of active rather than passive access.

The deal involving Telefonica relates only to in-building wiring. In 2012, alternative operator Jazztel signed an agreement with Telefonica to share the cost of deployment of in-building wiring for up to 3 million Households (increased to 4.5 million HH in 2014). Jazztel was acquired by Orange in 2015 (3.4 billion € deal).

Reasons for the co-investment

In a response to a questionnaire submitted for this study, Vodafone Spain stated that the main motivations behind the co-investment arrangement were (i) a response to the

30 No regulatory obligations were imposed above this speed
31 Based on a BU-LRIC+ model
32 Resolución por la cual se acuerda notificar a la comisión europea, al ORECE, al Ministerio de Industria Energía y Turismo y al Ministerio de Economía y Competitividad el proyecto de medida relative a la definición y análisis del Mercado de acceso local al por mayor facilitado en una ubicación fija y los mercados de acceso de banda ancha al por mayor. (ANME/DTSA/2154/14/MERCADOS 3a 3b 4).
33 In practice on FTTH
34 http://www.vodafone.com/content/index/about/policy/news/public-policy-news-releases/2014/vodafone-spain-orange-spain-fibre-sharing-agreement.html

Telefonica/Jazztel agreement; (ii) the need to reduce roll-out costs; and (iii) the need for compete against Telefonica in the provision of ultra-high speed broadband offers.

Vodafone Spain observes that the regulatory regime in Spain between 2009-2016, which limited the potential for wholesale access to the Telefonica NGA network, was a significant factor in supporting their decision to engage in co-investing in their own FTTP network. In turn, their ability to build FTTP networks – thereby providing them with the leverage to engage in a co-investment 'swap' arrangement - was dependent on the regulation of duct access and in-building wiring.

It seems likely that a similar rationale may have applied for Vodafone Spain's co-investment partner, Jazztel (which was later acquired by Orange).

3.5 Italy

Competition and investment

FTTP deployment in Italy had until recently remained limited to a deployment by Metroweb in Milan. Italy had thus fallen behind other countries in reaching the Digital Agenda for Europe targets for take-up of very high capacity broadband at speeds of 100Mbit/s or more.

However, data from IHS/VVA for the European commission shows an increase in FTTP deployment from 11% of households in 2012 to nearly 20% in 2015.

Competition to the incumbent in basic broadband in Italy has mainly been on the basis of Local Loop Unbundling on the incumbent network. There is no cable network in Italy.

However, a more dynamic competitive environment has emerged in relation to NGA.

Fastweb, one of the alternative operators extended its network to use subloop unbundling and installed FTTC/VDSL in competition with the incumbent – reaching around 30% of households in 2016.

From 2015 onwards, a further competitor to Telecom Italia emerged with the creation of Enel Open Fiber, a subsidiary of a utility company, which plans to install FTTH to 250 cities by 2019 by utililising its own and other utility duct and pole infrastructure to limit the cost of deployment. Enel Open Fiber's market position was further strengthened through its success in securing state aid under a programme defined by the Italian Government in 2015.

Regulatory regime for NGA

The Italian NRA has taken a comprehensive approach towards the regulation of the incumbent's NGA network. Alongside regulation to mandate access to TI's ducts, fibre unbundling and VULA have been mandated on the basis of cost-orientation. The relative risk associated with NGA deployment has been addressed through a risk uplift on the WACC, which is higher for FTTH than for FTTC. [35]

Co-investment

In 2012, Fastweb and Telecom Italia signed a co-investment agreement for the deployment (civil works) involved in deploying FTTC infrastructure. In a January 2017 presentation Fastweb described the main features of this agreement as follows:

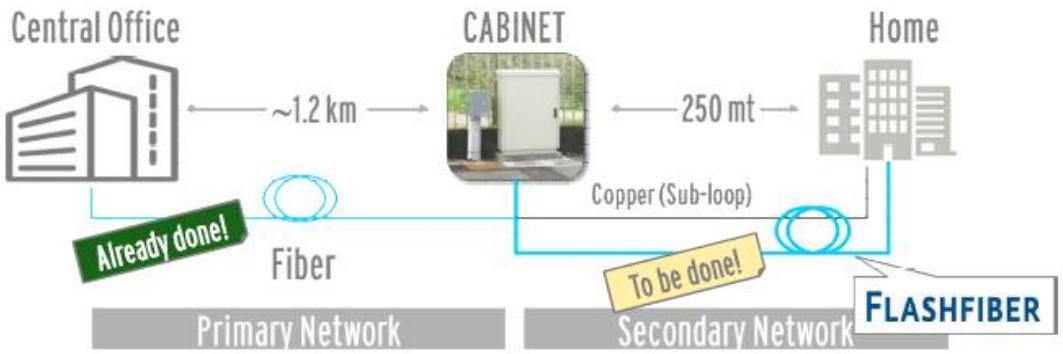
- The agreement provided for the co-ordinated planning of FTTC deployment by the two firms
- Cost-sharing was limited to digging costs on the primary network (the segment between the central office and street cabinet)
    - Where one of the two parties decides to dig and deploy, it must propose to the other party (the follower) to share the costs of deployment of the new infrastructure
    - The leading operator (i) provides the final design; (ii) requires and obtains excavation permits; and (iii) manages the contract with the excavation company
- There were no constraints on the technological choices for the development of the NGA networks of the two parties

Following the entry of the wholesale operator Enel Open Fiber, Telecom Italia and Fastweb extended their co-operation to provide for co-investment in FTTH networks through a joint venture called "flash fiber", 80% owned by TI and 20% by Fastweb.

Under this arrangement:

- Flash Fiber builds and manages fibre cables in the secondary network (between the street cabinet and home) and in verticals (in-building wiring).
- Telecom Italia and Fastweb obtain from Flash Fiber the exclusive right of use on dark fiber semi Gpon (1 semi Gpon for Fastweb and 1 for Telecom Italia)
- Flash Fiber sells spare passive elements on request to the market.

[35] The draft AGCOM market analysis of 2015 envisaged that cost-oriented VULA charges will be calculated using a DCF model with a mark-up on the WACC of up to 1.2% for investments in FTTC or up to 3.2% for investments in FTTH for all cost elements associated with the provision of NGA services



The target for the joint venture is to serve 3m homes in 29 major cities which are already served with FTTC.

Reasons for the co-investment

Fastweb observed that entering into the original cost-sharing co-investment enabled it to reduce digging costs by 50% and increase the pace of its deployment. It also ensured that it was able to make independent technological choices from those pursued by TI, which would not have been possible if it had relied on 'virtual access' such as VULA.

The timing of the Flash Fiber initiative suggests that a significant incentive may have been to react to the entry of Enel Open Fiber as an FTTH investor, and protect market share and the investments already made in FTTC.

The NGA regulatory regime in Italy, which was updated in 2015,[36] does not seem to have made any provisions to encourage or deter such co-investment.

3.6 Role played by regulation in co-investment

Effect of regulatory incentives on alternative operators

It is clear from the case studies examined as well as from statements from Fastweb and the responses to questionnaires received from the Vodafone operating companies, that alternative operators have much to gain from co-investment agreements. Benefits to alternative operators include:

- Long-term certainly
- Greater control over infrastructure and service offerings
- Reduced reliance on wholesale access from the incumbent operator, which may be subject to changes as a result of regulation or technological upgrades

[36] Case C(2015) 6884 final

- The ability to expand their network beyond what could be achieved alone given their smaller scale and customer-base compared with the incumbent

In addition, responses to the questionnaire from Vodafone suggest that the regulatory regime played a significant role both in *incentivizing* and *enabling* co-investment.

- Attention to duct access regulation and in-building wiring enabled Vodafone (and other alternative operators such as Orange Spain, SFR and Iliad) to install their own FTTP infrastructure thereby giving them leverage to engage in co-investment or swap arrangements with other investors; while
- The lack of wholesale access to the incumbent NGA network removed the 'buy' option, providing a strong incentive for them to build or co-build their own infrastructure at least in areas where this was commercially viable

As VULA is regulated on the basis of cost-orientation in Italy, Fastweb did not experience the same stark investment imperative faced by alternative operators in Spain, Portugal and dense urban areas of France. However, duct access regulation and close attention to the regulation of subloop unbundling – including a regime which set relatively low prices for subloops in relation to downstream wholesale access – did provide an enabling factor which is likely to have contributed to Fastweb's investment decision. The investment was further facilitated by the fact that its parent company Swisscom, which had acquired Fastweb in 2007 was pursuing an NGA deployment strategy in Switzerland and was able to provide strategic and financial assistance.

Effect of regulatory incentives for incumbent operators

Given their greater scale, market share and investment capacity, it is less clear what incentives incumbent operators might have to engage in co-investment. However, the incumbent operator engaged in some kind of co-investment in all of the five case studies examined.

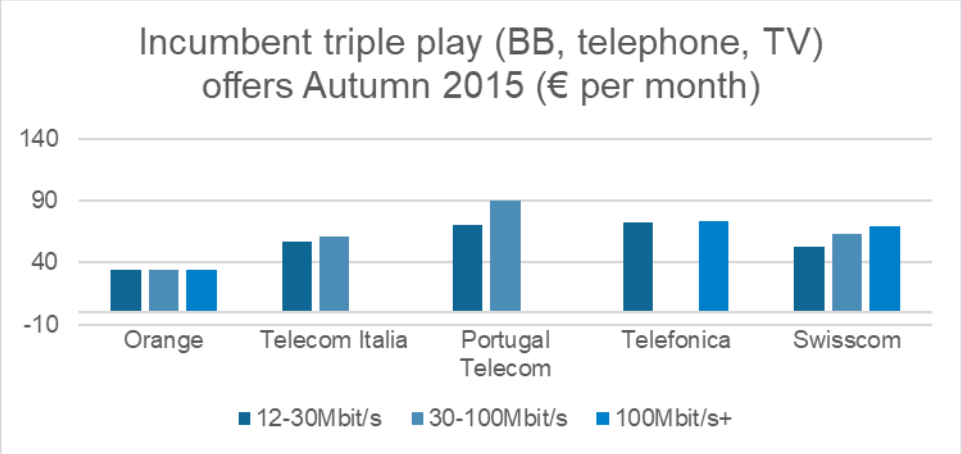
The engagement of Orange France was dictated by regulation. This is indeed the only country from those examined in which co-investment agreements had been made amongst all significant operators including the incumbent. The co-investment of Telefonica in Spain was limited to in-building wiring – leaving the field for the alternative operators to engage in wider collaboration amongst themselves.

Within the other three countries, a pattern emerges whereby incumbent co-investment in FTTP occurred in response to a significant competitive event or threat – including the prospect of competition from utilities in Switzerland and Italy and from a newly energized cable company (recently merged with the mobile operator Optimus) in Portugal. The financial position of incumbents in Italy and Portugal, and specifically relatively high debt burdens, may also have played a role.

Regulation seems to have been a less significant factor affecting the decision. Regulatory forbearance was applied in Portugal since 2009, but was not made contingent on PT engaging in co-investment. Telecom Italia engaged in co-investment with Fastweb despite being subject to relatively stringent wholesale access regulation.

3.7 Outcomes: price and quality

As of Autumn 2015, data collected for the European Commission shows clear differences between the countries considered, both in terms of price and quality of broadband access.



Source: WIK based on BIAC for the EC

Triple play bundles with very high capacity in France are offered at a similar price to bundles based on ADSL at least for a promotional period – and were not significantly higher thereafter. Offers making use of the maximum capability of the fibre (i.e. up to 1Gbit/s) are also routinely available from competitors such as Iliad and Bouygues.

Charges in Portugal and Spain for multi-play bundles on the other hand are higher than in France, while speeds are today capped at a typical 300Mbit/s symmetric in Spain and 200Mbit/s in Portugal.

At this time, high speed offers were not widely available in Italy.

4 Potential effects of co-investment incentive-based proposal in the draft Electronic Communications Code of the Commission

In 2016, the European Commission adopted proposals for the review of EU Framework for electronic communications, hereafter referred to as the 'Code'.[37]

A key element of the proposal was to provide incentives for both incumbents and competitors to make economically viable investments or co-investment in future networks that are capable of providing very high capacity connectivity to citizens and businesses.[38]

The details of the proposal concerning co-investment are described below. We conclude with an analysis of its potential effects in light of the case studies presented in the previous chapter.

4.1 The proposal of the Commission

Article 74 provide the basis for the Commission's proposals to support co-investment as a means of achieving sustainable investment and competition in very high speed infrastructure.

Article 74 establishes conditions under which an SMP operator might be *exempted from obligations* under the Directives when it instals new network elements that contribute significantly to the deployment of very high capacity networks. Specifically, NRAs are required not to impose obligations if the deployment of the new network elements is open to co-investment offers according to a transparent process and on terms which favour sustainable competition in the long term including inter alia fair, reasonable and non-discriminatory terms offered to potential co-investments; flexibility in terms of the valye and timing of the commitment provided by each co-investor; the possibility to increase such commitment in the future; and reciprocal rights awarded by the co-investors after the deployment of the co-invested infrastructure. The criteria that NRAs should use to assess co-investment offers is described in more detail in Annex IV.

Article 65 also requires NRAs to consider the impact on competition of co-investment at the stage of the initial market analysis. The implication is that where there are commercial co-investment or access agreements between operators which benefit commercial dynamics sustainably, this may affect the judgement as to whether the market justifies the imposition of regulatory obligations at all – before any consideration of SMP.

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37 http://eur-lex.europa.eu/resource.html?uri=cellar:c5ee8d55-7a56-11e6-b076-01aa75ed71a1.0001.02/DOC_3&format=PDF

38 Draft Code page 10

These provisions are supported by measures that aim to facilitate infrastructure deployment by alternative operators including article 70, establishes access to civil engineering (including duct access) as a horizontal remedy which can be used to support competition in various downstream markets (not necessarily restricted to the relevant market under consideration.

The approach in the draft Code towards co-investment and other access agreements which may have a significant competitive effect, marks a change in emphasis compared with the existing EU Framework for electronic communications. Whereas the existing Framework proceeds through logical steps to the conclusion that if SMP is found, one or more remedies from within the toolkit of the access Directive should be imposed by the NRA (i.e. a directive approach), the proposed Code aims to provide incentives for commercial agreements to be reached amongst operators – with the prospect of regulatory forbearance acting as an incentive for the deals to be offered or concluded.

In its explanatory memorandum, the Commission notes that: „*The sharing of new network elements between an SMP network owner and access seekers entails a greater degree of risk sharing compared to traditional access products, and also can give a more durable basis for sustainable competition if appropriate conditions on the design of the co-investment are met. This should allow adaptation of regulated access, enabling all coinvestors to benefit from first-mover advantages relative to other undertakings.„*

4.2 Potential effects of the proposals

Although considerable debate arisen over article 74, arguably the effect of article 65 may be even more significant. Under this article, markets which involve commercial co-investment agreements which "may increase the likelihood of the relevant market tending towards effective competition, such as those commercial co-investment agreements which benefit competitive dynamics sustainably" – could contribute to a finding that the '3 criteria test'[39] is not met in the specific circumstances within their country.

More specifically, the provisions might entail that NRAs should consider the likely effects on retail competition of the voluntary co-investment and access agreements which involve incumbents and alternative operators in Portugal, Switzerland, Spain and Italy before undertaking a wider review of the relevant market. Important aspects of that review should include not only the scope of the co-investment (and resulting households which can receive additional VHC offers), but the extent to which the access/swap arrangements enable the providers to differentiate their services commercially and technologically. Co-investment or access arrangements based on passive access (allowing differentiation based on technological innovation) and with long term pricing – such as

[39] The test by which NRAs assess whether markets may be susceptible to ex ante regulation

IRU-based pricing – are likely to offer greater prospects for sustainable competition than shorter term arrangements which involve bitstream access. The relative market position of the co-investors and level of the pricing and its relationship to cost is also relevant in understanding whether competitive prices would result at the retail level, or whether an outcome characterised by excessive pricing amongst an oligopoly group could be sustained.

If this hurdle is not passed, for example because the NRA concludes that co-investment agreements do not exist or would not be likely to significantly affect competitive developments, article 74 presents a second opportunity for the SMP operator to avoid the imposition of regulatory obligations, through making a co-investment offer that meets given criteria. A first observation is that from the case studies reviewed, perhaps the only example that would meet the criteria is the French case, in which the terms were influenced by regulatory intervention through dispute resolution, rather than commercial agreement.

The other offers considered in the case studies are not open to any undertaking, nor are they transparent. The lack of transparency also prevents an assessment of whether the terms provide for an extension in the commitment and the potential to enter into a commitment at any time. There are indeed indications that the commercially agreed co-investment may have involved limitations in this area. For example, a dispute arose between Vodafone and Portugal Telecom over whether the previous co-investment arrangement could be extended. A similar dispute over extending the agreement may also arise in connection with SFR's plans to expand deployment of FTTX networks in France.

An interesting question is whether the conduct of the firms engaging in commercial co-investment would be different if they were presented with the prospect that deregulation would be contingent on changing the nature of their offer.

Unfortunately, it is not possible to assess this from the case studies analysed. Regulatory forbearance on very high capacity connectivity was applied in Portugal and Spain, but was not made contingent on the existence of co-investment offers. Meanwhile in Italy, access obligations on TI's NGA network were applied, but without a clear signal that they might be disapplied under certain circumstances.

It remains therefore to consider *in theory* which strategies might have been in the best interests of operators if the contingent deregulation model were proposed.

For this, it is important to consider what the commercial effects may be of open co-investment, and compare these with the potential effects of the alternatives that would likely be applied through regulation under the Code.

The effects of open co-investment can most clearly be seen by looking at the outcomes of the French 'regulated' co-investment model, which includes many of the features listed in Annex IV of the draft Code.

Data on prices and speeds offered in the areas in which operators have made use of the co-investment arrangements in France suggests high levels of contestability. Offers at speeds of 1Gbit/s and above are routinely available, while pricing for high speed broadband is amongst the lowest in Europe. Potentially as a consequence of the limited price premium attributed to FTTH alongside low demand, FTTH deployment in France is below the EU average, and significantly below coverage levels in Spain and Portugal, where regulatory forbearance was applied and charges are higher.

Under the draft Code, operators would be subject to SMP regulation if they not pursue open co-investment models. This may mean that they are subject to detailed rules concerning non-discrimination and potentially charge controls. Such regulation could also limit the potential for SMP operators to price above the competitive level and thereby restrict them from benefiting from supernormal profits. However, an important difference is that their wholesale market share is likely to be higher than under a co-investment scenario. The retail market is also less likely to benefit from intense competition because wholesale access products under SMP regulation may be more tied to those of the incumbent technically (especially if architectures prevent physical unbundling) and commercially (if access is sold on a line by line basis rather than on the basis of capital costs).

The main options available to SMP operators and their respective advantages and disadvantages are summarised in the table below.

	Open co-investment (Annex IV)	No open co-investment. Access regulation applied
Advantages	No regulation of VHC assets	Potential for flexible pricing (in presence of ND/competitive constraints), extent of competitive pressure (technical and commercial) may be more limited than under open co-investment
Disadvantages	Price and profit erosion due to effective infrastructure-based competition	NGA subject to detailed access and potentially price regulation

5 Conclusions

Under the current EU framework for electronic communications, the approach to ex ante regulation has been 'directive'. There is a presumption that if, following a market analysis, an NRA finds SMP, 'one or more access obligations' should be imposed by the NRA.

The proposed electronic communications Code seeks to pursue a more incentive-based strategy, whereby regulation would not be applied if certain co-investment or access arrangements exist which would support competitive developments, or failing that, if SMP operators make co-investment offers available which meet certain specifications. The presumption is that, if effectively implemented, co-investment should support more sustainable competition in very high capacity networks.

Voluntary co-investment arrangements have emerged in a number of EU and EEA member states including Spain (between altnets), Portugal (PT and Vodafone), Switzerland (incumbent and utilities), and Italy (TI and Fastweb). Th motivation for such arrangements for alternative operators is clear in that they offer a means for greater independence in network management and pricing than relying on regulated wholesale access. They may also need such arrangements to match the scope of the incumbent's investment. The motivations for incumbents are less clear, but could include the need to respond to a competitive threat or gain access to capital.

The regulatory framework has been key in encouraging alternative operators to invest and co-invest in FTTH. Specifically, duct access and in-building wiring have provided the ability and leverage to invest in FTTH, while forbearance in certain countries likely provided a strong incentive due to the lack of viable alternatives. In contrast, the regulatory approach may have played a relatively minor role in the co-investment strategies of incumbents. This may be because NRAs have not thus far made regulation (or forbearance) explicitly contingent on the terms of co-investment.

In the absence of examples where regulatory forbearance was used as an incentive for SMP operators to engage in co-investment, it is possible only to consider the likely effectiveness of this measure from a theoretical perspective.

Evidence from France suggests that open co-investment models, if effectively implemented, might yield some of the most pro-competitive outcomes – supporting competition in speed and price to the benefit of users. At the same time, these benefits might also limit the degree to which FTTH coverage can be achieved rapidly and profitably. They may also limit the attractiveness of such a model to SMP operators compared with the alternative of access regulation, which is more intrusive but supports high wholesale market shares and is less likely to facilitate disruptive retail competition.

On this basis, there may be reason to question whether the ‘ideal’ of open co-investment is likely to be achieved purely through regulatory incentives. On the other hand, the draft Code provides scope for markets to be considered not susceptible to ex ante regulation if existing commercial co-investment arrangements (not necessarily meeting the Annex IV criteria) are likely to result in sustainable competition. This potential leaves the door open to operators to demonstrate that commercial deals which fall short of open co-investment may still result in effective competition.

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