Final Report for OPTA

Fixed Telecoms 'Make-or-Buy' Decisions

Analysys

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Final Report for OPTA, 14 March 2003

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Analysys

1 Introduction

In this final report, we discuss the investment decisions of incumbent and entrant telecoms providers, with a particular focus on the impact of the current negative capital environment. The goal is to determine the ways in which OPTA can promote investment in telecoms infrastructure in the Netherlands.

Exhibit 1.1 provides a framework for the discussion to follow.

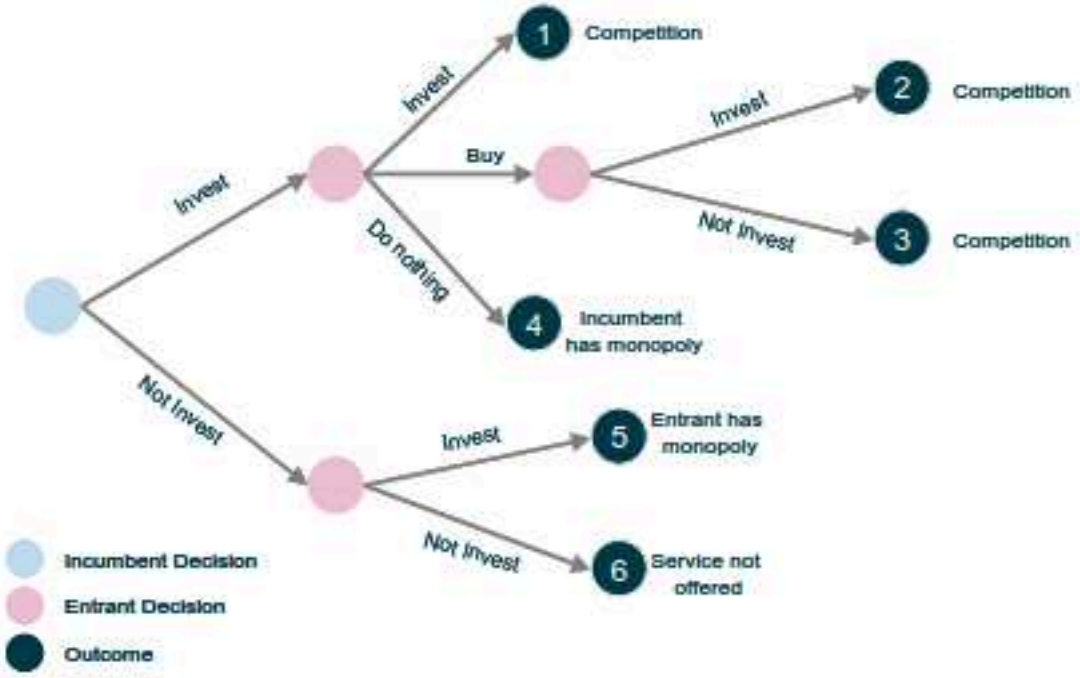

Exhibit 1.1: *Sequential decision tree for investment decisions [Source: Analysys]*

In this framework, the incumbent first chooses whether or not to invest. If the incumbent does invest, the entrant has a 'make-or-buy' decision – it can choose to invest, or it can choose to buy access from the incumbent, and then possibly invest later. In financial terms, the entrant can enter the market by buying access from the incumbent, and it then has a real option (i.e. the right to invest in assets) which it can exercise at a date some point in the future from its decision to enter the market. We will analyse the investment decisions of incumbents and entrants in two stages:

- economic theory of investment
- investment decisions of entrants and incumbents in practice, based on interview surveys.

We will also note, in particular, how the type of the investment has an impact on these decisions. For instance, if the investment in question is the local loop, for which the incumbent has already made significant investments, in practice only the entrant faces an investment decision (and the only possible outcomes are 1–4 in Exhibit 1.1). On the other hand, if the investment is fibre to the home (FTTH) or other new broadband investments, we start at the beginning of the sequential decision tree above, and any of the six outcomes are feasible as both the incumbent and entrant have investment decisions to make.

Finally, we will discuss how the regulator's decisions have an impact upon the investment decisions of companies in practice. The main emphasis is on the price of access, which has a direct effect on the entrants' make-or-buy decision, and indirectly impacts the incumbent's investment decision, where relevant. We will also discuss non-price access issues that may impact investment decisions.

2 Review of economic theory

We will examine two important decisions – firstly, the decision to invest, based on the cost and expected return on investment, and secondly, the evaluation of the real option by the entrant. We will also talk about how these decisions are impacted by current capital market constraints.

2.1 Cost of capital

First, we determine how to value the returns from investment – the challenge is that the investment must be made upfront, while the returns are spread over time.

Net present value (NPV) calculations are widely used in financial evaluation. The fundamental principal of such an analysis is that forecast future revenues are expressed in terms of revenues received today – the 'present value'.

The present value is calculated by adjusting the future cashflows to reflect the fact that there is a cost associated with not being able to receive cashflows now. This adjustment is known as 'discounting' and we discuss how it is calculated below.

2.1.1 Discounting future forecast

If an investor knows that he can invest a dollar at a return of 10% per annum (for example, by depositing it in a bank), then any alternative investments he considers must offer a return greater than 10% per annum to be attractive. Deferring receipt of the dollar for one year means that the investor will receive USD1.10 in a year's time.

The investor knows that he has a return available of 10% per annum, therefore any alternative investment requires him to sacrifice that return. The investor could receive the 10% return from the dollar investment or the return from the alternative investment; he could not receive both returns from the same one dollar investment.

The advantage of a discount rate is that it can be used to calculate the present value of a series of cashflows that are forecast to occur in different years. The forecast cashflow is discounted by the discount rate for each year by which the cashflow is deferred. In the example above, it was only one year, so the discount rate used was expressed as 1.10.

However, if the investor was told that the USD1.00 would be deferred three years hence, then the cashflow would have to be adjusted to reflect the opportunity cost of not having 10% per annum return in each of those three years. The discount rate is still 10%, but to reflect the loss of three years return, it is expressed as $1.10^3 = 1.331$.

This reflects the opportunity cost to the investor of not having the initial USD1.00 for three years, rather than only one. It assumes that the investor could have invested USD1.00 at the start and received 10% per annum, discounted, on that investment.

2.1.2 Weighted average cost of capital (WACC)

The examples above are simple, but a business that is presently engaged in investing cash cannot return that cash to its investors. To calculate an appropriate discount rate, consideration must be given to the return the business expects to generate from those forecast cashflows.

Although the investor in the example above could have either spent the USD1.00 a year ago or waited until now for USD1.10, the choice for the business would have been to invest the money in a range of projects or return it to its investors.

If the business invests the money in its projects, these are expected to generate cashflows that can be returned to investors. Alternatively, if the projects cannot generate cashflows that satisfy the expected returns of investors, then the business should have returned the money to them in the first instance and allowed them to invest it elsewhere.

The rate of return that investors would expect – and which the company has lost by being deprived of the cashflow – is known as weighted average cost of capital (WACC). This reflects the cost to the business of borrowing from a combination of debt and equity investors.

A business typically has two different types of investors: those who have lent money in the form of corporate bonds or long-term loans (debt investors or lenders), and those who have subscribed to equity capital in the form of stocks and shares (equity investors). Each of the different types of investor will normally have a different discount rate.

Lenders to the business generally demand a lower rate of return than equity investors because they are bearing a lower risk than equity investors. Lenders will normally charge interest on their loan, and this interest is not paid, they can ultimately force the business into bankruptcy and require that assets be sold to repay them.

In addition, lenders' loan agreements will often contain covenants restricting the range of activities that the business can undertake or requiring it to meet certain growth or profitability targets. If these are not met, then the loans may become immediately repayable and if they are not repaid, lenders could force the business into bankruptcy.

The logic for these conditions is that if the business is not performing as expected, the risk to lenders has increased and they may like to withdraw their loans and lend instead to a less risky borrower. Clearly, companies want to avoid either having to make repayment of long-term loans on demand or bankruptcy, and so they work to ensure that interest is paid on time and that loans can be repaid when due.

In contrast, equity investors are not normally guaranteed dividends, nor can they normally force the business to repay their investment. As such, they bear a much higher proportion of risk and rely on the business to be able to pay dividends or deliver an increase in the value of its shares, providing them with a capital gain.

An appropriate WACC for a business must reflect the opportunity costs of both its equity investors and its lenders. The WACC comprises two main components: the business's cost of equity capital and its cost of debt capital.

Cost of equity capital

The cost of equity capital is used to determine the discount rate. It depends on a number of key variables:

- the risk-free rate of return
- the equity risk premium
- the beta (β) of a business's shares.

The risk-free rate of return, usually represented by government treasury bonds, is the rate at which someone can invest in a given country at no risk, assuming obviously that the government does not default on any repayments.

The equity risk premium is the premium to the risk-free rate that an investor would expect to receive by investing in the equity markets. Historically, this premium has been between 3% and 5% for equity investment in the UK and US stock markets.

Investing in the stock market *as a whole* (for example, through a diversified portfolio of shares), an investor would expect to receive a return equal to the risk-free rate plus the equity risk premium. However, because we are only considering the return that an investor would demand from one particular stock, we have to determine how that stock performs relative to the stock market as a whole. This is done using the beta of a stock.

The beta is an historic measure of the volatility of a stock when compared to the volatility of the market as a whole. For example, if a stock falls or rises by exactly the same percentage as the market, its beta would be 1. If it falls or rises by twice the movement in the market, its beta would be 2. If it moved counter-cyclically to the market, falling as the market rose and vice versa, then its beta would be a negative number.

The volatility is used to express the level of risk of the stock. Therefore, if a stock had a beta of 1.2, it would be considered 1.2 times riskier than investment in the market as a whole. The required return for an equity investor would be 1.2 times the market risk premium, plus the risk-free rate.

The cost of equity capital is the rate of return that equity investors expect a business to generate for them. Therefore, in order to satisfy the requirements of equity investors, the business would have to generate cashflows that, when discounted by the equity cost of capital, represent a satisfactory return for the investor. Essentially, this means that the present value of these future cashflows would have to exceed the amount of the initial investment.

Cost of debt capital

The cost of debt capital depends on two key variables:

- the interest rate on the business's long-term borrowings
- the corporate tax rate, if applicable.

A lender's cost of capital is somewhat easier to determine; it is simply the interest rate charged on the loan. However, from the perspective of the borrower, this cost of capital can be reduced because of the tax treatment of borrowings. Interest paid on a loan, unlike dividends paid to stockholders, is often deductible against tax on profits. Therefore, although a business still has to generate cash to pay interest, the true cost of that payment is reduced by the amount of tax the business saves (the 'tax shield') by deducting the interest payment from its profits.

The cost of debt capital is then the interest rate on the loan, less the value of any tax shield.

The cost of debt varies with risk in a similar, but not identical, manner to the cost of equity. Certainly, if a company's overall business plan is considered to be more risky than others, then the cost of debt for that company will increase to reflect that risk. (The company's cost of equity would also be higher).

However, debt normally costs less than equity because – irrespective of the risk of the company – debt holders usually enjoy certain privileges (not extended to equity investors), which make their investment in the company less risky than equity. All of these privileges provide greater assurance of seeing the expected return on their investment (i.e. the initial loan and all interest due) to the equity investor than the lender.

The privileges normally include:

- A right to pre-determined interest payments. Interest on debt has to be paid, in the correct amount, on the prescribed dates. If the borrower defaults on these payments, additional charges may result due or the lender may have the right to demand immediate repayment of the loan in full. In contrast, equity holders cannot demand dividend payments from the company, even when the company is profitable.

- Preferential ranking as a creditor. In addition to interest being due on specified dates, borrowers rank ahead of other creditors of the company should there be insufficient cash to pay them all. This ranks them ahead of equity investors, who are often left with nothing in a corporate bankruptcy.

- Restrictions or conditions on the performance of the business. Lenders can make certain levels of revenues, customers, profit, total liabilities or other commercial metrics[1] a condition of the loan. If the business fails to meet these conditions (known as 'covenants'), it is deemed a breach of the loan. Additional interest charges may be levied or the loan may become due for immediate repayment. Equity holders can only influence the management of a company by appointing directors to its board – it is not usually possible for them to have as much direct control over the business as the debt holders.[2]

2.1.3 Calculating the WACC

The WACC is calculated by taking the equity cost of capital, weighting it by the amount of equity in the business's capital structure, and then taking the debt cost of capital and weighting that for the amount of debt in the capital structure.

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1 Loans to phone networks commonly include conditions requiring that certain levels of network coverage be established by specific dates.

2 While shareholders can – and do – vote to replace boards that they feel are not performing, this cannot be done without a great deal of effort and of course the support of a majority of shareholders. In the case of covenants, the company has to stay within these covenants constantly.

The amount of debt in a company's capital structure is known as its gearing ratio. Gearing is expressed as {debt capital ÷ (debt capital + equity capital)}.

This WACC then represents the opportunity cost to the business of investing the money – instead, it could have returned it to its investors. Investors will expect the business to generate a return at least equal to the WACC. This expectation of a given rate of return is the reason that WACC is often referred to as a 'hurdle rate' – if the project is not profitable at a given WACC, it fails to clear the 'hurdle' set by investors to proceed. Otherwise, as seen in the initial examples explaining discount rate, investors would prefer to invest elsewhere and would expect the business to return their money to them rather than the business investing it on their behalf.

It should also be remembered that the WACC reflects the capital structure of the business and the *expected* returns of all types of investors. This means that issues such as dividend payments or capital gains in share values (either historic or expected) need not be considered by the future cashflow model. The business and its investors can see that sufficient cash is being generated to meet their expected returns, without the manner in which those returns will be achieved further complicating the analysis.

2.1.4 Adjustments to WACC for uncertainty

Although macro-economic uncertainty is reflected in the 'risk free rate of return' discussed above, there are other adjustments that can be made to the NPV analysis for projects with uncertain outcomes.

The first – and most simplistic of these – is to apply a probability to the cashflow actually happening. For example, if you are forecasting the cashflows from an agricultural business and you know that there is a 7% chance each year of a total failure of the harvest, then each year's forecast cashflow can be adjusted by 7% to reflect the chance of that failure.

The second method of reflecting uncertainty about a project is to consider the appropriateness of the WACC itself. For example, a project that is similar to the existing business of the company can use the company's WACC relatively safely. However, if a business in computer manufacturing, for instance, decides to move into semi-conductor

manufacture, it would not be appropriate to use its current WACC. Instead, it should choose the WACC of a semiconductor manufacturer – and preferably a start-up, rather than that of an established player such as Intel Inc. This would ensure that the WACC actually reflected the investors required return – they have not invested in the computer manufacturer to see their cash being put to potentially riskier use in semiconductor manufacture.

This has been seen most recently in the mobile telecoms industry. The growth in customers and revenues amongst 2G operators worldwide during the mid-1990s led many people to revise downwards their assessment of the risk of these businesses. Share prices rose, reflecting investor confidence that the businesses would provide satisfactory returns.

When these businesses began to deploy new 3G technology, investors began to revise their expectations of the returns available from this technology. They felt that the cashflows were far less certain than had been the case in 2G and hence they viewed the investments as being more risky and consequently demanded a higher return. In effect, their WACC increased. With no sign of these new expected returns, share prices fell and the new share prices reflect the now lower expectations that shareholders have.

This increase in WACC has made raising capital more difficult in general for telecoms companies. Investors tend to be very concerned about the risk they see now applies to the segment.

2.1.5 Calculation of the net present value

Having determined the WACC, a calculation of NPV can then be undertaken.

NPV calculates the total cashflows from the investment and expresses them as a present value, i.e. all future cashflows are discounted (as described in Section 2.1.1) using a WACC (as explained in Section 2.1.2).

As a simple example, consider a project with an initial investment of EUR60 that returns EUR70 in each of first three years of the project lifetime. The WACC of the project is 12%.

	Year 1	Year 2	Year 3
Cashflow	70	70	70
Discount rate	1.12	$(1.12)^2$	$(1.12)^3$
Discounted cashflow	63	56	50
Present value of cashflow	168		
Initial investment	-60		
Net present value	108		

Exhibit 2.1: *Example of NPV calculation [Source: Analysys]*

The outcome of this evaluation is that the project has an NPV of EUR108. The project would proceed on this evaluation.

The project has demonstrated that it has a positive NPV for the selected WACC.

2.1.6 Other possible financial measures for uncertainty

The payback period of an investment is an important indicator of risk. A payback period is simply the point in time when the total investment costs of a project are offset by the cumulative cashflows received. The payback period provides an indication of a project's risk because it shows how long the invested capital will be 'at risk', meaning the longer the payback, the longer the invested capital is tied up, and the lower the liquidity. Investors set cut-off periods, timeframes in which the payback must be achieved, in order to appraise the investment.

In order to reduce some of the uncertainty of multi-period cashflow forecasts, a sensitivity analysis with respect to the key underlying variables of the cashflow can be applied. In order to do a sensitivity analysis, the underlying variables that would have the greatest impact on the forecast outcome if incorrectly estimated need to be identified. The forecast cashflow is expressed in terms of key variables and by varying the assumed forecast for these key variables, the consequences of incorrectly estimating the variables is then calculated.

This is done on a variable-by-variable basis if the variables are independent. If they are likely to be interrelated, it may be more appropriate to consider a number of alternative plausible variable combinations. In order to consider all possible combinations and to analyse the entire combination of outcomes, Monte Carlo simulation can be applied.

In order to conduct a Monte Carlo simulation, the cashflows are modelled allowing for forecasting errors and specifying the interdependence between different periods and different variables. In a next step, probabilities for forecast errors for each variable are specified. This can be done by setting the range of possible estimates (range of forecasting errors) for a variable and the expected forecast error, assuming a normal shaped distribution of error probabilities. By sampling from the distribution of the forecast errors, the resulting cashflows for each period are then calculated. Iterating through all variables, the probability distribution of the resulting cashflows is estimated.

2.2 Real options

Although they have a certain degree of flexibility, the methods for calculating NPV, described above are limited in that they only examine the specific project under evaluation. This means that if the project returns a positive NPV, it would be accepted and, conversely, rejected if it returned a negative NPV.

This rigid approach does not provide an analysis that allows the users to consider the alternatives – or options – open to them. These 'real options'[3] allow businesses to evaluate alternatives that may be open some time after the commencement of a given project. This differs from the discounted cashflow approach, outlined above, which allows projects to be evaluated only before they commence, providing a forecast value for the cashflow to be derived from the entire project. The real option theory assumes that during the lifetime of the project, the business can amend its behaviour to reflect changes from the forecast cashflow.

Real options provide a mechanism whereby companies can attach a value to choices offered by their investment decisions – over and above the simple 'invest/ do not invest'

3 So called to allow them to be distinguished from financial or traded options.

options afforded by DCF analysis. These real options allow them to consider a wide range of "what if" analyses that go beyond the rather simple "if this project goes to plan, is it profitable" determinations of DCF analysis.

Real options can be categorised into a range of broad choices:

- abandon
- switch
- expand
- contract
- defer

Each of these real options is discussed in more detail below, together with an illustrative example for each one.

From the perspective of a telecoms operator, perhaps the most valuable option (although all of them have an intrinsic value for the telecoms industry) is that of deferral. In an industry where technology is developing rapidly and where there are examples of 'new' technology becoming rapidly obsolete[4] the option to wait and see how the market and technology develops before committing to large investments is extremely valuable.

The next most valuable would be an abandon option. This is often impossible for network-based investments. A telephony network cannot be easily sold for another purpose or shipped to another location. Having a genuine option to abandon in the case of business failure would be also very worthwhile.

[4] e.g. (i) The deployment of Ermes paging networks made in Europe the early 1990s was quickly superseded by the coverage and data capabilities of GSM. (ii) Wireless local loop services found themselves unable to cope with the bandwidth requirements of residential internet users. (iii) Cable TV networks found their local monopolies challenged by DTH satellite broadcasters.

2.2.1 Abandon option

This is a fairly straightforward option. If a business fails to perform as planned, the possibility of selling the business (in its 'failed' state) can be considered as an option to abandon.

A company considering two rival manufacturing technologies may find that one offers high profits if all goes to plan, but the specialised nature of the plant means that it can only be used in that specific manufacturing process. In the event that the business does not go to plan, the specialised nature of the equipment makes it unattractive to a potential buyer and it has no resale value.

If the business is successful, the alternative technology will deliver lower profits. However, as the equipment it can be used in other processes, it has a resale value. This resale value can be seen priced as an option to abandon the business if it does not go to plan.

Therefore, in evaluating the alternatives the company would compare the value of the business using the higher profit technology with the value of the business using the lower technology profit, *plus* its assessment of the value of the option to sell the equipment if the business does not perform as planned.

For instance, the owner of a hotel with planning permission to convert it to an office building may value the planning permission as an option to abandon if the hotel business becomes unprofitable. He can then sell the building for development, rather than having to continue to operate it as a hotel.

2.2.2 Switch option

In a similar vein to the concept of an abandon option, a switch option evaluates the ability of the business to switch assets into other activities.

Using a similar example to the abandon option, above, instead of selling one piece of machinery, the company could deploy it in another production line.[5] Here the comparison is between the high profitability technology and the lower profitability technology *plus* the value of the option to deploy the technology making an alternative product if the initial plan fails.

A specific example of this would be in the automotive industry, where manufacturers have invested heavily in recent years in flexible production techniques. Investments of these types have allowed Honda to respond to falling demand in Europe by switching production in its UK market from European models to those that are exported for sale in Japan and North America.

2.2.3 Contract option

The opposite of the contract option, this allows the company to reduce capacity at a facility, rather than keeping it running at a loss. This is very similar in practice to the abandon option.

2.2.4 Expand option

When a business is considering investing in capacity to meet forecast demand, it may also consider investing to meet demand beyond the forecast levels. This will allow the company to increase its profits by (quickly) increasing production to meet demand.

In practice, this is a difficult option to value because the decision to expand capacity need not be made at the time of the initial investment e.g. an additional line could be added to a new factory when the factory is first constructed or added to it at a point in future.

An example of a business using such an option would be the case of a European cellular operator that chose to substantially increase the number of cell sites in its network, to

5 It is assumed that the company has already determined that the alternative production line offers lower profitability than the first choice. Otherwise, rationally, they would have made the additional investment in that line in the first instance.

improve coverage and hence generate more revenue. In addition to the DCF analysis of the increased revenue from the cell sites, the operator also recognised that an increasingly harsh planning regime was going to make it more difficult to acquire sites in future. Part of the operator's decision to expand capacity beyond current demand levels was based on the value of having sites deployed now when it would become more difficult, if not impossible to do so in future.

2.2.5 Defer option

The final type of real option is an option to defer making a decision – be it to abandon, switch, contract or expand – until a date in the future. This would mean that instead of deciding, for example, to expand capacity now, the potential investor could wait until demand becomes less uncertain.

Licences to development oil and gas fields are a classic example of this type of option: the holder of the licence may have determined that exploitable reserves exist, but will wait until prevailing prices reach sufficiently high levels before proceeding with extraction.

2.2.6 Valuation of real options

As with DCF analysis of projects, option valuations are based on finding market prices for traded investments that mirror the risks and returns of the project under consideration.[6] Once the similar investment is found, the option can be valued. This is a complex task, which, as with almost all option valuations, is generally done using far more complex computer modelling than would be applied to a DCF calculation.

At this stage we focus on two key principles that distinguish it from simple DCF analysis.

- Option pricing recognises that the discount rate changes as the value of the underlying asset changes, i.e. as cashflows are observed accumulating over time, the uncertainty

[6] Although the prospect of finding such an exact match may strike many as being improbably low, it is nevertheless the basis that underpins both DCF and option valuation.

attached to them reduces. For example, in year nine of a ten year plan it is possible to have a much clearer idea of whether the plan has been successful and the likelihood of the cashflow for year ten materialising than at the start of year 1.

- Options themselves change in value over time. For example, the option to expand a factory in 12 months is granted *before* the decision to expand needs to be taken. The option holder does not know whether he will want to expand in 12 months, but attaches a value to the option because it lets him decide at the end of the 12 months whether or not to expand.

  At the end of the 12 months, demand is known more certainly. If demand does not justify expansion, then the option to expand would be worthless. Conversely, if demand warranted expansion, then the option to expand would have increased in value over the 12 months.

Option pricing is a complex area of financial mathematics, which is only now moving from the arena of traded options[7] into "real options". Although widely promoted by the academic community, we believe that while the use of real options within businesses may be widespread, we do necessarily think that the analysis performed is detailed and mathematic in its foundation. Certainly, businesses recognise that flexibility – in all its forms – has a value, but they may be unwilling to expend the effort in determining that value. We have tested this within our interview programme, discussed in Section 3.

2.3 Cost of capital in a constrained capital market

We have addressed the issues of cost of capital and real options in the sections above. Both of these approaches are relevant to the discussion of the cost of capital in a constrained capital market.

In this section we discuss "capital charging" techniques to apply NPV to existing business units and we also consider the implicit use of real options in favour of "simple NPV" in making investment decisions for new projects.

7 i.e. those which are based on the right to buy or sell an underlying security at a specified price and specified future date.

2.3.1 Capital charging

In many established businesses, new projects are disadvantaged because they have to win new capital investment from the shareholders (i.e. the Board) to start operations. Existing units do not have this problem: their capital investment is in place and they are measured against the historic cost of the cash invested.

In recent years a number of proprietary methods have been developed to "charge" existing businesses for the use of capital that they employ. This provides the business with a better understanding of the value that is being contributed. It also means that under performing units do not continue to tie up resources at the expense of new projects. The return of the under performing units can be shown not to match the cost of capital of the business. In the simplest terms, these businesses must either improve their performance or face closure so that the capital employed in them can be better deployed elsewhere.

2.3.2 The implicit use of real options

The "classic" rule of NPV analysis is to accept all projects that have a positive NPV, i.e. those that meet the expected returns of both debt and equity investors. However, there is a significant body of evidence that suggests many businesses require new projects to generate substantially higher returns than NPV theory would suggest.

Academic research indicates that hurdle rates (the return that an investment requires to be approved) are typically three to fours times the WACC. A survey[8] of the 200 largest companies in the Fortune 500 found hurdle rates of between 8–30%. A similar survey[9] of Fortune 1000 companies found a mean hurdle rate of 17.5%. These hurdle rates would seem to be well in excess of any reasonable WACC calculation for the time.[10]

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8 L Summers Investment Incentives and the discounting of depreciation allowances in "The Effects of Taxation on Capital Accumulation", University of Chicago Press 1987.

9 Poterba & Summers, A CEO survey of US companies ' time horizons and hurdle rates, Sloan Management Review.

10 Analysys is also aware of telecoms operators with WACC in the range of 12–13% who set their "hurdle rate" at 20.

It is important to consider why such theoretically improbable (and by implication irrational) hurdle rates are being set for investment decisions. Some of the reasoning lies in the fact that as a business undertakes more new projects, it becomes riskier. While this increase in risk may not be to the same extent as the computer manufacturer entering the semi-conductor market, outlined in Section 2.1 above, management implicitly recognises that each new business they start involves an element of risk and also absorbs management time and effort – which may not always be accurately reflected in the cashflow forecasts.

In some cases, these new ventures – apparently by businesses not straying from their established markets – can turn out to be highly risky indeed. An example of this would be the large investments made by many European mobile telephony operators in 3G licences. At the time, financial markets readily lent money to these businesses, believing that 3G mobile telephony would be as profitable as its 2G predecessor. When technical delays and revisions to consumer demand were accounted for, the likely returns fell below expectations and stock prices declined accordingly. We can therefore see that investors are adding an additional premium to these new investments to reflect an inherent risk, not captured by either the cashflow forecasts or the WACC itself.

A further reason for high hurdle rates for investment is that management is implicitly recognising the cost of real options in the evaluation of investment proposals. A decision to invest means that the business has also given up the option to defer investment. As we discussed above, these options can be highly valuable. An investment then raises the value of the business by its own NPV, but also reduces it by the value of the option to defer, which has now been lost.

Although not always going to the lengths of attempting to quantify the value of this option, management certainly recognises that they are not simply foregoing the cash now in order to make the investment, they are foregoing the option to make the investment later. This concept is particularly important to technology-based industries where there is a real option that the investment could be made at a later date, when the technology involved is proven and therefore less risky, or when the technology has been further developed and may simply cost less to deploy.

Conversely, if the value of the business, for example, an oil field, may increase in future, then there is a risk that developing the field and extracting oil today may simply deprive the business of the opportunity to extract the oil later at a higher price.

3 Interviews on operator investment criteria

In this section we first describe the sample of firms that we interviewed; we then examine investment decision processes by incumbents and entrants, and finally review interviewees' responses to questions on their evaluation of the 'make-or-buy' decision.

3.1 Interview sample

We have conducted ten telephone interviews with fixed telecoms operators in order to investigate how real investment decisions are taken in the telecoms industry and to contrast this against economic theory.

Three of the operators were selected from the Netherlands, the rest from Belgium, France, the UK and the USA. The interview sample that this section is based upon was drawn from a broad range of fixed telecoms players, including incumbent and new entrants, as well as copper, cable and fibre network operators. Customer segments served by the interviewees cover both business and residential customers.

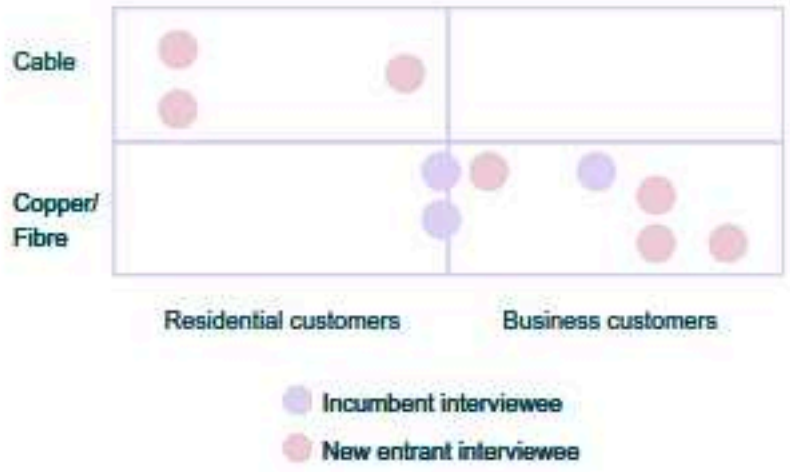

Exhibit 3.1: *Operator interview sample [Source: Analysys]*

The questions asked during the interviews considered the processes and criteria applied for investment approval, risk considerations, capital constraints and their impact on investment decisions, and non-price related factors that influence make-or-buy decisions. The interview questionnaire is shown in Annex A and provides more detail on the content of the interviews.

It is important to note that in an interview programme such as this, operators can 'game' the regulator by giving biased responses; we will take this potential bias into account when drawing conclusions later in this report.

3.2 Investment processes and criteria applied

3.2.1 Financial criteria applied

The financial criteria applied mirrors the basic financial theory outlined in Section 1 above. The standard financial measures, such as the investment's NPV, the payback period and the required level of peak funding are all commonly applied by incumbents and new entrants.

Real option analysis is not a tool that many operators are familiar with, and in cases where they are, it is not commonly applied in a quantitative manner. It was noted by interviewees that quantitative option analysis would be too costly to adopt as there would be the need to hire third parties due to lack of internal expertise. By way of anecdotal evidence, our

finance group, which has worked with incumbents and entrants worldwide, is not commonly asked by a client to formally evaluate the real option value of investments.

3.2.2 Incumbent and entrant decision processes

The investment decision, in particular for incumbents, involves traditional processes. Decisions are taken for an annual budgeting cycle and are then reviewed by cross-functional committees. Entrant operators pointed out that the post 'boom period' has been characterised by a move towards process formalisation and an emphasis on financial discipline, whereas the boom period itself was characterised by non-financial considerations, such as speed of deployment, quantity of infrastructure and subscriber growth rates.

It can be noted that the type of fixed infrastructure investment undertaken, in particular by entrants, is less strategic than was the case during the boom period. Even with sufficient national and regional coverage as well as transmission capacity, some entrants pointed out that there would be opportunities for strategic, longer-term investments, which make business sense and pass the NPV criteria mentioned above. These are, however, currently not undertaken due to capital constraints. Key considerations for both entrants and incumbents are the attempt to reduce debt financing as well as negative influences on share price performance.

Investments undertaken today are often only incremental, essentially moveable equipment, directly customer-related (e.g. connection of an additional customer to the network) or directly revenue linked (e.g. new products or product enhancements). These investments must pass very prudent short-term financial criteria, such as, in most cases, cash payback periods of up to 12 months. Only in particular cases, for instance, when connecting a new key account that could tap a new 'pocket' of customers, are these prudent payback periods allowed to be exceeded.

3.3 Risk factors of the 'make-or-buy' decision

3.3.1 Incumbents

For incumbents, risk from the uncertainty of regulatory intervention is a commonly quoted factor. A specific form of regulatory risk that was frequently named was the risk of misinterpreting the regulator's intentions when deploying a new technology. Knowing the regulatory obligation before the investment is made would lower this risk.

Investment into access infrastructure is regarded as carrying the greatest risk because of the scope for regulatory intervention in terms of unbundling and in terms of wholesale pricing. Investment into transmission infrastructure is seen as carrying less regulatory risk because transmission capacity is no longer a bottleneck due to high market supply levels.

Incumbents also identified further areas of regulatory uncertainty that translate into risk in financial terms, such as short, usually annual, time spans of interconnect tariffs and no upfront capacity commitments by carrier clients – both factors impede financial planning.

In contrast to new entrants, incumbents also quoted technology risk more prominently, i.e. the stability of new technology and standards. Risk with regard to the maturity of a technology was named, in particular, for investments currently considered in the access layer, such as, for example, very high data rate digital subscriber line (VDSL) and fibre to the home (FTTH).

3.3.2 Entrants

As the nature of the fixed infrastructure investments, in particular by new entrants, changed in recent times, the main preoccupation now revolves around market and customer risk factors. Long-term risk factors, such as regulatory and technology risk, are of less relevance for these investments. For example, a CLEC laying fibre to connect an additional customer to its local ring is mainly preoccupied by the customer's credit worthiness and the risk of the customer churning to a competitor.

Taking a longer-term view, network investment was regarded as least risky if it is service-independent, i.e. capable of delivering a multitude of services. An investment into fibre would be considered less risky than an investment into DSL network equipment given the multitude of services at vastly different bandwidths that can be offered over fibre as opposed to DSL.

Some entrants also quoted regulatory uncertainty as a risk factor, in particular the uncertainty of future regulatory requirements for wholesale offerings once an investment has been made because it could make available or change a previously unattractive 'buy' option. In the context of uncertainty over regulatory actions, it was also noted that delaying tactics available to the incumbent can increase the risk of investment recovery, for example, when investing in further points of interconnection or co-location equipment in local exchanges.

It was noted that entrants also try to reduce risk by increasing planning certainty. This is achieved by negotiating longer-term interconnection agreements or by passing minimum rental period terms for partial private circuits (PPCs) on to their end-customers.

3.3.3 Treatment of risk in the evaluation process

When it comes to factoring the above risk factors into the financial considerations and the evaluation process, generally neither incumbents nor new entrants do this very scientifically. Operators generally do not adjust the WACC for investments into, for example, new technology to explicitly account for the technology risk that is not otherwise reflected in normal company costs.

However, operators use techniques such as scenario planning and sensitivity analysis to test the impact of certain variables on the recovery of the investment outlay. The main criteria for the appraisal of the investment are that the business proposition's robustness is tested and the return on investment is regarded as sufficient.

Operators try to reduce risk from customers, in particular in the corporate segment, by performing credit checks and request financial guarantees. The minimum retail contract period is often adjusted to cover the calculated payback period.

3.4 Other factors of the 'make-or-buy' decision

The general tone from the interviews was that the financial terms of wholesale arrangements are the key consideration in the 'make-or-buy' decision. This was quoted both from the perspective of entrants and incumbents. Incumbents generally treat their wholesale (carrier) departments as separate EBITDA-contribution business divisions, and wholesaling at fair terms was quoted as a revenue opportunity rather than a threat to retail operations.

Subordinate factors to the financial terms, but nevertheless stated as important by entrants in the decision whether to 'make-or-buy', were flexibility, availability, service levels and response times offered by the incumbent or OLO. In particular, CLECs considering whether to build or to rent often prefer to rent ducts rather than rent existing infrastructure, and if considering renting loops or PPCs to a business customer premise, they are keen to ensure that the rented loop offers the same quality as the rest of their network.

3.5 Conclusions

The outputs of the interviews conducted show a broad consensus on the topic of institutional investment decision processes. The main points relevant to the discussion of regulatory options for encouraging infrastructure investment are summarised below.

- The financial analysis, while characterised particularly for new entrants by emphasis on financial discipline, is less rigorous than may be expected.
- Decision-making and the nature of infrastructure investments have changed both for incumbents and entrants.
- Investment in infrastructure would benefit from increased planning certainty both for price and non-price aspects of wholesale arrangements, as well as early commitment with regards to the regulatory obligations applied to the infrastructure in question.

4 Options available to regulators

4.1 Introduction

In this section we bring together the outputs of the economic theory review, the interviews on real-world investment criteria and our workshop with OPTA on 18 December 2002. The aim of this section is to provide insight into the options available to regulators to ensure efficient investment and the use of scarce resources when addressing the following questions:

- what would be a reasonable risk compensation (with focus on pricing and conditions) to be given to the dominant provider?
- which incentives should be incorporated to stimulate the right make-or-buy decision?
- which incentives need to be incorporated in the pricing and conditions of access?
- what should the regulatory policy on this be?

It is important to put this discussion in the context of the major overhaul the EU's regulatory framework that is currently underway, and the new series of Directives that will come into force in July 2003. This overhaul is designed to build on the development of competition since full liberalisation was introduced in 1998.

In contemplating new regulations to correspond with the implementation of the new regulatory framework, it is important to keep two regulatory principles in mind:

- regulatory flexibility
- regulatory certainty.

Regulatory flexibility

We will propose below a variety of approaches to regulating both existing and new infrastructure. This will require that the regulator has significant freedom to select the regulatory tool most appropriate to the achievement of regulatory objectives at the particular point in time at which regulation is imposed.

The new regulatory framework requires regulators to identify proportionate ex-ante regulation to be imposed on undertakings with significant market power (SMP). The new framework maintains the previous range of possible obligations to be imposed on undertakings with SMP, namely transparency, non-discrimination, accounting separation, access and price control, including cost orientation. The framework does not, however, specify remedy mechanisms to be imposed by regulators. From our discussion below, where we propose a number of different approaches, it will become clear that ex-ante regulation to be imposed on undertakings with SMP requires the availability of a choice of regulatory tools, including non-cost based tools, in order to address the whole range of issues faced by the regulator. Thus having flexibility in the setting of access costs and conditions will be very important to help stimulate both competition and investment.

This flexibility should not, however, extend indefinitely. As we show in the next sub-section, once rules have been implemented, the regulator should not have the flexibility to change them in an arbitrary or capricious fashion. In other words, the regulator should be able to provide the industry with certainty that the rules will remain consistent.

Regulatory certainty

While regulatory flexibility is necessary in being able to set the appropriate regulatory framework, once that framework is in place regulatory certainty is a very important concern for companies, and one that was raised during a number of our interviews. This means that once regulations are implemented, the regulator should not have the freedom to easily change these rules. There are two aspects of regulatory certainty that are important.

The first aspect of regulatory certainty is that regulations are decided before decisions based on these regulations need to be taken. Thus it is important that incumbents know the

relevant access conditions before making new investments, as discussed in Section 3.3.1 above (incumbents' interview responses). It is also important that entrants know the access conditions upfront, before they have to take a make-or-buy decision – this was an important concern of entrants, as expressed in Section 3.3.2 above. In addition, any foreseen changes in access conditions, or at least the criteria for making any such future changes, should be announced upfront so that there are no surprises.

This leads to the second aspect of regulatory certainty, which is to note that while regulatory flexibility is important in setting ex-ante regulation of SMP, the flexibility to alter such regulations over time may be harmful. In this respect, it is necessary that once regulation on wholesale access to network infrastructure is implemented, there should not be any unforeseen changes in these regulations.

In particular, one should note that certain government promises can be such that, once they evoke the sought after response, the government then has an incentive to break its promise. In the field of economics these types of promises are called "time inconsistent." As an example, the regulator could set high access prices on newly built infrastructure, such as fibre to the home, to reward the incumbent for making this investment (as we propose below). But once the investment is made and the costs are effectively sunk, the regulator then has an incentive to break its promise and lower the access charge for this fibre. The investing operator would probably operate the network infrastructure anyhow, given that it is a sunk cost, and the lower access cost will stimulate more competition.

Therefore, it is important that the regulator be able to credibly provide certainty that, once it has set access conditions, there will not be any unforeseen changes in the future. In general, this means avoiding changing regulations without warning. In this particular case, for instance, changes in regulation should only be expected subsequent to any review of SMP, when regulations would be lifted if an entity were deemed to no longer have SMP. As discussed above, any other foreseeable changes in access conditions should be announced upfront, so that they will not come as a surprise.

4.2 Network dichotomy

Before discussing our regulatory recommendations, we first present a simplified model of the network that we are examining, in order to discuss likely differences in investment incentives for the different parts of the network.

In broad terms, we present a view of the network in Exhibit 4.1 below.

Exhibit 4.1: *Network diagram [Source: Analysys]*

For purposes of examining network investment incentives, there are three observations to be made about the economics of network investment.

- Firstly, in general terms, moving from left to right in the diagram, the economies of scale increase. Therefore, all things being equal, the entry barriers are greater the closer the network elements are to the end user. Thus, for transmission facilities, there are greater economies of scale for local loops than for long-haul transmission. As a result, as one would expect, there tends to be more facilities-based competition in long-haul transmission than there is in local loops.

- Secondly, economies of scale, and thus barriers to entry, are greater for transmission facilities than they are for switching facilities in the tandem and central offices. Nonetheless, even for switching facilities, the economies of scale increase with proximity to the end user. Consequently, empirically it is no surprise that entrants often unbundle loops but invest in switching, and that the switches tend to be in the core of the network rather than the periphery.

- Finally, economies of density are extremely important for network investments. Specifically, as one moves from urban to suburban and then rural settings, the

economies of density decrease, and so there are greater entry barriers in rural areas than in urban areas. This observation is borne out by empirical observations that most facilities-based competition takes place in urban settings.

While this provides a general framework of types of network elements, there is a further dichotomy of network investments that is important. With reference to Exhibit 1.1 above, we mentioned that there are two types of investments: existing investments such as local loops, and new investments, such as those needed to offer DSL services. In order to determine the reasonable risk compensation on the capital employed, and corresponding access conditions, it is necessary to distinguish between these types of investments.

As discussed above in Section 2.3.1, different financial criteria are used to justify expenditures on existing infrastructure versus new infrastructure. One reason for this is that existing infrastructure usually carries a lower risk than new infrastructure. This will be recognised by investors, and should also be recognised by regulators. As mentioned in Section 2.1.4, an example from the mobile telecoms industry of a higher risk profile for new infrastructure is the higher cost of capital that investors usually apply to 3G mobile investments compared to established 2G undertakings.

There are several reasons why the risk is different for existing infrastructure.

- The nature of costs – existing infrastructure is largely sunk (literally in the case of loops), and thus most of the remaining costs are variable, and can be funded from revenues. On the other hand, new infrastructure can require large fixed costs that must be spent upfront, often before demand becomes clear.

- The nature of the services – demand for services using existing infrastructure is known and predictable, while new services requiring new infrastructure investments are less proven, and as a result it is harder to guarantee a return.

Hence, access to existing infrastructure requires lower risk compensation compared with infrastructure for which the investment decision has yet to be made. Thus, the type of investment will critically impact the nature of regulatory policies needed to stimulate investment and competition. We differentiate two main types of investments.

- Existing investments – these are investments already made by the incumbent, and therefore the only decision to be made is the make-or-buy decision for the entrant. This decision will be critically impacted by the access charges and conditions set by the regulator.

- New investments – these are investments that need to be made in order to offer new services, and can be made either by the incumbent or the entrant. We differentiate two types of new investments:

  - Complementary investments – these are new network elements, such as DSLAMs, that are used in conjunction with existing network elements.

  - Replacement investments – this involves the replacement of existing network elements, such as copper transmission, with new elements, such as fibre optics. The incentives for such investments include increasing capacity, enabling new services, and/or reducing the cost of offering existing services.

Exhibit 4.2 provides further detail on the types of investments we are considering for each category.

Investment	*Long-haul transmission*	*Tandem switch*	*Transport*	*Central office*	*Local loop*	*Customer premise equipment*
Existing infrastructure	Fibre optics	Circuit-switches	Fibre optics	Circuit-switches	Copper	Telephone
Complementary infrastructure	None	None	None	DSLAM; routers	None	DSL modem
Replacement infrastructure	Wave-length division multiplexing (WDM) equipment	Packet-switches	WDM equipment	Packet-switches	Digital loop carrier (DLC); fibre to the home (FTTH)	IP telephone; video gateway

Exhibit 4.2: *Equipment dichotomy [Source: Analysys]*

For purposes of this table, we are assuming that, with respect to existing infrastructure, the incumbent is already using fibre optics for transport, but not yet fully in the last mile.

Additionally, we (safely) assume that the incumbent is still using circuit-switches for voice telephony.

The main complementary investments that we consider are the addition of equipment to be able to provide DSL services. This includes DSLAMs and routers in the central office, and the provision of DSL modems to end-users. These network elements then use the existing transmission network to provide these DSL services. This is true for most flavours of DSL – from ADSL to VDSL – although higher speed DSL will benefit more from having fibre in the local loop, as discussed below.

In the future, incumbents may consider making three types of investments to replace existing infrastructure:

- The first would be to replace existing circuit-switches with packet-switches in the central offices and tandem offices. These switches could potentially, but not necessarily, be IP-based, but will ultimately offer the same benefits as IP systems, namely more efficient use of transmission infrastructure, as well as enabling new value-added data services to be offered to end users.

- The second replacement target could be the local loop. This could be replaced in two stages.

  - The first stage is the creation of digital loop carrier (DLC), which involves replacing part of the loop with fibre-optic cable that terminates in a remote terminal (RT) where the signal is then put onto the legacy copper loops for the last mile to the house. The main advantage of this system is that it shortens the length of the copper loop and thus makes DSL more accessible to more households (overcoming the length of copper loop restrictions inherent in DSL services).

  - The second stage would be to replace the remaining copper loop with fibre-to-the-home (FTTH), thereby radically increasing the bandwidth available to end-users.

- The final replacement target is the optical switches used with the fibre transmission – these can be replaced with new wavelength division multiplexing equipment in order to get higher transmission speeds.

We now examine each type of investment in turn. In particular, we discuss the way that regulators can best meet two important, and often conflicting, goals – stimulating investment while also promoting competition. Specifically, there can be a conflict between static and dynamic efficiency, in particular with respect to new infrastructure investments. While policies that encourage competition generally promote static efficiency, they can provide a disincentive for investment that negatively impacts dynamic efficiency. We address this issue in our recommendations below.

4.3 Existing infrastructure: make-or-buy decisions

4.3.1 Background

As shown above, the incumbent has already made these investments, and thus the only decision that the regulator can influence is whether there will be competitive entry, and if so, whether the entrant will make its own infrastructure, or buy access from the incumbent.

Based on our discussion of Exhibit 4.1 above, entrants are most likely to invest towards the core of the network, where economies of scale are relatively low. Therefore, they may invest in transport, typically long distance networks and also intra-city networks, and may also invest in their own switching capacity. Entrants would naturally be relatively disinclined to invest in their own local loops, but this is also a function of density – they may invest in multiple dwelling units in cities, but not in suburban or rural settings.

The decision for the regulator is how to optimally price access to the different network elements in order to encourage entry.

4.3.2 Solutions

For existing infrastructure, forward-looking long run incremental costs (LRIC) is the optimal costing methodology to set access charges. There are five points to consider as guidelines in setting access prices for existing infrastructure within the LRIC methodology.

- Risk – as discussed above, the risks for the incumbent are fairly low for existing infrastructure, as the investments have already been made, and the demand for the existing voice services that use this infrastructure is well established and mature, albeit subject to increasing competition in some areas. This would suggest that any risk premium added to access charges should be very limited, which would tend to keep access charges low, but moderated to reflect the differences in risk associated with different facilities. Risk is lowest for those facilities least liable to competition, such as local loops, and greatest for those facilities more easily duplicated by competitors, such as switches and transmission facilities. Access charges should be moderated accordingly.

- Nature of costs – again, as discussed above, capital costs for existing infrastructure are relatively low, and thus most of the costs are variable. Much of the investment in capital has been made, and moreover was probably made before competition was introduced, and hence the costs have been paid during a time of regulated monopoly. This is likely to be particularly true for local loop facilities and the passive components of transmission facilities (i.e. fibre optic cables and associated civil works), and less so for switching and the active components for transmission facilities (i.e. the opto-electronics) where technology continues to evolve and hence investments continue to be made. Thus, access charges for the former should be lower than the latter – as discussed below, the lower the access charge for new investments, the less incentive there is for the incumbent to make those investments.

  Variable costs are mainly maintenance and depreciation, which again are likely to be less significant costs. Again, this would suggest relatively low access charges. In line with the variable costs of providing access, these access charges can be monthly rates.

- Economies of scale and density – accounting for these economies, costs and corresponding access charges would be relatively low for last-mile assets (i.e. local loop facilities) in high-density urban settings, and increase into the core of the network (i.e. switching and transmission facilities) and in outlying suburban and rural settings.

- Capital market conditions – as discussed in Section 3.3.2, entrants we spoke with are less likely to make significant infrastructure investments in the current environment. This suggests that service-based competition, as opposed to facilities-based, is the most

realistic type of investment to expect today. Service-based competition is best stimulated with relatively low access charges.

- Network efficiency - the use of forward-looking costs is desirable as it assumes an efficient network using modern technology, to prevent the subsidization of any inefficiencies in the incumbent's network by entrants.

Therefore our recommendation based on these five points is for relatively low access charges. Setting access charges according to these rules can have a number of benefits:

- Firstly, setting the overall access fairly low, reflecting the low risk and low capital expenses for the incumbent, tends to promote service-based competition as opposed to facilities-based competition. However, for standard voice services, this competition can nonetheless have a large impact on the market. For instance, in the US recently, competitors have made significant inroads into the market using total element long-run incremental cost (TELRIC) priced platforms – indeed, for the first time, the incumbents in the US have lost access lines in the past year.

- Secondly, allowing the relative cost level to vary by economies of scale will help to induce investment where it is most feasible, namely in the switches and aggregated transmission facilities where access charges will be relatively higher than in the last-mile. Indeed, it may be possible to eliminate access to facilities such as switches when enough facilities-based investment has been made. We would recommend that any test for when access will be eliminated be stated upfront, so that it can be factored into planning by incumbents and entrants alike.

- Finally, there is evidence suggesting that low access charges for existing infrastructure can increase investment in the complementary infrastructure that we will describe below. For instance, in the US DSLAMs are not required to be unbundled. Discussions with a major competitive DSL player in the US suggest that the highest investment into DSLAMs is made in those states with the lowest access prices for local loops. This provider stated that California has the lowest LLUB rates of all its markets, and as a result the entrant made its biggest investment there, and the state now makes up two-thirds of its total customer base for DSL services. This access to unbundled loops was crucial to the entrant's ability to compete. While a number of these competitive DSL

providers went bankrupt several years ago, nonetheless this is the only likely model able to generate competition in DSL services, and given a stable regulatory regime is likely to be sustainable. (Much of the bankruptcies were due to regulatory uncertainty in setting conditions for entry). Hence partial facilities-based competition can be stimulated by encouraging investment in those pieces of the network that are most affordable to entrants, while keeping access charges low on infrastructure that is not likely to be duplicated.

In summary, we recommend that in this period of capital constraints, regulators focus on stimulating service or partial facilities-based competition. Low access prices and resulting competition will maximize consumer surplus, with little impact on dynamic efficiency. Dynamic efficiency is little impacted because, as discussed above, most investments are largely sunk and thus the investment behaviour of the incumbent is little changed by entrants using existing infrastructure. As discussed below, the same is not true for access to new infrastructure, and we account for that in our recommendations.

As discussed above in Section 2.2, the entrant still has a valuable real option to defer infrastructure investment to a later date, when capital markets improve and/or the entrant has enough customers to justify its own investment in facilities.

In order to push the entrant towards eventual investment, it may be optimal to allow access charges to rise over time, in particular for those parts of the network, such as switches, where entrant investment is most economically feasible. This will provide more incentive for entrant investment. Indeed, the FCC has just decided to go beyond this and eliminate competitive access to switches altogether in those areas (dense urban) where there is most competition already. If this route is chosen, it is important that the criteria under which the access cost of these elements is raised (or access is eliminated altogether) is announced upfront, as per our discussion on regulatory certainty in Section 4.1.

In the case of copper local loops, where, as pointed out above, entrants are disinclined to invest, not only is the above approach of raising access charges over time not optimal, but it is also not consistent with the strictly cost–oriented basis for access charges that is required under the new regulatory framework. We believe that our recommendations for unbundled local loops are fully cost-oriented, and thus consistent with the framework.

4.3.3 Non-price access conditions

In addition to pricing, in order to stimulate entry and investment, it is important to ensure that non-price access conditions are optimal (as discussed in Section 3.4) – this is involved with speedy provisioning of wholesale access by the incumbent as well as high quality of service for wholesale access services. These access conditions should be clearly spelled out, and enforcement must be strong and swift in order to provide maximal access certainty for entrants.

4.4 New investments: risk sharing

In general, new investments differ significantly from existing investments in two respects.

- Risk – the risk of these investments is much higher than for existing investments, as these investments correspond to offering new services, for which demand will be uncertain prior to making the investments. This suggests building a risk premium into the access charge, in order to compensate the investor for the risk, in particular in these times of capital constraints.

- Nature of costs – in addition, the balance of costs will tilt towards capital costs as opposed to operating costs. While some investments can be made in relatively small increments (such as DSLAMs), most new investments need to be made in relatively large chunks. Combined with unproven demand, this again suggests relatively high access charges to compensate for these costs. As discussed below, the structure of the access charges may also be changed to compensate for these costs.

For the regulator, there are trade-offs involved in trying to stimulate both infrastructure investment and competition in the new services using this infrastructure. Low access charges that are designed to increase service-based entry are likely to dampen investment incentives, because investors will feel that they are not receiving a fair return on their investments. On the other hand, higher access charges designed to promote investment will tend to dampen competitive service-based entry. This is particularly harmful to competition when facilities-based competition is unlikely.

In our recommendations below, we tend towards promoting investment with relatively high access charges, even if this may dampen competition. There are several rationales for this.

- Firstly, there are cost-based reasons that drive setting relatively high access prices for new services.

- Secondly, infrastructure investment is the precursor to service-based competition – if no one invests in infrastructure, there can be no platform for competition.

- Thirdly, given current capital constraints, and the relatively high hurdle rates applied to new investments (as described in Section 2.3.2), incumbents need incentives to invest, while entrants are unlikely to invest at all (as per our interview summarised in Section 3.3.2).

- Finally, the patent system provides a long-standing, and we would argue quite successful, model of promoting investment at the expense of competition, at least initially.

In terms of the trade-offs between static and dynamic efficiency, and consumer and producer surplus, our recommendations lead to the following outcomes:

- Our general focus is on promoting long-term investment and therefore dynamic efficiency, for the simple reason that there can be no static efficiency considerations until these investments are made.

- For similar reasons, our initial focus is on producer surplus – the high access charges that we recommend are good for the incumbent – as a means of promoting investment. Not only is this our preferred option for stimulating the investment that leads to the enjoyment of consumer surplus using this new infrastructure, these investments can also stimulate service-based competition that can increase consumer surplus in the long-run.

4.4.1 Complementary investments

As shown in Exhibit 4.2, the main complementary investment that we have identified is the DSLAM in the central office, which is used to offer DSL services. For the DSLAM in particular, upfront capital costs are relatively low, as each DSLAM serves a relatively low number of households. Accordingly, a strong argument can be made that, subject to other conditions, access to complementary investments such as DSLAMs need not be made mandatory. Both the incumbent and entrants can invest in their own DSLAMs and related equipment, leading to at least partial facilities-based competition as described above.

It is worth noting that, based on our discussions with entrants, service-specific infrastructure such as DSLAMs is riskier than more general infrastructure (such as fibre transmission), so an argument can be made to allow unbundling, at least initially, in order to spur entry. Nonetheless, as shown by the example of entrants slowly making inroads in the US market without unbundling DSLAMs, the model can work given the relatively low investment involved in DSLAMs, as opposed to other parts of the network. Therefore, we would conclude that unbundling is not necessary for these types of investments.

This is only feasible if it is easy for entrants to get reliable access to existing infrastructure, most notably the local loop, in order to be able to easily offer DSL service to end users. In addition, other charges, such as the cost of transferring the loops to the entrants network, and any costs of conditioning loops for DSL, must be reasonable and in line with costs. Finally, there must be room in the central office for co-location of the entrants' DSLAMs and other equipment, in order that these entrants can offer services similar to those provided by the incumbent.

4.4.2 Replacement investments

For the replacement investments detailed in Exhibit 4.2 above, there is a significant cost difference with the complementary investments described in the previous section. This difference is that the capital cost of these investments is likely to be quite significant, even for new switches in the central offices.

Recent experience in the US with DLC investments has shown that these investments are very sensitive to access conditions. Several of the RBOCs have announced significant projects to replace part of the local loop with DLC, but then retrenched in the face of having to unbundle these assets to entrants. They argue that, faced with the prospect of having to make these investments and then unbundle them at cost to entrants, they do not have the proper incentive to invest in DLC. While there is a question whether this is a posture meant to influence regulatory decisions,[11] nevertheless they have decided to limit their investments, even in the face of strong broadband competition from the cable companies. The incumbents have not yet broached other replacement investments, such as fibre to the curb or fibre to the home, but they would likely to be at least as sensitive to access conditions as they are for DLC systems.

Given the high capital costs, risks, capital constraints and economies of scale for these replacement investments, it becomes clear that it is unlikely that one could expect overlapping investment by incumbents and entrants. That is, if the incumbent invests in this infrastructure, it is unlikely that entrants would invest in parallel matching infrastructure. This suggests a reliance on access to enable at least service-based competition to take place using this new infrastructure. However, as discussed above, access conditions are also likely to influence the incumbent's decisions to invest.

Consequently, we would recommend implementing risk-sharing for these new investments. Specifically, this would involve re-thinking traditional access conditions that may not suitably reward the incumbent for investing in new infrastructure. One imbalance in typical access conditions involves the time-period of leasing. Typically, entrants pay access on a monthly basis, and only for network elements being used by actual customers. While this may be satisfactory for existing infrastructure (for which demand is proven and investments are largely sunk), this is unlikely to provide sufficient risk compensation for new investments.

The investment in new infrastructure involves capital expenditures with great uncertainty as to the demand for these services. With few exceptions, it is not possible to make these investments gradually when a new customer is won, and of course the capital cost is sunk

11 If this was simply a posture, it was a successful one, as the FCC just announced that it would forebear from requiring unbundling of new network investments, including bitstream access to DLC systems.

and cannot be retrieved if the corresponding customer discontinues service. Therefore, in order to truly share risk, access conditions should simulate as closely as possible the conditions under which incumbents make investments. Indeed, access should actually be conceived to be infrastructure sharing, rather than the more traditional access described above.

There are two forms of infrastructure sharing that could be adopted:

- ex-ante infrastructure sharing – this is traditional infrastructure sharing, in which a group of companies together invests in constructing the infrastructure, which they then jointly own
- ex-post infrastructure sharing – in this case, the infrastructure is built by one company, and other companies can only get access to the infrastructure by paying a fixed and non-refundable share of the investment.

The following subsections discuss the pros and cons of these two infrastructure-sharing schemes in turn.

Ex-ante infrastructure sharing

The possibility of infrastructure sharing has been raised most recently in the context of 3G investments. On the fixed side, the Stokab dark fibre network, owned by the city of Stockholm, is one version of infrastructure sharing, albeit not one owned by the companies who will be using it.

The upside of ex-ante infrastructure sharing is the ability to share risk explicitly before investments are made. As a result, there is the maximal likelihood of investment in infrastructure. Sharing infrastructure also reduces costs, and so can lead to lower retail prices than would otherwise be the case. In addition, the investors are partners in this venture, and thus the concept of incumbency becomes mooted for the relevant infrastructure, eliminating many of the non access-price issues that surround typical access arrangements.

The most frequently cited downside of infrastructure sharing stems from the partnership arrangements needed for ex-ante infrastructure sharing. Specifically, the question of potential collusion on the part of the partners is closely scrutinised. The issue raised is that the partners can extend their collaboration on the underlying infrastructure to the offering of services over the infrastructure – agreeing on prices and/or other service parameters.

In our analysis, the major risk with respect to collusion for ex-ante infrastructure sharing revolves around coverage. Typically, with new infrastructure, one important means of competition is based on coverage. Competing firms may choose different areas to roll out infrastructure in order to seek maximal competitive advantage. The risk with infrastructure sharing is that the partners agree to only focus on certain high-density, high-demand areas and limit their investments elsewhere. With 3G investments, this risk can typically be mitigated with minimum roll out conditions that can be inserted in the licence. To the extent that infrastructure sharing for fixed investments requires prior regulatory approval, minimum deployments could be made a condition of approval to mitigate the risk of limited roll out.

In terms of collusion on retail prices, we find this to be an unlikely outcome of infrastructure sharing, given the difficulty that firms have in coming to agreements on the terms of any collusion, and then maintaining this collusion in the face of incentives to undercut their partners. However, we would point out that the further removed the infrastructure is from retail services, the lower the risk. For instance, if partners share in the construction of ducts, but then lay their own fibre in the ducts, there is very little relationship to the ultimate retail services being provided. On the other hand, sharing in new switches could have a greater potential for collusion, as the partners would have greater knowledge of the services being offered by the other partners using these switches, and would also potentially be able to monitor each other's usage patterns to get a sense for each other's commercial positions.

Therefore, we would recommend that infrastructure sharing be limited to transmission facilities rather than switching facilities. This fits our model, as described above, that economies of scale are greater in transmission facilities, and thus this is where there is less likely to be any new infrastructure investments without risk sharing.

For switches, without such infrastructure sharing, access conditions might nonetheless be appropriate in order to ensure competition. This would depend on the costs of the relevant switches. If the costs are high, we would recommend the ex-post infrastructure sharing described in the next section, in order to stimulate at least service-based competition. If the costs are lower, as with DSLAMs, mandating access may not be necessary, as described above.

Ex-post infrastructure sharing

Ex-post infrastructure sharing changes the access conditions under which entrants access incumbent's new infrastructure. To be specific, it involves changing the access conditions so that the entrant's risk more closely parallels the incumbent's risks.

The main change is to the rate structure of access. Rather than allowing the entrant to pay a variable (monthly) fee for the access required by their current customers, the entrant would be required to pay a fixed fee per customer, that effectively compensates the incumbent for the portion of the underlying investment used by the entrant. This fee would not be refunded if the entrant loses this customer, so that the risk burden has shifted from the incumbent to the entrant.

Ex-post infrastructure sharing will differ from ex-ante sharing in two important and interrelated ways.

First of all, the risks of collusion are eliminated, because there is now a supplier-customer relationship involved in access, rather than an upfront partnership. However, because there is no upfront partnership and corresponding guarantee of sharing costs, the incentives for the incumbent to invest are lower under ex-post infrastructure sharing.

As a result, such sharing may be more appropriate for network elements such as switching, where ex-ante infrastructure sharing may be more conducive to collusion, and where costs are lower than for transmission, so that the incumbent may be more likely to invest without the upfront assurance provided by ex-ante infrastructure sharing.

An example of such investment risk sharing through the contractual wholesale conditions is BT Wholesale's partial private circuit (PPC) offer. Both the pricing and contractual conditions attached to BT Wholesale's PPCs differ quite significantly from those applying to retail private circuits (leased lines). This difference is intended to more equitably share between BT Wholesale and the purchasing OLO the risks associated with the investments necessary to provide individual PPCs. In particular, the entire cost of the network investment necessary to provide individual PPCs (as opposed to those investments made to support multiple PPCs or other services, or PPCs in general) are recovered through the connection charges for PPCs, rather than through monthly rentals.

BT Wholesale therefore faces no appreciable risk that it will be unable to recover these specific investment costs, irrespective of the lifetime of the service provided. By contrast, if the OLO prefers not to pass on these one-off costs directly to the end user through one-off charges, but instead chooses to recover them over time through monthly rental charges, then it does indeed bear the risk that it will not fully recover these costs if the lifetime of the service is shorter than anticipated. BT Retail, as a supplier of retail private circuits (leased lines), chooses to bear this risk – it is required to buy network capacity from BT Wholesale on the same terms as OLOs, including the payment of the high upfront connection charge, but chooses to recover some of this cost through monthly rental charges to its end customers.

This example demonstrates how the structure of access charges can be modified to more equitably share the risks of investment between the builder and buyer, with potentially advantageous consequences for investment.

4.4.3 Dynamic Efficiency Considerations

As discussed above, this proposal, at least in the short-run, is focused on promoting investment. In the long-run service-based competition may be quite vigorous. The new fibre optic infrastructure will be able to support a high quality of service (QoS) Internet platform. We already observe from current experience the level of competition between service providers that can be supported over the Internet. A high QoS Internet platform will be able to support converged voice and video services, and theoretically enable service providers other than the joint owners of the infrastructure to compete in both voice and

video services. The vigour of such competition depends, however, to some degree on non-price access conditions.

4.4.4 Non-price access conditions

By separating the linkage between infrastructure and service provision, the Internet has enabled a very high degree of service competition, which to varying degrees has already created additional competition for traditional service providers. For instance, voice over Internet Protocol (VoIP) service providers have been able to take advantage of above-cost international calls in some countries to provide a significant level of competition with the incumbent telecom operator, who owns the infrastructure over which the VoIP providers compete. It should be noted, however, that such VoIP offerings are relatively low quality. The move to QoS services may enable the infrastructure owners to introduce some barriers for independent service providers.

For instance, Excite@Home acted to restrict certain types of competition. Excite@Home was the largest cable modem provider in the United States before its bankruptcy. Excite@Home was owned by some of the major cable operators, and had exclusive access to the cable network for providing cable modem service. In order to increase the service quality of its own content, Excite@Home had its own content delivery network, and situated its own servers directly in the cable infrastructure, enabling it to offer better service quality than independent service providers could offer, since they did not have direct access to the cable network. Such differences are particularly pronounced for services such as streaming audio and video.

It should be further noted that Excite@Home also restricted streaming video sessions to be less than 10 minutes long. While this reduced congestion on the network, it also reduced the possibility of cannibalisation of the cable operator's own video offerings. Such exclusionary practices are likely to be employed by the owners of new infrastructure, and if successful will limit service-based competition.

To ensure vigorous competition between providers offering services over any shared infrastructure, it is important to ensure non-discriminatory access to this infrastructure, such that independent service offerings are the same quality as the services provided by the

owners of the infrastructure. The exact details of how to ensure such access depend on how the infrastructure sharing is undertaken (for instance whether packet switches and routers are shared), and are thus beyond the scope of this paper, but we stress here that it is important to ensure that non-discriminatory access conditions are specified in the eventual regulations governing any infrastructure sharing.

In addition, to the extent that the new infrastructure builds on the existing infrastructure of the incumbent (for instance, fibre investments that still use the incumbent's central office facilities) it is important that the other investors in the infrastructure have non-discriminatory access to these central offices. While it is true that these investors will understand this, and should negotiate such access in the contracts that formalize the infrastructure sharing, the same could be said about certain current access contracts. Nevertheless, recent experience with interactions between entrants and incumbents has shown the willingness and ability of incumbents to exploit their advantage when possible, for instance to ensure a first-mover advantage in DSL services, even at the expense of fines and other regulatory interventions. Thus, it is critical that the regulator be involved to approve the contracts and provide speedy dispute resolution services in order to ensure that there is a level playing field from the outset.

4.4.5 Universal Service Considerations

It is likely that infrastructure built out under infrastructure sharing will focus on areas and customers with high revenue potential, notably urban areas and business customers, respectively. In order to extend this infrastructure to residential customers, and particularly those in suburban and rural areas, we recommend the usage of universal service obligations. Specifically, we recommend that such universal obligations be made explicit, in acknowledgement of the fact that costs are higher in low-density areas, and potential revenues are lower from residential customers. Explicit universal funding would be available to any operator or group of operators, and thus there could be competition between operators for these funds, which could reduce the cost of the universal service program.[12] The details of how to raise and administer these funds depend in part on the

[12] For instance, one way to administer universal service obligations for new infrastructure is through a reverse auction. In this case, operators bid on how much they would require from the universal service fund in order to roll out the new infrastructure. The bidder who requires the *least* amount of subsidy wins this auction.

goals of the government and plans of the operators, and are thus beyond the scope of this paper.

4.5 Summary Overview

Exhibit 4.3 summarizes our recommendations for regulation of existing and new infrastructure.

Investment type	*Characteristics*	*Regulatory approach*	*Comments*
Existing infrastructure	Low risk, low fixed costs	Low initial access charges, rising over time	Promotes service-based competition initially, then a migration to facilities-based competition
Complementary new infrastructure	High risk, medium fixed costs	Access may not be necessary	As long as access to existing infrastructure is low cost and high quality, can lead to partial facilities-based competition
Replacement new infrastructure	High risk, high fixed costs	Infrastructure sharing (ex-ante and ex-post) to share risk	Increased investment incentives, leading to service-based competition over shared infrastructure

Exhibit 4.3: *Summary of regulatory recommendations [Source: Analysys]*

We now address several questions regarding an overview of these recommendations.

4.5.1 Integral Vision

As discussed above, there are different ways of delivering broadband over the PSTN, with different infrastructure investment levels. The first, and most common now, is DSL over copper loops; the second is DSL with DLC (fibre in the loop), and the third is broadband over fibre to the home. We believe that investments in these technologies under our proposed regulation will be driven by both intra-modal and inter-modal competition, as

much as by the regulations themselves. Furthermore, we believe that it is important to view investments in these technologies dynamically, as the investments are likely to come in stages.

In the first instance, under our proposals we expect competition to be enhanced in DSL services using copper loops. Under our proposal, the incumbent would not need to unbundle any DSLAMS, and thus the incumbent has a greater incentive to invest in DSLAMs to provide DSL service. Likewise, entrants can get low-cost access to unbundled copper loops, which they can use to provide DSL using their own relatively low cost DSLAMs.

Although this initial competition in DSL is only partially facilities-based (with the entrants investing in DSLAMs but using the incumbent's loops), there could be enough intra-modal (DSL-based) competition to provide lower prices and increased coverage among these DSL providers. However, it is important to always bear in mind the possibility of inter-modal competition, notably from cable companies and fixed wireless. This additional competition can give additional incentives to the DSL providers to further lower prices and increase service rollout.

Moving beyond DSL over copper loops, there are two incentives for the DSL providers to invest in putting fibre in the loops, using DLC technology initially.

- DLC enables additional rollout, particularly in rural areas where copper loop lengths are too long to support DSL service. While this may not be a significant problem in the Netherlands, there is another reason to install DLC technology.

- By shortening the length of the copper loops, DLC also enables higher-speed DSL, which can enable better quality of service, and even video services.

The main drivers of installing DLC are likely to be the ability to rollout DSL service to all households, and further the ability to begin to compete with other broadband providers, in particular cable, by offering video services. Under our proposal of infrastructure sharing for replacing parts of the loop with fibre, the incumbent has a greater incentive to install DLC than they may under traditional methods of access pricing, since their risk is reduced. On the other hand, entrants may have less incentive to enter, as they will have to share risk

with the incumbent in DLC investments. As a result, there is likely to be a trade-off between intra-modal and inter-modal competition. While it is likely that there will be less competition between DSL providers under our proposal (since entrants may be less likely to invest with the incumbent in DLC systems), there will be more inter-modal competition, as the remaining DSL providers (who do invest in DLC systems) will be in a better position to compete with cable companies, in particular, across a full range of services including video.

This line of argument can be extended to an eventual fiber-to-the-home strategy. The incumbent makes such investments to further expand the capacity of broadband offerings, which could encompass advanced video and audio services. It is possible that the cable company could join the infrastructure-sharing consortium to limit investments, and as a result competition will be limited to be service-based. However, the trade-off is a positive one, as it is likely that the only way to stimulate such large investments may be to settle for service-based competition. Of course, as this competition is likely to be riding on an Internet platform, this competition is likely to be quite vigorous, as can already be seen by the level of competition between application and service providers on the Internet today.

4.5.2 Developments Over Time

In order to foster regulatory certainty, as described above, we recommend that once implemented, these policies that we recommend do not change, unless any changes are embedded up front in the regulations themselves.[13] In other words, the regulations on infrastructure sharing should remain in place for the life of the infrastructure. Once companies enter into deals to share a DLC system, for instance, the regulation that requires infrastructure sharing should not be eliminated for existing DLC systems. This fosters certainty in the regulator that will be important for future new regulations. To draw an analogy, a similar dynamic holds for patents – if ever a government invalidated a patent before its natural lifespan had expired, while that may stimulate competition in the particular invention covered by that patent, it will reduce inventors' and investors'

[13] In other words, it is acceptable to state in a new regulation that this regulation will expire in three years, but if this is not stated up front, it is not acceptable to simply eliminate the regulation after three years.

confidence in the value of future patents, thereby ultimately reducing innovation and investment.

On the other hand, as new technologies and infrastructures investments are being contemplated in the future, there is no reason that the regulator should not have the flexibility to impose new types of regulations, based on the particulars of the infrastructure as well as market conditions at that time. Thus, for instance, when capital market conditions eventually improve, appropriate regulations (for instance without infrastructure sharing) could be imposed on new investments going forward from that point in time. This is consistent with our discussion of regulatory flexibility above.

The final development, however, could be that as a result of competition, both intra- and inter-modal, the incumbent is declared to no longer have SMP in a particular market. In this case, it is important that access regulations are not eliminated in such a way that the incumbent can withdraw access (or infrastructure sharing) from competitors and thereby recreate SMP. This is of course true for all SMP regulations, not just the ones that we propose here. Indeed, the new framework recognizes the need for planning certainty and specifies that an appropriate period of notice shall be given to parties affected in the case of an amendment of withdrawal of obligations.

4.5.3 Implementation Issues

It is undoubtedly the case that operators will have a strong reaction to the implementation of at least some of these regulations. This could include explicit challenges to the regulations, implicit 'foot-dragging' that will have the effect of delaying the benefits of the regulations, or at the extreme, the operators may decide not to invest at all, thereby thwarting the purpose of the regulations in the first place.

In surveying the entirety of our proposals across the different types of infrastructure, we feel that the operators will have a mixed reaction. While the incumbent may resist the lowering of access charges for existing infrastructure, the incumbent should react favourably to the lack of access obligations on some new infrastructure, as well as risk-sharing on other new infrastructure investments. Likewise, the entrants will have the

opposite reaction; they will welcome lower access charges on existing infrastructure, but be resistant to our proposals for new infrastructure.

In light of the mixed reactions on the part of operators, we advise that this new regulatory approach be adopted as a package; that is, all new regulations be adopted at once, so that, if possible, no operator can object to one part of the package without jeopardizing the adoption of the other, more favourable, parts of the proposal. In particular, for the incumbent, the more closely tied the "good" (new infrastructure risk-sharing) can be tied to the "bad" the more likely that the regulations will be successful in stimulating investment.

This trade-off is reminiscent of the core of the U.S. 1996 Telecommunications Act. In this Act, the incumbent RBOCs (Regional Bell Operating Companies), were granted their long sought after entry into long-distance, upon completing a checklist of actions that would end their monopoly over local services. While it is true that the incumbents challenged the implementation of the 1996 Act as it pertained to local entry (while nevertheless winning the right to enter long distance), recently competitors have begun to make inroads into local markets. Indeed, for the first time since the 1930s (Great Depression), the incumbents have shown a loss in total access lines, demonstrating the effectiveness of competitive entry.

4.5.4 New European Regulatory Framework

We believe that the remedies discussed above all lie within the scope of remedies that are permitted under the new regulatory framework when applied to operators that have been found to have significant market power. We would stress that we do not propose the imposition of any regulation on any operator that has not been established as dominant in the relevant market.

The general options and limitations on the range of regulatory obligations on SMP undertakings available under the new regulatory framework include transparency, objectivity, non-discrimination, accounting separation, access, and price control, including cost orientation, as a set of maximum obligations that can be applied as well as the ability to lay down technical or operational conditions to be met by the provider and/or beneficiaries of such access. We are here suggesting a form of access that is consistent with these remedies.

We have also explicitly accounted for a number of features of the new regulatory framework. Specifically, the new framework recognizes the need to balance the rights of an infrastructure owner to exploit the infrastructure with the rights of other service providers to access facilities that are essential for the provision of competing services. The new framework also weighs the need to maintain incentives for competitors to invest in alternative facilities that will secure more competition in the long-term. Finally, the framework makes specific allowance for the risks undertaken by the infrastructure owner in making the investment. We have accounted for this by incorporating the risks involved in various infrastructure investments into the incumbent's access charges, while also being realistic about where service-based competition versus facilities-based competition is most likely to occur.

4.6 'Quick-win' regulatory measures

The regulatory options discussed above are aimed at medium term sector development. Taking account of the particular fixed telecoms infrastructure situation in the Netherlands, two areas where regulatory measures could have a more immediate impact in fostering infrastructure deployment were identified in our discussions with OPTA:

- more rapid deployment of telecoms services through cable TV networks
- alternative operators investing into the next lower network hierarchy level.

First, we propose a test for access charges for existing investments, to ensure effective competition. This test can be applied to both of the quick-fix examples proposed in the bullets above.

4.6.1 Value chain analysis

Background

We discussed above the theoretical arguments for setting access charges for existing investments in order to encourage entry and stimulate competition. It is possible, however,

that even with the relatively low access charges that we propose, there will be relatively little entry into the market. Here we argue that retail prices play an important role in entry decisions, and propose a market test to ensure that there is an adequate potential margin between retail prices and access prices to attract entrants.

In the context of price controls being necessary when inefficient competition is identified in a particular market, the new regulatory framework points at price squeeze testing in particular. The price squeeze test is a comparison of retail and wholesale prices – if the wholesale price is too close to the retail price, then the entrant cannot make any profit and is squeezed out. The basis for determining the wholesale access price is usually the incremental cost base of the dominant, infrastructure-providing operator.

When setting access charges to stimulate market entry, one must look at the totality of costs and revenues for the entrant. It must be recognised that the provision of telecoms services involves a value chain that extends from the various inputs required to provide telecoms services, through the retail service itself. It is likely that the entrant will face higher costs than the incumbent, and also that the entrant may have to offer retail discounts off the incumbent's tariffs in order to attract customers.

Solutions

The standard price squeeze test does not mean that the competitive environment is fully accounted for, because the dominant operator enjoys economies of scope and vertical integration resulting in a lower cost base than that of an entrant operator. Thus it may be more appropriate, in order to determine the margin achievable by an entrant operator, to base the price squeeze test for wholesale rates on the entrant's expected cost base. This cost base may be higher due to additional costs related to access that are not borne by incumbents, and also higher customer acquisition costs.

In addition, the expected cost base should not be compared against the incumbent's retail price, but rather against a reasonable discount that may need to be offered by the entrant in order to determine whether a reasonable margin is available to the entrant. Analysys has estimated that this discount may be between 8–18% off the retail tariff charged by the incumbent. This also opens questions on whether rates have been fully rebalanced to

account for competitive pressures, and in particular whether all implicit universal service subsidies have been removed from tariffs. For instance, local retail access rates were often subsidised in order to meet social goals of universal service, and if these subsidies have not been removed from retail tariffs, then it is very unlikely that an entrant can compete with the incumbent in the local access market.

This potential solution attempts to answer questions such as: can an entrant, having to buy access, make a reasonable return based on the cost of access and also on its customer acquisition and other ancillary costs? Furthermore, can the entrant reasonably be expected to charge the same retail rate as the incumbent, or must it provide a discount in order to induce customers who may be wary about using a new provider to switch?

While it is true that effectively building in a margin in this fashion may encourage inefficient entry, the cost of this inefficient entry needs to be weighed against the other extreme – that the existing margin between retail tariffs and wholesale rates is too small to allow any competitive entry at all. The price of inefficient entry may be worth paying in the short term in order to jump start competition in the market. As discussed above, as entrants begin to win customers and grow in scope and scale, access charges for existing infrastructure can rise to both eliminate the possibility of inefficient entry, and also, as argued in Section 4.3.2 above, provide incentive for facilities-based competition.

4.6.2 Cable TV networks

The Netherlands has an extensive cable TV infrastructure, with cable TV reaching over 98% of households. The three main cable TV operators have pursued a strategy of developing their networks in order to offer a combination of cable TV and broadband cable modem access services. In November 2002, there were about 590 000 cable modem subscribers versus 240 000 DSL subscribers (210 000 of which were KPN subscribers). However, only one cable operator has pursued the roll out of residential facilities-based telephony services, with the other operators citing doubts as to the business case for rolling out local access with conventional PSTN connections, and preferring instead to wait until they can offer commercial VoIP services from a lower cost-base.

The reasons for cable TV operators' reluctance to offer residential voice telephony can be found in the unproven commercial viability of the VoIP technology, as well as the particularly tough capital constraints on cable TV operators. In order to be able to compete effectively with KPN at sufficient margins in the residential voice market, cable TV operators feel that a reliable VoIP platform is required.

However, given the value of the facilities-based competition that can be provided by cable TV operators, who only have to make incremental investments to provide telephony services, it may be important to consider applying the value chain analysis discussed in the previous section to interconnection (as opposed to access charges), which is critical to the ability of cable TV providers to offer services. In other words, accounting for the incremental cost of providing VoIP services over existing cable networks, are interconnection rates sufficiently low to enable effective competition by the cable TV operators given current retail telephony rates by the incumbent and the retail pricing options open to cable TV operators?

In addition, any uncertainty regarding the regulatory treatment of VoIP services should be confronted upfront. Issues that will need to be considered include: will VoIP over cable TV be treated the same as circuit-switched voice for regulatory purposes? Will any universal service obligations (USO) be levied on VoIP? Will VoIP providers be eligible to receive USO funds?

4.6.3 Alternative fixed network investment into the next lower network hierarchy level

For voice telephony, none of the operators in the Netherlands currently interconnect at the local interconnect points. The reason for this is that there are over 600 local interconnection points, which is too many for alternative operators to roll out their networks to, even though the interconnection tariffs at the local level have become more attractive. For a long time there was a price squeeze for local interconnection. OPTA is currently investigating how many local interconnection points an operator could be requested to roll out while maintaining efficiency.

During the operator interviews, the reasons identified for the limited infrastructure competition from alternative operators (in addition to the high number of local interconnection points and OPTA's outstanding decision in this regard) were given as:

- capital constraints on alternative operators
- insufficient planning certainty
  - uncertainty over regulated last mile bitstream access
  - uncertainty due to the danger of incumbent delay strategies
  - lacking regulatory commitment to infrastructure-based competition.

We have already discussed an approach to address capital constraints above, and in addition to addressing these planning certainty issues, an approach to manifest a commitment to infrastructure-based competition might be to vary access prices over time and geography.

For instance, increasing access prices over time would first encourage market entry, when access prices are low, and then infrastructure investment over time once an entrant has built-up its retail customer base. Thus, access prices would be relatively low at first, allowing the entrant to exploit the economies of scope and scale of the incumbent when the risk (and thus the cost of capital) is at the highest level for the entrant. As the new entrant matures and its risk declines, its own investment costs fall (as described in Section 2), and at the same time the cost of access from the incumbent would rise, so it is given a motivation to invest in its own assets. Of course, these initial low access prices should be tested using the value chain analysis proposed above, to ensure that they are truly low enough to encourage entry in the first place.

Allowing, in addition, a geographic differentiation of wholesale rates (as per the new regulatory framework) may also increase investment. Of course, given the economies of density, the cost of access infrastructure is higher in rural areas than in urban areas, and passing on these higher access costs to entrants in the form of access charges would not promote rural investment. Instead, setting up an explicit USO support system that would raise effective retail rates in rural areas would compensate for higher costs, and thereby help to promote entry and competition.

5 Conclusions

Our review of the economic theory of investment discussed standard investment appraisal techniques as well as some more recent developments in decision analysis theory. In contrast, the interviews showed that some of this more recent theory has not yet been incorporated into actual corporate decision making processes.

As the nature of fixed infrastructure investments currently undertaken by fixed telecoms operators has changed to less strategic and more incremental investments, the financial criteria that these investments have to fulfil are short-term and cash payback related.

The outputs of the interviews revealed that regulators could facilitate investment decision processes by providing increased planning certainty, resulting both from price and non-price aspects of wholesale arrangements. Early commitment with regards to the regulatory obligations applied on the infrastructure in question would further reduce uncertainty.

If the regulator is given sufficient flexibility in setting ex-ante regulations, there are several options for regulators in order to increase competition and investment, even given the current capital constraints imposed on the industry. These recommendations are summarised in **Exhibit 4.3** above.

Taking this nuanced approach to defining access conditions depending on the type of infrastructure is most likely to lead to increased investment in infrastructure, while also promoting competition. While competition will tend to be service-based, at least in the short-run, we feel that this is a realistic 'second-best' solution in the face of current capital constraints that have not only severely impacted entrants' business plans, but are also impacting the ability of the incumbent to invest in new infrastructure. In particular, for new infrastructure investments, our solution is most likely to promote investment, which is the

necessary precursor to new innovative solutions, as well as competition in the provision of these services.

Annex A: Questionnaire for operator interviews

Brief introduction to the project: Analysys is working on behalf of a European regulatory body. The purpose of this study is to characterise the factors that operators take into account when deciding whether or not to make fixed-network investments. In particular questions we are interested in include: How do operators decide whether to build their own infrastructure rather than "buy" it from the incumbent? What risks are considered and how are these factored into the decision process (explicitly or implicitly)? To what extent are regulatory considerations factored into the decision process? How are current capital market conditions affecting these decision processes?

A.1.1 Describe your business

Classify business along the following dimensions:

Y/N or %	*Y/N or %*
Cable	Copper
Telephony	Data
Local/metro	National/international
Residential	Business
New entrant	Incumbent
Narrowband	Broadband

Exhibit A1: *Business characterisation*

A.1.2 Describe your organisation's infrastructure investment process

Describe any framework(s) and process(es) that your organisation uses to make infrastructure investment decisions. Identify if there are different categories of investment e.g. narrowband/broadband, defensive/offensive, access/transmission, market entry/business-as-usual, by size of investment, by one-time/multi-year commitments, etc.

What financial criteria are applied in the infrastructure investment decision-making process?

Measure	*Comments*	*Used (Y/N)*	*Target value*
NPV			
IRR			
Payback Period			
Real Options			
Other (1)			
Other (2)			

Exhibit A2: *Financial criteria applied*

A.1.3 How do you account for risk?

What risk factors are considered in the investment making process and what is their order of priority? (This section may be repeated if the interviewee has previously identified different categories of investment).

How are these risks factored into your financial considerations/evaluation process?

Do certain classes of infrastructure inherently carry more risk than others? If yes, please describe below.

A.1.4 Capital constraints and their impact investment decisions and on the cost of capital

How are capital markets affecting your company's investment plans?

List any impact on decision-making process.

List any impact on investment programme.

What investment-related changes, if any, do you foresee in the medium term?

A.1.5 Price considerations in the buy situation

Questions for an incumbent operator

How do you treat the provision of wholesale access – as a revenue contributor or as a cost item (avoided cost of not selling at retail)? Do you consider wholesale access to be an additional revenue opportunity (i.e. additional sales through wholesalers), or an opportunity cost (i.e. wholesalers sell to your customers, so instead of the retail price you receive wholesale access price)?

Is risk compensation adequately reflected in regulated pricing (of what?)?

Are there any non-price issues from selling and what are these?

Questions for a new entrant

Discuss impact of wholesale access price on make-buy decision?

Are there any non-price issues that influence the make or buy decision?

- Delivery times of incumbent interconnect services
- Service level agreement (SLA)
- Minimum contract periods
- Committed volumes
- Compromising of commercially sensitive information
- Other strategically important reasons for asset ownership.

A.1.6 What regulatory policies would increase incentives to invest?

Questions for an incumbent

What regulatory factors would have the greatest impact on your investment decisions? (note whether the impact would be positive or negative)

- higher wholesale prices
- longer term of lease to entrants so that there is greater assurance of recouping investment?
- Ability to get prior commitment from entrants before making investment? (is this an appropriate question?)
- Non-price issues described above?
- Other?

Questions for a new entrant:

What would have greatest impact on ability to buy?

- Price issues?
- Non-price issues?
- Would you be willing to commit to longer term buying in order to stimulate investment in new technologies?

What would have greatest impact on decision to invest (make)?

- Easier buying would stimulate more investment later on?
- Any other way to be able to spread risk that regulator could impact?