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A framework for analysing strategies of Internet Service Providers

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The fast proliferation of services over the Internet and the development of new Internet standards and technologies are affecting the existing business models of the traditional telecommunications market. This holds, in particular, for the ISP market. This paper assesses the impacts of basic elements of business strategies on the relative competitive position of selected types of ISPs. One result is that the incumbent telcos have a relatively strong starting point in the ISP market, while small regional ISPs have a weak starting point.

1. Introduction

This paper aims to provide an analysis of developments in markets for Internet Services, to identify key factors affecting the competitive position of ISPs, and to develop scenarios describing the further development of the ISP industry.[1] Based on a characterisation of the value chain of Internet service provision as well as on an analysis of the dynamics of the ISP industry and its driving factors, it identifies and analyses strategic factors determining the potential for value creation and the competitive position of ISPs. In analysing ISP market development, this paper will focus on the role of business strategies affecting (1) cost structure and (2) service quality differentiation. The analysis is based on a conceptual model of the business of ISPs capturing basic elements of business strategies and is addressing the qualitative impact of various business strategies on the competitive position of ISPs. The role of contextual conditions such as market structure, network externality effects, consumer preferences, and regulatory and policy

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constraints, in shaping ISP strategies is taken into account. These contextual conditions provide not only the context for strategy in the ISP market but also the incentives for continuing investment and innovation in Internet infrastructures and services and determine the evolving usage patterns of Internet services.

The paper is structured as follows. A short overview of developments affecting the ISP industry is presented in section 2. Section 3 presents a framework for analysing ISP competitiveness. Starting point is the ISP value chain of economic activities underlying IP-based service provision. The framework takes into account other dimensions of competitiveness such as factor inputs, product portfolio, pricing and market segmentation. Section 4 focuses on how choices concerning these dimensions affect cost advantages and opportunities for service differentiation. The analysis proceeds in section 5 with a pairwise comparison of types of ISPs and qualitative results will be derived for a set of observable business strategies. Moreover, based on a scenario view on technology, we analyse the impact of several technological options on types of ISPs. Finally, section 6 concludes with some final remarks.

2. Developments in the ISP market

The developments in the ISP market will be illustrated to give an idea of the market situation. A number of issues currently are going on in the ISP market that will be of great importance for the ISP industry and for strategy development of ISPs. Therefore, we describe Internet technology and services, innovation, regulatory issues as well as the market structure and market development. From these developments all can be seen as starting points for an analysis of business strategies of ISPs. Only a few can be elaborated in this paper.

2.1. Internet technology and services

Quality of Service (QoS) is becoming a crucial factor in ISP competition. QoS requirements currently are driven by the development of real-time applications such as video on demand, IP telephony and video over IP. Especially important in realising QoS are technologies regarding the next generation Internet. Examples are protocols such as IPv4 and IPv6 (transport of data independent of the underlying network), RSVP (Resource Reservation Protocol, enabling applications to signal per-flow requirements to the network), RTSP (Real-time Streaming Protocol). Two broad developments are visible which are partly complementary:

- INTserv (integrated services) technology offers end to end QoS per data flow. It is based on reservation of resources through the network (RSVP, resource reservation protocol). A disadvantage is its low level of scalability.
- DIFFserv (differentiated services) technology supports capacity division in different pipes each with a different capacity. DIFFserv, thus, offers not reservation but is based on end-to-end prioritisation per hop (classes of service).

Accounting architectures are currently being developed supporting management of Internet resources including pricing and accounting of different classes of service supporting different QoS. Middleware technologies such as enhanced IP multicast facilitate a new range of communication applications. Relevant issues are technical as well as strategic. Among the technical issues are what kind of accounting architectures should be developed for the next generation Internet and what the middleware components should be. Examples of strategic issues are how the Internet services portfolio will evolve, how technologies and architectures will affect existing players or provide opportunities for new ones, what the strategic importance of technologies will be, and what alliances should be developed.

2.2. *Internet business innovation*

As a result of technology development, new business strategies will evolve in supplying infrastructure capabilities as well as in provisioning differentiated qualities of service. This is already becoming apparent in innovative players, for example, combining fibre optic networks and Internet technology to build networks providing new services such as video voice mail, video conferencing, or differentiated quality of service. Electronic commerce services also may provide new opportunities for Internet services providers. New business models arise based on differentiated pricing structures and methods of (re)packaging and (un)bundling [9]. Again, a precondition is the development of billing and accounting systems. Relevant strategic issues concern the positioning of existing and new players in the ISP market, i.e., the integration towards new services segments.

2.3. *Regulatory and policy issues*

One of the issues is the impact of interconnection and traffic exchange issues. Internet traffic exchange requires agreements between very different parties involved, on an international scale. Current exchange patterns are strongly in discussion for not being transparent or nondiscriminatory, and for not providing sufficient compensation for cost to some of the parties involved. Insight is needed in how Internet traffic is developing under given interconnect agreements (peering, transit), what the international and cross-supply chain interdependencies are, how these dependencies affect quality of service and finally how it affects strategic innovations and market development, i.e., electronic commerce. Strategic decisions of service providers concerning infrastructure, location of electronic commerce activities and innovation will be affected strongly by these developments [5].

2.4. *Market structure and market development*

The landscape of providers of Internet services is rapidly changing due to the interplay between technology, business, regulatory and strategic factors. A recent European

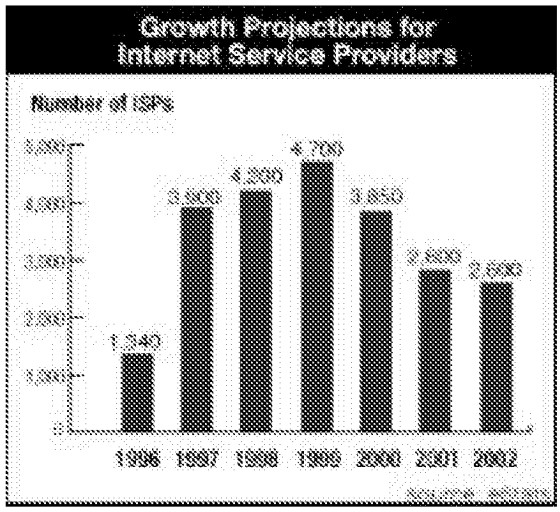

Figure 1. Number of Internet service providers.

Commission study distinguishes between types of actors at the ISP-supply side as follows [3]:

(1) Global operators (cf. GlobalOne, Concert, MCI Worldcom).

(2) National telecom operators.

(3) Internet backbone operators (cf. EUnet, Ebone).

(4) New entrants (cf. O.tel.O in Germany).

(5) National or regional ISPs.

In the following analysis we will refer to (1) global operators as "new carrier", (2) national telecom operators as "telco incumbents", and (5) national or regional ISP with restricting us to small regional ISP.

A first look towards the supply side of the ISP market shows that the number of ISPs is at its top this year (see figure 1). This is the net result of two opposing trends in the ISP market, namely (partly based on `www.emarketer.com/estats/nmsg_isps.htm`):

(1) merging and consolidation, led by the giant cable and telecommunications companies which have the infrastructure and financial resources to swallow up smaller ISP firms; further, less competitive players get weeded out; and

(2) the emergence of ISPs dedicated to a specific industry, nation, region or user group.

Examples of empirical evidence on mergers, acquisitions, joint ventures are: WorldCom and MCI, AT&T (phone) and Time Warner (cable); America Online (ISP) and Netscape (Web browser); Microsoft (software) and BT (phone); Cisco and Motorola;

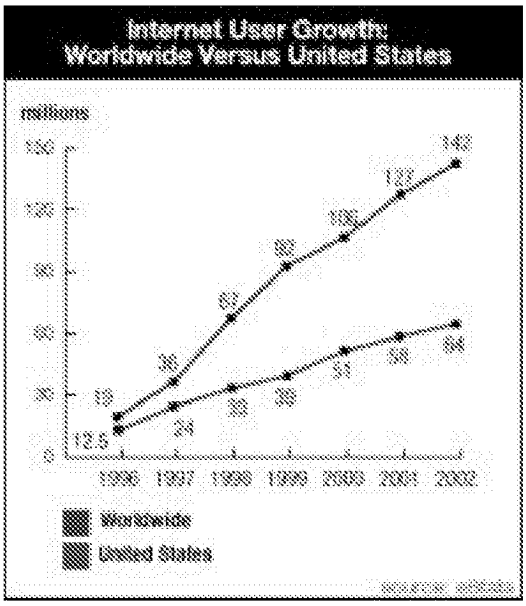

Figure 2. Internet user growth.

BT buys Arrakis (Spanish ISP); KPN (phone) buys Xs4All (Dutch ISP); Cable & Wireless buys ECRC Network Service (German ISP); @Home merges with Excite; KPN and Qwest; and many more (see `http://www.com-broker.com/` for information on ISP mergers and acquisitions).

Looking to the demand side of the ISP market, the number of users of Internet is increasing sharply. In 1996 there were world-wide 19 million Internet users; this has grown to 36 million in 1997, an increase of 90%. In 1997, about two-third of the total number of users were inhabitants from the U.S. The expected growth of the number of users is depicted in figure 2. World-wide the growth is expected to be approximately 30% per year until 2002 to 142 million users. In the U.S. the annual growth is expected to a little over 20% per year until 2002. Therefore, the number of users *outside* the US, grows about 45% annually until 2002.

Combining and extrapolating the above stated two developments regarding the market supply side (number of ISPs) and market demand side (number of users) implies that on average it is expected (given the above stated projections) that ISPs in 2002 will have 6 times as much subscribers as in 1997.

Given the stated developments and expectations of market researchers, several questions arise with respect to the evolving ISP market structure and how it affects ISP strategies:

- Given the shake-out in number of ISPs, what will be the viable ISP business models? What are successful strategies to attract new customers, and to obtain advertisement revenues? How will ISP business models possibly relate to e-commerce business models such as electronic marketplaces or information brokers?

- How will the ISP market structure develop? Which ISPs will form successful combinations? Should ISPs collaborate with horizontally complementary ISPs to enhance product differentiation? Should ISPs strengthen vertical integration? Should ISPs merge with the same type of ISPs to gain economies of scale?
- Under what conditions can small ISPs co-exist beside big players, like telco incumbents (traditional national telecommunication operator) or new international carriers? And if they can, what are their niche markets?
- What are the essential strategic technologies for ISPs? Is infrastructure an essential facility in the market for Internet services, are there competitive advantages involved in ownership by service providers, or will a more extensive separation of the network and services take place?

It would be too ambitious to fully answer all these questions in this paper. What we do is to provide a framework of analysis and to apply this to a few examples that reflect observable business strategies in the market.

3. A framework for analysing ISP competitiveness

3.1. Approach

Key elements in the analysis of competitive advantage of ISPs are derived from the work of Porter and others [7,8] and include:

- the concept of competitive forces, determining industry profitability (attractiveness);
- the value chain concept aiding the analysis of sources of competitive advantage and the development of strategies in the areas of cost and differentiation.

Competitive advantage of ISPs is a function of attractiveness of ISP market segments and the specific competitive strength of an ISP in these segments. Taking into account the trends and developments sketched out in section 2, this paper takes ISP industry attractiveness as a point of departure and focuses on analysing sources of ISP competitiveness.

A first step is to identify the economic activities assembled in a value chain in providing Internet services. The functional value chain contains the value activities to be performed by ISPs in order to be able to deliver Internet services (including IP-transport, Web hosting, e-mail, telephone, Intranet, consultancy, content delivery). The activities can be divided in various forms of supply of infrastructure (I, II and III) and intermediary services (A,B, . . . ,G; see table 1).

The functional value chain of Internet services in general contains more than the basic activity of an ISP, which is IP-transport. Additional activities – to be performed by the ISP, other suppliers or carried out by the user himself – will complete the value chain. This over-all functional value chain is represented in figure 1. Value activities (I, II, III, A, . . . ,G) are described in table 1.

Table 1
Activities of the functional value chain and its representation.

	Value activity (infrastructure and intermediary services)	Internet services	Main cost components
	Infrastructure		
I	Supply of network accessing the Internet Access Provider (IAP)	IP-transport, Telephony (dial up)	Lines, interconnection, hardware, software, labour
II	Supply of access network (connecting the IAP with an ISP connected with the Internet backbone)	IP-transport	Lines, interconnection, hardware, software, labour
III	Supply of backbone	IP-transport	Lines, interconnection, hardware, software, labour
	Intermediary services		
A	Supply of terminals		Hardware, software
B	Converting data into transportable IP-packets		Hardware, software
C	Supply of modems to access the IAP		Hardware, software
D	IP-transport	IP-transport	Lines, interconnection Hardware, software
E	Supply of content	Content delivery	Labour
F	Hosting for applications/content	Web hosting, e-mail, content delivery	Hardware, software
G	Off line services	Consultancy, Intranet services	Labour, marketing, sales, other expenses

The main activities of the (functional) value chain, related Internet services and main aspects of their cost structure are listed in table 1. Focusing on the characteristics of the ISP service delivery chain (factor inputs and associated cost structure; degree of vertical integration), value activities I (supply of network accessing the Internet Access Provider, IAP), II (supply of access network), III (supply of backbone), C (supply of modems to access the IAP), and D (IP-transport) are central. How characteristics of ISPs are determining competitiveness is discussed in more detail below. To a large extent, ISP costs are of a fixed nature and strongly dependent on technology.

3.2. *Strategy dimensions of ISPs*

In order to analyse the impact of the various features of business strategies, a framework is built up capturing the important dimensions of ISP business strategies and relating these dimensions to business characteristics and environmental variables. A framework capable to analyse business strategies for different types of ISPs should fulfil certain minimum requirements, even if it is limited first and foremost to qualitative aspects. These requirements relate to a detailed understanding of the choices in dimensions of strategy, as well of the relationships between these dimensions and choices.

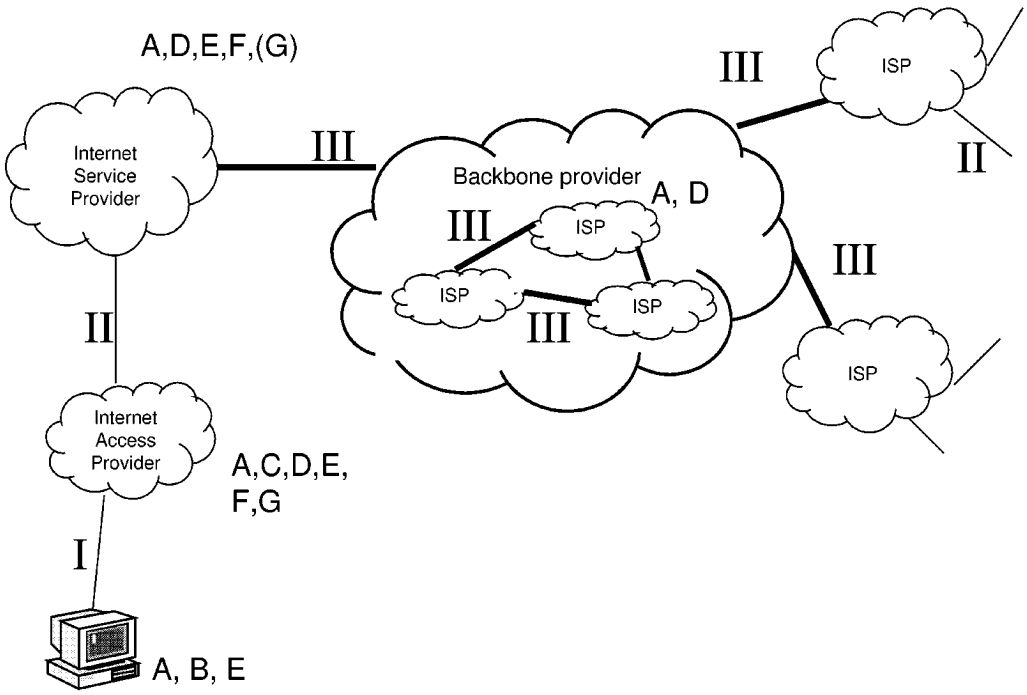

Figure 3. Functional value chain for Internet service providers.

The analysis of ISP business strategies is based on five dimensions of strategy, each consisting of several features and strategic choices. Together, these dimensions constitute the type of ISP and its strategy:

1. *Factor inputs*. Features of this dimension relate to technology employed, and to specific capital and labour inputs.
2. *Value chain structure*. Features consist of the specific value chain activities, as well as related make or buy choices, i.e., ownership versus leasing or hiring infrastructure.
3. *Product portfolio*. Is characterised by the offered services like IP-transport, Web hosting, e-mail, etc. A basic portfolio consists of IP-transport, Web hosting, e-mail.
4. *Pricing policy*. Pricing structures include flat fee (price is independent of usage, but usually within certain limits as stated in the agreement between customer and ISP), usage based (price depends on usage where usage may be calculated based on various factors, such as time, volume of traffic, type of application and so on).
5. *Market segmentation*. Segmentation dimensions include geographical scope (regional, nation-wide, international) and user categories (residential versus business).

In this report, only a selection of dimensions and their features and not the whole portfolio is studied. The elements of the framework are visualised graphically in fig-

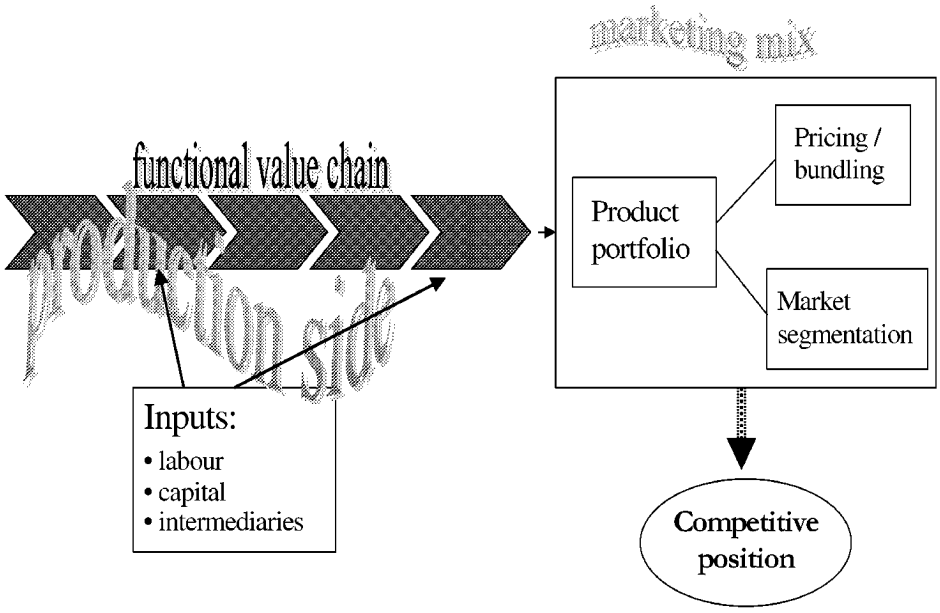

Figure 4. Conceptual framework for analysing the competitive position of ISPs.

ure 4. Each of the dimensions contains several features. On the factor input side both the *quality* and the *quantity* of the types of input is taken into account, such as labour, capital and intermediate products. The impact of differentiation of inputs on the competitive position will be taken into account. Factor inputs are closely related to the second dimension: the functional value chain. For each economic activity of the value chain there is a specific allocation of production inputs. The functional value chain characterises the degree of vertical integration. The third element "product portfolio" comprises options concerning IP-transport, Web hosting, e-mail, telephony, consultancy, content and Intranet facilities. The fourth element "pricing policy" is characterised by the combination of flat fee versus usage based pricing, and of bundled versus unbundled services. The fifth element "market segmentation" is characterised by two dimensions, namely the geographical scope (regional, national, international) and the type of customers (e.g., residential customers, SMEs, large national firms, multinational enterpries).

The dimensions product portfolio, pricing policy and market segmentation together constitute the "marketing-mix" and all five elements constitute the over all business strategy and at least the type of ISP (see figure 4). Production (cost) conditions and the marketing-mix together are the essential firm-specific dimensions determining the competitive position. However, competitive position is also affected by other market conditions such as demand, technological factors, policy and regulation, and the number and strategies of competitors.

Table 2
Characteristics of ISPs.

Features	Type of ISP		
	Incumbent telco	New carrier	Small, regional ISP
Inputs	Capital intensive, (inter)national Mature technology	Highly capital intensive (advanced), (inter)national	Less capital intensive, less advanced, mature technology
Functional value chain	I, II, III; C, D, E, F, G Vertically integrated	II, III; D, G Ownership of infrastructure	C, D, F, G Not vertically integrated
Product portfolio	Basic portfolio + other services	IP-transport, intranet, . . .	Basic portfolio, consultancy services, content
Pricing and bundling	Flat fee, bundling of access and dial-up	Usage oriented, . . .	Flat fee, bundling of services
Market segmentation (type of customers; geographical reach)	Residential, business (SME, LNF, MNE, ISPs); (inter)national	Business (LNF; MNE, ISPs);	Residential, business (SME); regional
Examples	KPN (Netherlands), Deutsche Telekom (Germany), Sprint, AT&T (USA)	Worldcom/MCI, Qwest, Global Crossing and Level3	IVM and Angel in Germany Vuurwerk and A1 in the Netherlands

3.3. *Selected ISPs – characterised by strategy dimensions*

We characterise ISPs by the above presented strategy dimensions. Given all the different strategy options multiple ISP strategies and – as far as a type of ISP is characterised by his conducted strategy – types of ISPs can be derived. For the following analysis we selected 3 stylised types of ISPs: The incumbent telco, the new carrier and the small, regional ISP. Their characteristics are shown in detail in table 2. We are aware of the fact that the characterisation of the types of ISPs is simplified and that, of course, e.g., not all incumbent telcos not necessarily conduct exactly the strategy outlined here. Nevertheless, we think that the provided characterisation pretty well reflects the observable strategies on the European market. To derive the impacts of these strategies in the competitive position of these stylised ISPs, we will make a pairwise comparison in section 5.

3.4. *Line of analysis*

A competitive advantage can be obtained on the basis of [1]:

(1) a cost advantages, or

(2) an advantage through service differentiation.

A competitive advantage always relates to a specified market or market segment. For a specified market a cost advantage always results in a higher profitability. In

this case profitability is the suitable indicator for measuring the competitive advantage. Whenever a competitive advantage results from differentiation new market segments will be opened up. For these market segments the cost analysis has to be applied again. In the following analysis we will not quantify the profitability of ISPs and restrict ourselves to qualitative results.

This framework facilitates comparison of the competitive position of different types of ISPs. Because the ISPs differ in various aspects (expressed by the elements in figure 4) it is necessary to identify the factors that could result in a competitive advantage. As far as two different types of ISPs distinguish themselves only in terms of one element, a competitive advantage could easily be derived from this difference. In reality, however, the existing types of ISPs in all likelihood differ in more than one element. A five-step approach has been developed guiding the analysis of the impact of the various choices on the competitive position of stylised ISPs:

Step 1. Identification of critical factors driving competitive advantage. As was discussed before, different features were identified of each dimension that determines the type of ISP and their strategies (inputs, functional value chain, product portfolio, pricing policy and market segmentation). An example is the dimension of "pricing" where it was distinguished between flat fee and usage sensitive, and further between bundled and unbundled services. This sort of analysis can be applied to all strategy dimensions.

Step 2. Analysis of factors ceteris paribus affecting ISP competitive advantage. Based on the features identified in step 1 it is analysed whether and how variations in one feature will *ceteris paribus* result in a competitive advantage or not. I.e., *ceteris paribus* whether it is advantageous to replace flat-fee by usage sensitive pricing or not. This partial analysis was carried out for a selection of features and focuses on impacts on cost advantage and product differentiation opportunities (section 4).

Step 3. Identification of the types of real world ISPs in terms of specific features. For the categories of real-world ISPs that are taking into account, the dimensions and features were identified constituting their strategy (see figure 4). The analysis focuses on a selection of ISP-types as they are presented in table 2: telco incumbent, new carrier (backbone capacity supplier) and small regional ISP.

Step 4. Comparison of real world ISPs in terms of relative competitive advantage. Pairs of ISP-types as defined in step 3 are compared with respect to the issue how factors in dimensions of strategy turn out to affect competitive advantage. To this end, the results of step 2 were applied to each of the selected ISP-types as defined in step 3. By combining the partial effects and comparing among ISPs, the relative impacts on the competitive position of the different types of ISPs can be assessed. This results in identification of the dimensions and features of the observed ISPs as well as their interrelationships that are really critical in creating leverage and competitive advantage.

Step 5. Scenarios: consideration of technology uncertainties. Finally, ISP industry scenarios are being constructed on the basis of uncertainties affecting ISP industry structure. It is focused mainly on the Internet technology dimension of ISP industry scenarios. Results of step 4 are taken into account in order to assess the options ISPs may consider and the room for manoeuvre ISPs may employ in order to cope with different and uncertain futures. A strengths – weaknesses – opportunities – threats (SWOT) analysis connects the information concerning ISPs relative competitive position derived from step 4 and the technology scenarios.

4. Factors affecting ISP competitiveness

According to steps 1 and 2 (line of analysis) in this section, a partial analysis is carried out where it is assumed "other things equal". Distinguishing features are characterised of the elements "factor inputs" (section 4.1), "functional value chain" (section 4.2), product portfolio (4.3), pricing and bundling (section 4.4) and market segmentation (section 4.5). It is analysed whether and how choices concerning each of the features are affecting the cost structure or the opportunities for product differentiation.

4.1. Impacts of factor input choices

Factor inputs represent one of the five elements that constitute the type and the strategy of an ISP. Factor inputs involve the physical resources that are necessary for the provision of Internet services. These inputs depend on the type of services that are offered by an ISP. Nevertheless, an ISP has the choice within a set of inputs to produce a service. An ISP may choose within the type of inputs, their quantities and relations, and select his preferred quality of the inputs individually. Therefore, an ISP has the ability to differentiate from competitors through the selected inputs to provide his services.

In analysing how differentiation of inputs affects competitive position, first it is necessary to define the offered services that are produced with these inputs. The analysis can be applied to all services, like IP-transport, e-mail, Web hosting, content, consultancy service, etc. Second, the alternative sets of inputs from which the ISP is choosing, must be outlined. The impacts of the selected inputs can be twofold:

- Impacts in costs for provision of the service might result in a *cost advantage*.
- Impact on characteristics of the output might result in an advantage by *differentiating the services* from other competitors.

In this paper it is not possible to cover all services. To illustrate the impacts of factor input choices we restrict ourselves to an ISP that is only supplying basic services. The main factor inputs for providing IP-transport are: network infrastructure (lines, including network technology), routers and servers, labour and interconnection.

The impact of two different input choices on the competitive position is analysed:

(1) choices with respect of quality of the input "network infrastructure" (see section 4.1.1), and

(2) choices with respect of increasing the regional scope of IP-transport by employing additional inputs (see section 4.1.2).

4.1.1. Advantages of advanced network infrastructure

Two alternatives are compared: (1) advanced network infrastructure, versus (2) mature infrastructure. All other strategy dimensions are equal. The quality of network infrastructure (different types of physical network and technologies) does not affect the TCP/IP technology. The later one is set on top of the network technology and is not affected by it. Even though the characteristics of the IP are not affected by the quality of network infrastructure, it has features that are important for the operation of the IP network and, therefore, for its quality of service. The dimensions of this quality of service are (1) bits per second, (2) reliability of the service. We analyse the impact of using *high quality network infrastructure*, instead of using a mature, *low quality network infrastructure*. In both cases it is assumed that the supplier of Internet services is owning the infrastructure, i.e., we neglect the impacts of the difference between owning and leasing.

Impacts on costs of using advanced network infrastructure. Advanced infrastructure and technology goes along with a higher productivity and in general also with higher costs. Whether it is advantageous to choose the new technology or not depends on the costs of the two alternatives: using mature (existing) technology or building up a new one. Then this decision is affected by the following factors:

- costs of network infrastructure, including capital costs and expenses for network operation,
- productivity of network infrastructure,
- risks and uncertainties concerning the life expectancy of the network infrastructure.

An advanced and high quality network infrastructure goes along with reduced expenses for network operations (labour is substituted by capital) and an increased reliability of network services. Improved reliability of network performance goes along with higher productivity and, therefore, is expressed in a higher productivity of the infrastructure. This productivity must be related to the costs of the network infrastructure to compare the two alternatives. The quantitative effects on costs depend on the individual characteristics of the already owned infrastructure and expectations on future usage, technology development, as well as the costs of bearing uncertainty. Increasing demand is advantageous for the high quality network infrastructure because of its higher productivity. Opposing effects can result out of a fast technology development: Competitors can invest in these new technologies with even higher productivity and capture these advantages. But such developments are highly uncertain and it is difficult to predict

the technology development. Nevertheless, it is likely that the demand for bandwidth will be tremendous in the future and – neglecting further technological innovation – it is very likely that high quality network infrastructure will be superior to mature infrastructure.

Impacts on differentiation of using advanced network infrastructure. Features of a high quality network infrastructure, like quality of service in terms of transmission time, are adding value to the service of IP-transport. It is likely that there exists an additional willingness to pay for this service within the market segments for business customers and maybe also for residential customers. This is improving the competitive position of the ISP using an advanced network infrastructure.

Conclusions. Choosing an advanced network infrastructure as input for the provision of IP-transport is resulting in a competitive advantage by service differentiation. Also it is likely that cost advantages exist in comparison to the mature infrastructure.

4.1.2. Advantages of increasing the regional scope of IP-transport

The minimal configuration of an ISP goes along with a specific regional scope: only customers within this area can be served by that ISP. If the ISP wants to supply Internet services to more than one area he needs to build up an additional Point of Presence (PoP) in the new area and he needs additional infrastructure to connect the PoPs to the existing ones. Again, two alternatives are compared:

- increasing the number of PoPs and substituting the additional server capacity for e-mail and Web hosting by a backbone router, versus
- increasing the number of PoPs without investing into a backbone router.

Impacts on costs of increasing the regional scope. An increase in the number of PoPs from one to two not necessarily doubles the costs, even though the supplied services are the same. If the PoPs are built up independently it is likely that the costs double. But it is also possible to interconnect the two PoPs and use some parts of the infrastructure jointly: e-mail server, Web server, uplink connection to the Internet backbone. To be able to use these resources jointly, it is necessary to run a backbone router. Whether a cost advantage results from the interconnection of the two PoPs, depends on the costs for e-mail, Web server and uplink connection in comparison to the costs for a backbone router. Nevertheless, the increase of the regional scope goes along with additional customers. An increase in the number of customers is accompanied by economies of scale: decreasing costs per customer resulting from the jointly used resources. Because infrastructure is one of the largest cost components, and can realise more scale than e-mail and webserver, it is likely that interconnecting of PoPs is more advantageous.

Impacts on differentiation of increasing the regional scope. It is likely that there are customers that have an additional willingness to pay to be able to access his ISP from

different areas at local rates. These customers can be attracted by the strategy to increase the regional scope of IP-transport. To provide such a service the ISP has at least to provide nation-wide access.

Conclusions. Cost advantages can be derived out of the operation of additional, interconnected PoPs, as far as with an increasing number of customers economies of scale can be derived. Furthermore, an increase in the regional scope is attractive for those customers that prefer local access to their ISP independent of their location.

4.2. *Impacts of functional value chain choices*

The functional value chain structure reflects the degree of vertical integration. Whether it is advantageous to differentiate the degree of vertical integration or not, must be reflected in a cost advantage. All activities of the functional value chain can be performed by one ISP or be split up to different suppliers. The less activities of the functional value chain an ISP is performing, the lower its degree of vertical integration. There are multiple possibilities in what respect ISPs can differ in terms of vertical integration. To analyse the impact of the degree of vertical integration on the competitiveness of an ISP, a partial analysis is done. Choices concerning vertical integration are compared and the impact on competitive position is analysed with respect to cost advantage. Research concerning the market structure of ISPs with emphasis on the degree of vertical integration is conducted by Lehr [6]. Examples of choices in the degree of vertical integration are shown in table 3.

We elaborate on the first example: supply of network facilities. It is analysed whether it is advantageous to *own* infrastructure in comparison to *lease* it. It is assumed that only the services of the basic portfolio (IP-transport, Web hosting and e-mail facilities) are supplied. To identify economies of scope that could result out of a higher degree of vertical integration for the production of the basic services, we need to take into account not only the infrastructural activities of I, II and III but also the activities for IP-transport, D as well as for e-mail and Web hosting, F. The ISP owning the infrastructure could represent either a telco incumbent or a new carrier such as MCI Worldcom.

Table 3
Analysing differences in vertical integration.

With		Without	Activity*
Supply of network facilities (telephony access, IP access and IP backbone network)	Versus	Outsourcing of network facilities	I, II, III
Supply of e-mail server	Versus	Outsourcing of e-mail server	F
Supply of Web server	Versus	Outsourcing of Web server	F
Supply of dial up access	Versus	Outsourcing of dial up access	C

* Activities of the functional value chain. See figure 3 and table 1.

Table 4
Factors affecting choices of value chain structure.

Factor	Factor impact on costs	Increases relative attractiveness of
Scarcity of venture capital	Increases capital costs for building up an own network	Leasing infrastructure
Scarcity of rights of way	Increases costs for building up an own network	Leasing infrastructure
Uncertainty about demand, regulation and technology together with the required time for building up an own network	Increases the risk of cost recovery of the investment in own infrastructure	Leasing infrastructure
Ability to control the network and its quality	Own infrastructure lowers the costs of unstable network performance and QoS	Owning infrastructure
Complexity of business focus	Own infrastructure increases the coordination costs	Leasing infrastructure
Scarcity of infrastructure on the wholesale market (monopolistic prices on the wholesale market)	Increases the price for leasing	Owning infrastructure

4.2.1. Costs of vertical integration of network supply: owning infrastructure

A number of variables have been identified having an impact on the costs of the two alternatives. These variables, their impact on the relevant costs and their effect on the attractiveness of owning or leasing infrastructure are represented in table 4. Whether a cost advantage can be derived from owning or leasing infrastructure, depends on the individual resources and perspective of each player.

4.2.2. Demand side related aspects of vertical integration of network supply: owning infrastructure

The vertical integration of network supply does affect the demand side in two respects:

- The self-production of network facilities with the possibility to control the performance of the network can be interpreted as a product differentiation. A higher reliable QoS can be offered with own infrastructure that is operated by the supplier himself. It is likely that especially within the market segment of business customers a higher willingness to pay for that reliable QoS can be found. These customers will be lost if the control of QoS is not possible for the ISP. Such a loss in revenues was already considered with the costs of unstable network performance and QoS.
- With the supply of network facilities for own production purposes it is obvious that the ISP can also offer his network facilities to other suppliers on the wholesale market. Especially if the market for bandwidth is still quite monopolistic – as many parts in Europe are – this is an attractive market segment. Therefore, the advantage that

could result out of the provision of infrastructure on the wholesale market, needs to be taken into account for evaluating the alternatives *owning* or *leasing* infrastructure.

Conclusions. Vertical integration in combination with self-provision of infrastructure results in competitive advantages in a market with increasing demand and still monopolistic features. The more competitive the market is and stable or even decreasing demand, the less advantageous the owning of infrastructure will be. Finally, it is not likely that genuine ISPs will integrate upstream. But telco incumbents and new carriers can derive competitive advantages out of existing facilities.

4.3. Impacts of product portfolio choices

Choices with respect to the product portfolio, such as telephony services, standardised and/or customised consultancy, content services, affect the cost structure as well as the potential for differentiation.

4.3.1. Additional supply of telephony services

In providing *telephony services* (including dial up connection) in addition to the basic services portfolio, competitive advantages in terms of cost and differentiation can be acquired. Cost advantages stem from the ability to offer dial up connections to a lower price than market price, or from substituting PoPs with low priced dial up services. The latter is affected by the geographical scope of the market activity. A differentiation advantage results from the ability of cross selling. Bundling of telephony and IP-transport increases the competitiveness of a supplier that is offering telephony services besides the basic portfolio (facilities for e-mail, Web hosting; IP-transport) including dial up access. This results from the ability to reduce administration and transaction costs.

4.3.2. Additional supply of consultancy services

Provision of *consultancy services* also is an attractive feature. Offering customised services may secure the attractiveness of small regional ISPs for specific groups of potential customers (residential customers, SMEs). There are two important reasons for this:

1. These customers often do not have the ability to do without consultancy services (especially helpdesk and support for Web page creation). They are better off taking customised services and paying a higher price instead of choosing the cheaper standardised service.
2. Offering customised consultancy services and being close to the customer makes it possible to differentiate from the standardised services.

For small ISPs the standardisation process results in too high costs per customer; that is the reason why they generally stick with customised services.

Table 5
Successful consultancy services.

	Small ISP (little resources)	Large ISP (many resources)
Residential customers	Customised	Standardised
Small and medium enterprises	Customised	Standardised
Large national firm		Standardised and customised
Multinational firm		Customised

The results of analysing the attractiveness of offering consultancy services to the different market segments are summarised in table 5.

4.3.3. Additional supply of content

Concerning the *provision of content* in addition to the basic portfolio, strategic options and trade-offs involved are of a very complex nature. Important aspects are the necessity of a choice between offering content *or* efficient network service provision, the pricing of information, arrangements concerning rights, etc. The cost aspect of storage, of Intellectual Property Rights (IPR), etc. is likely to become more important with the shift from data-oriented to multimedia-oriented and targeted information.

4.3.4. Conclusions

The impacts of product portfolio choices are manifold and strongly depend on demand related aspects. Offering additional services to the basic portfolio is likely to increase the stickyness of the customer. Customisation can leaves niche markets to small players. Nevertheless, there are large economies of scale in the provision of content. The higher they are the more difficult it is for small players.

4.4. Pricing and bundling

Pricing and bundling strategies are part of the marketing mix. There are different choices concerning pricing policy. A simplified distinction is between flat fee and usage based pricing. See, for example, [2,4] for discussions on pricing strategies for Internet traffic and services. Another choice is between unbundled and bundled services.

Cost impacts of flat fee pricing

Usage sensitive pricing itself requires the metering of usage and the allocation of the used quantities to the customers. This is absorbing more resources than with flat fee, because metering and accounting is not necessary with flat fee. Therefore, the strategy of flat fee pricing goes along with a cost advantage.

Demand side related impacts

The pricing strategy not only affects costs but also the behaviour of the customers. We assume that customers do differ in their usage intensity. Furthermore, we assume that prices recover costs.

To outline the impacts of the pricing strategy on user behaviour, we look at the market segment of residential customers and distinguish two cases:

- the customer is certain about his usage behaviour,
- the customer is uncertain about his usage behaviour.

Certain usage behaviour. When the costs for pricing are the same for both pricing strategies, the under average user is better off demanding the usage sensitive price. This will affect the calculation for cost recovery: because of adverse selection the flat fee is not adequate to recover costs. This disadvantage of the flat fee strategy can be outweighed by the costs for the usage sensitive pricing itself. Depending on the cost differences of the pricing costs of both strategies and the distribution of usage behaviour, it is possible that adverse selection not necessarily takes place. The higher the cost difference and the less the variance, the more likely it is that the flat fee strategy is more advantageous than the usage sensitive one, also with respect to cost recovery.

Uncertain usage behaviour. Uncertainty of usage behaviour refers to the fact that the customer is uncertain whether his usage behaviour will be above average *or* below average. We distinguish between risk averse and risk indifferent customers. The risk-averse customer might be willing to pay an additional price to eliminate the uncertainty of bearing high usage costs. Therefore, he might prefer a possibly higher flat fee price, to avoid the risk of bearing higher costs in the usage sensitive case. The risk indifferent customer does not care about uncertainty and therefore is not willing to pay a higher price. He will react in the same way as under certainty.Thus, under uncertainty both pricing mechanisms are sustainable.

Conclusions. Because of the higher costs for usage sensitive pricing itself, the flat fee can be a sustainable strategy. If the metering costs are coming down, the flat fee is only attractive for risk-averse customers that are uncertain about their usage behaviour.

4.4.1. Bundling

Pricing strategies can also be divided in:

– Bundling: the customer is charged only once for the complete portfolio; from the viewpoint of the customer, the costs of a service are dependent on other demanded services.
– Unbundling: the costs of a service are *in*dependent of other demanded services (viewpoint of customer) and the customer is charged per service.

In some respects, bundling has the character of flat fee pricing: a set of services is priced as one commodity, no matter to what extent the customer makes use of the different services.

To analyse the differences between these pricing strategies we analyse whether it is advantageous to offer the basic portfolio bundled or unbundled.

Cost impacts of bundling and unbundling. If billing costs increase with the number of billed services, it is less costly to offer bundled services than unbundled services. Therefore, a cost advantage can result from bundling. In comparison to other cost elements this cost advantage might not have a big impact on the overall competitive position. This needs to be validated with empirical data.

Demand side related impacts of bundling and unbundling. We distinguish between customers that are demanding all services of the basic portfolio and those who are only demanding one or two services of the basic portfolio. Assuming a customer who only demands e-mail facilities. This customer would prefer an ISP that offers its services unbundled. In a bundled portfolio this particular customer also would have to pay for the other services.

The same reaction can be expected from a customer that needs the whole basic portfolio but has different quality requirements for each service. The bundle only by chance fulfills these different quality levels. Therefore, such a customer would prefer to buy the services unbundled.

Nevertheless, there might be customers with homogeneous preferences that demand all services of the basic portfolio. They might prefer bundled services over unbundled services, because of the lower transaction costs. For this market segment (demanding the whole portfolio) the bundling results in a competitive advantage.

4.4.2. Conclusions

Because of accounting and billing costs, a cost advantage can be derived from bundling. The differentiated demand in terms of services and qualities has a countervailing effect on the competitive position.

When there is a market segment with homogeneous preferences for a basic portfolio, bundling will be an advantageous pricing strategy. In that case both strategies are sustainable.

4.5. Market segmentation

Market segmentation reflects the product strategy as far as different user groups can be distinguished and served by differentiated products which have specific characteristics, i.e., place of consumption, time of consumption, bundled, unbundled, quality of service and many more aspects. Therefore, market segmentation discribes the business strategy with respect to the different customer groups. Nevertheless, market segmentation can be interpreted as a result of successfull product differentiation. It has no generic impact on costs or differentiation. Instead, itself is a result of the business strategy.

5. Different types of ISPs and their competitiveness

This section confronts the analysis results of the previous section with types of ISPs as presented in table 2; qualitative results will be derived for a set of observable

business strategies. The main conclusions are summarised in section 5.2. This is the result of our static analysis. In addition, to take account of uncertainty and technological options, in section 5.3, we analyse the impacts of several uncertain technological options on the competitiveness of the different types of ISPs. The construction of ISP scenarios is an important vehicle for the development and assessment of strategic options for ISPs.

5.1. Pairwise comparison of ISPs

In this section the results that are derived in section 4 are applied to the institutional types of ISPs defined in section 3.3. This is done by comparing ISPs in pairs of two. The comparison is based on the different strategies of the ISPs, that are reflected in the five elements constituting their strategies. The starting point for the analysis is to identify the market segments the ISPs are acting in.

For the three selected types of ISPs (telco incumbent, new carrier and small regional ISP) in principle three pairwise comparisons can be made. Here, as an example, we restrict ourselves to the following two pairwise comparisons:

- telco incumbent – new carrier,
- telco incumbent – small regional ISP.

5.1.1. Example 1. Telco incumbent – new carriers

The characteristics of a telco incumbent and a new carrier are outlined in table 2.

Market for residential customers

With the supply of e-mail, Web hosting and content, the incumbent telco addresses the market for residential customers. The new carrier does not offer his services to residential customers. Therefore, they are not competing on this market.

Market for business customers

Both suppliers are able to supply Intranets on their own networks. Therefore a cost advantage can not be derived from vertical integration by the supply of lines for Intranets.

1. Competitive advantages for the telco incumbent

On the market for business customers the telco incumbent is competing with the new carrier for the LNFs and MNEs. The telco incumbent can derive a competitive advantage from the following features:

- high density of nation-wide infrastructure,
- telephony service.

High density of nation-wide infrastructure. The density of the network makes it possible for the telco incumbent to supply Intranets to customers independent of their location

within a reasonable set up time. Even though the new carrier might be able to offer Intranet services on leased lines, it is not certain that he is capable of providing a reliable quality of service. That is because he is not able to control the network infrastructure. It is likely that this feature is of more relevance for LNFs than for MNEs, because the latter one's are often located in areas with a dense infrastructure.

Telephony service. Expertise in supplying a reliable telephony service can result in customer credits. These credits can be advantageous for selling Intranet services. The new carrier obviously cannot rely on such credits; he more or less just entered the market. To sustain this advantage the telco incumbent must provide a high quality, both in telephony and in Internet services.

2. Competitive advantages for the new carrier

The new carrier can derive a competitive advantage from the following features:

- high quality of international network infrastructure,
- international scope of the network infrastructure.

High quality of international network infrastructure. The high quality of the network infrastructure (including the amount of available capacity) makes it easy for the new carrier to dominate the telco incumbent in terms of reliability and quality of service. Especially the provision of "bandwidth on demand" qualifies the new carrier over the telco incumbent.

International scope of the network infrastructure. The international scope of the network infrastructure of the new carrier is larger than that of the telco incumbent. Therefore, he can attract MNEs more easily than a telco incumbent also he can easily bypass the accounting rate regime for international telephone calls and, therefore, derive cost advantages. A telco incumbent must rely on leased infrastructure or has to set up new infrastructure. The latter takes a lot of time. A customer would only accept waiting if it results in a highermore reliable quality of service. (This, however, depends on other inputs, that are not necessarily related to these types of ISPs.)

Conclusion

The inputs, i.e., the network infrastructure, determines the relative competitive positions of a telco incumbent and a new carrier. The latter one generates his competitiveness from the international scope of his infrastructure and the overall high quality. The telco incumbent, on the other hand, can rely on the density of his infrastructure, especially at the nation-wide level.

In the market for business customers, both are able to supply Intranets on their own networks. The telco incumbent derives a competitive advantage from its high-density nation-wide infrastructure and its expertise in providing reliable telephony services. The new carrier may derive competitive advantages from its ability to provide high quality network infrastructure and its international scope.

A relevant distinction is that a new carrier has the newest types of lines and technology available. Thus he might benefit more from the introduction of new technologies such as WDM, Wavelength Division Multiplexing. Whether this results in a competitive advantage for the new carrier also depends on developments in demand and the requirements of available applications. When there is a surplus of bandwidth then there is no competitive advantage. However, demand for bandwidth usually follows the availability of bandwidth with some delay; when there is a surplus new applications are developed that use the available capacity.

In reality the incumbent telco also could adopt its infrastructure very quickly and the differences in competitive position due to technological changes therefore may not be that large or sustainable over time. But this, obviously, is determined by the strategic decisions of the management.

5.1.2. Example 2. Telco incumbent – small regional ISP

The telco incumbent and the small regional ISP are distinct in all five elements defining their strategies (see table 2).

From the perspective of market segmentation, it is obvious that the telco incumbent and the small regional ISP do not compete on the market segments for LNFs and MNEs. In general they are only competing on the market segments for residential customers and SMEs. The competition is also limited geographically to the regional area of the small ISP.

Apart from the telephony and Intranet services that are only supplied by the telco incumbent, both types of ISPs, in general, offer the same types of services. Nevertheless, there are other possibilities to differentiate for an ISP, as we have seen in section 3.

Market for residential customers

1. Competitive advantages for the telco incumbent

A telco incumbent can derive competitive advantages over a small ISP on the market for residential customers from:

- supply of telephony,
- supply of content,
- scale of his infrastructure for the provision of the basic portfolio,
- nation-wide supply of PoPs.

Intranets are only demanded by business customers and are therefore irrelevant for the market for residential customers.

Supply of telephony. The telco incumbent that offers Internet services on a large scale, has a competitive advantage over a small ISP, because of his additional supply of telephony services (dial up connection and access can be bundled) and the already established customer relation. These features reduce the transactions costs for a customer by a combination of one-stop shopping, low costs for monitoring his Internet expenses and low search costs. (On a long-term perspective the latter one cannot be that important.

Once entered the Internet the customer does not face high search costs any more. That is because of the ease of searching via the Internet.)

Supply of content. Whether the supply of content is more advantageous for the telco incumbent or the small ISP cannot be stated in general (see section 4.3). There are a few arguments in favour of the telco incumbent. In our model, the ability of supplying attractive, well packaged and well tailored content is measured in terms of number of hits (cost per hit of a site is decreasing by increasing hits). This determines the competitiveness of a content supplier.

For our comparison we assume that both suppliers do offer content of the same attractiveness. Information on the existence of an attractive Web site helps to attract customers. Since the telco incumbent has many more customers than the small ISP, he can offer this information to many more potential visitors and, thus, has at first stage a competitive advantage in attracting visitors. This advantage results out of information costs (transaction costs) that the customers bear when searching content. As already mentioned, they are only important in the short run. Therefore, to sustain this advantage, a telco incumbent has to provide a higher quality of content than the small ISP is offering. But it is likely that he can manage this easily because of high economies of scale.

Scale of infrastructure for the provision of the basic portfolio. Because of the law of large numbers and the independent usage behaviour of the customers the telco incumbent has a cost advantage over the small ISP since he is serving a larger number of customers.

For an ISP it is important *to manage the IP traffic in such a way that the available capacity is efficiently used and the agreed QoS is met.* Larger ISPs can more easily do this because of:

- *Law of large numbers*: if the number of customers is high, each with their own typical behaviour, than the aggregate demand can be fairly accurately estimated (the degree of accuracy is dependent on the number of customers and the diversity in demand). Moreover, by choosing the portfolio of customers such that their behaviour is complementary, an ISP can efficiently use the available capacity.
- *Offering QoS*: a larger ISP has more influence on the QoS level than a smaller ISP, because the former one has control over a larger part of the network. Thus, the range of the network is an important indicator of ensuring QoS.

Therefore, the incumbent telco has a competitive advantage over the small regional ISPs, especially in the market segment of business customers which have strong preferences for high QoS.

Nation-wide supply of PoPs. This is important to attract customers all over the country (at low access costs: leased lines or dial up). Furthermore, this feature captures those customers that do frequently access their ISP from another area than their home area.

The nation-wide distribution of PoPs makes it possible for the customer to access their ISP at local or regional rates from any place within the country.

2. Competitive advantages for the small ISP

The small ISP can derive a competitive advantage over the telco incumbent on the market for residential customers from *customised help desk services.*

With the provision of customised, high quality consultancy services, the customers with a strong preference for this service can be captured (we assume that the likelihood of high expertise in small ISPs is quite high). Small ISPs might have a competitive advantage over the incumbent telco here, since their operators usually have a high quality of IP skills. Besides that a telco incumbent usually prefers to provide standardised consultancy services. The ability to find a niche market and provide customised services successfully depends on the quality of service delivered. It is only possible for those ISPs that have enough expertise in information technology and IP.

Market for SMEs

1. Competitive advantages of the telco incumbent

The telco incumbent can derive competitive advantages over the small ISP on the market for SMEs from:

- the scale of his infrastructure for the provision of the basic portfolio,
- standardised consultancy services,
- nation-wide supply of PoPs,
- Intranet.

The scale of his infrastructure for the provision of the basic portfolio. The advantages that can be realised on the market for residential customers also apply to the market for SMEs. Supplying the basic portfolio to *both* market segments makes it even more likely to generate economies of scale.

Standardised consultancy services. Economies of scale in offering standardised consultancy services give the telco incumbent a competitive advantage. He is able to dominate the small ISP in price competition.

Nation-wide supply of PoPs. Only *medium* sized enterprises demand this feature. Small enterprises are not likely to make use of this service and therefore have no willingness to pay for it. We will discuss this feature when looking at the market for LNFs.

Intranet. Because the telco incumbent owns lines all over the country, he can offer SMEs one-stop shopping for Intranet services. The small ISP has difficulty competing here, because he is not able to control the whole infrastructure (only the IP infrastructure).

2. Competitive advantages of the small ISP

The small ISP can derive a competitive advantage over the telco incumbent on the market for SMEs from:

- customised consultancy services.

These customised consultancy services must be of high quality. Small ISPs that have a high expertise and a close distance to residential customers have a competitive advantage. This advantage holds for a niche market of SMEs with a high willingness to pay for quality of service.

Conclusion

The telco incumbent generates his competitive advantages from economies of scale that he can realise because of his large number of customers. However, he needs a nation-wide scope to serve so many customers.

The small ISPs that are characterised by high expertise can only sustain a competitive position on small niche markets. That is because of their cost disadvantages in comparison to the telco incumbents.

5.2. Strengths, weaknesses, opportunities and threats

This section summarises the findings of the previous sections where various business strategies for different types of ISPs were analysed. The results are mentioned as Strengths, Weaknesses, Opportunities and Threats. The strengths and weaknesses reflect the current situation and are based on an internal analysis. The opportunities and threats relate to future developments and are based on an external analysis.

Note 1. The opportunities and threats are put together because it is usually a matter of wording that determines whether it is an opportunity or a threat.

Note 2. The difference between current situation (S and W) and future situation (O and T) is frequently arbitrary because we are (always) in the middle of a transition period.

5.2.1. Incumbent telco

The incumbent telco has several *strengths*. For example, the incumbent telco is able to offer one-stop-shopping to his customers, which may be an advantage for a specific type of customers. An incumbent telco has control over a large part of the necessary network, and therefore, is able to provide a higher guarantee for QoS. An incumbent telco offers a nation-wide supply of PoPs and therefore customers only bear the local telephony costs. Furthermore, an incumbent telco faces low costs for IP-transport and thus their total costs for offering IP-services are lower. In the market for consultancy services, the incumbent telco faces increasing economies of scale because of their large number of customers in *standardised* consultancy services (and therefore, they have a

competitive advantage over smaller ISPs). Moreover, they are able to offer customised consultancy services with a high added value to customers that have a high willingness to pay for those services (especially larger companies). Finally, the incumbent telco is well-known by customers, partly because of their long standing supply of telephony, and therefore customers have faith in the incumbent telco; new customers on the ISP market may first consider the incumbent telco as a business partner.

A *weakness* of the incumbent telco is that they are using relatively old technology and for that matter are less suited to offer QoS. Therefore, updating the quality of their network is necessary to remain competitive to new entrants on the market for backbone capacity; that is, it is an *opportunity* to join the high technology carriers in providing QoS. *Threats* are the increased competition on the market for backbone capacity and new regulation. Together they lead to lower prices for and lower margins on IP transport.

5.2.2. New carrier

A new carrier is a backbone capacity supplier with a new and large international network. His *strengths* lie on the wholesale market and large business customers. New carriers have a high degree of control over their network, which is useful in providing QoS to their customers. Furthermore, they are facing relatively low costs for IP-transport. A major *weakness* for a new carrier is that they are not (yet) well known (contrary to their main competitor: the incumbent telco). Therefore, customers do not easily find their way to the new carrier; the new carrier has to invest to build up "a name".

A major *opportunity* for the new carrier is to face the competition on the market for backbone capacity with other new entrants on this market and with the incumbent telcos: prices for and margins on IP-transport are decreasing. Furthermore, the new carrier should exploit his advantage of having the newest technologies for providing QoS. This will attract the customers with a high willingness to pay for quality.

5.2.3. Small regional ISP

A small regional ISP offers access to customers in a particular limited region. Their *weakness* is that this type of ISP has only a few PoPs and therefore it depends on others to offer IP services, at present still on the incumbent telco. Therefore their costs for IP transport are relatively high. Another *weakness* is that the small ISP can not offer guarantees for QoS to its customers, because of their very limited control over the network.

A *strength* for most small regional ISPs is that their personnel are flexible and highly qualified. The personnel identify themselves with the organisation and therefore they are very motivated and thus offer high quality of service. Further, a small ISP is close to its customers and therefore the small ISP is able to offer flexible and customised service. A major *opportunity* then is to find a niche market for consultancy and content services. Due to its low number of customers, the small regional ISP is not able to profit from standardisation and thus increasing economies of scale.

Table 6
SWOT-results.

ISP	SWOT		
	Strengths	Weaknesses	Opportunities and threats
Incumbent telco	One stop shopping Control over large part of network Nation-wide supply of PoP Low cost for IP-transport Economies of scale in standardised consultancy	Relatively mature technology	Provision of QoS Join high-technology carriers in providing QoS Increased competition in the market for backbone capacity
New carrier	Advanced technology Ability to provide QoS Low cost for IP-transport International network	Market entry (brand name)	Exploit new technologies to provide QoS
Small regional ISP	Flexibility Customer orientation	High cost for IP-transport Dependency on telco incumbent Inability to gain economies of scale	Exploit decreasing costs of leased lines Niche markets for consultancy and content services Competition with incumbent telco

5.2.4. Summary of strengths, weaknesses, opportunities and threats

It is instructive to look into the strengths, weaknesses, opportunities and threats of each of the ISP-types. This provides a basis for analysing the dynamics of competition in scenarios. The results of the SWOT-analyses above are summarised in table 6.

5.3. Focusing scenarios: the role of Internet technology

ISP industry scenarios should take account of uncertainties in the external environment and consider the capabilities of the different types of ISPs to react and anticipate on these uncertainties (strategic leverage). Uncertain external factors are:

- Technology: new Internet technologies (IPv4 – IPv6, INTserv – DIFFserv, scarcity in the backbone network or in the access network).
- Regulation and policy: changes in interconnection agreements, competition policies, regulations concerning intellectual property rights.
- Market structure: new players and essential market characteristics.
- Customer needs: developments in preferences and trade-offs, pace of adoption of Internet services, penetration of services and Internet access rates.

Focusing, in particular, on Internet technology developments, it is clear that the impact of technology supporting QoS is a factor concerning ISP's competitiveness. In section 2, developments concerning QoS (INTserv, DIFFserv) and IP protocol develop-

Table 7
Options for scenario development.

	Uncertainties		
Options	QoS	IP version	Scarcity
Option 1	DIFFserv	IPv4	Backbone network
Option 2	INTserv	IPv6	Wired access network

ments were already mentioned. Although the developments seemed very promising, it recently turned out that there are some important limitations (scalability) of RSVP and thus INTserv, such that it will not be used in the Internet at large. However, the market requires an immediate solution for handling QoS. This led to the development of differentiated services (DIFFserv).

In the following short analysis it is assumed that a limited set of options concerning three types of technology uncertainties are determining the strategies of ISPs (table 7):

- QoS technologies (options: INTserv – DIFFserv);
- IP version (options: IPv4 – IPv6);
- Scarcity of transport capacity (options: backbone network – wired access network).

A basic difference between INTserv and DIFFserv is that INTserv provides guarantees on a connection basis for individual traffic streams and DIFFserv provides probabilities on an aggregate basis. Thus, DIFFserv has a lower ambition level. An important aspect of DIFFserv is the opportunity that it provides to customers to make agreements with its ISP on the tariff and the specific pipe he will use for its traffic (associated with a different quality). The capacity of the different pipes is relatively static; that is, the capacity will not be adjusted in real time. When there are agreements in advance for a longer period between the customer and an ISP on the combination of traffic class and tariffs, then there is no *direct* price tag associated with every IP-traffic. Only *indirect* costs in the sense that a service uses a certain capacity in the pipe/for that quality. DIFFserv has much lower requirements towards accounting and billing procedures than would be the case with INTserv.

Concerning *scarcity of transport capacity*, access networks offer the local loop to the backbone. The wired access network is characterised by high cost per data unit because of limited usage, ownership by incumbent telcos and its serving mainly as access to consumers and SMEs. Aspects of the backbone network are: low cost per data unit because of shared usage, a high degree of competition (a/o Worldcom), and a strong capacity growth induced by fibre technology (WDM). Most probably, scarcity of transport capacity will be in the access network.

A likely technology scenario thus might consist of the following assumptions: DIFFserv technology will emerge as the dominant QoS solution; IPv4 will prevail during the next few years; scarcity in the access network will be above scarcity in the backbone

Table 8
A likely scenario and its impacts on ISPs.

	Scenario		
Impact on ISP	DIFFserv	IPv4	Access network
Incumbent telco	++		+
New carrier	+		–
Regional ISP	–	–	–

network. Table 8 depicts the resulting developments for competitiveness of incumbent telcos, new carriers and regional ISPs based on this scenario. The consequences are as follows:

- DIFFserv will increase the competitive position of incumbent telcos regarding consumer markets, because of its end-to-end ownership of the backbone as well as the access network. DIFFserv will also benefit new carriers because these carriers can guarantee a high QoS for advanced services such as VPN, VoIP and VIP to enterprises. New carriers may "cherry pick" in enterprise markets.
- Scarcity in the wired access network will benefit incumbent telcos, because of their current ownership of the access network. It will result in disadvantages to new carriers because extra investments are required in order to guarantee full access and to decrease the risk of overcapacity. It also will provide a disadvantage for small regional-based ISPs who are fully dependent on incumbent telcos.
- IPv4 will result in a disadvantage for regional ISPs because its consumer orientation requires one address for each consumer where in enterprise markets much more data per address is transported.

6. Discussion and conclusion

The goal of the research as presented is to develop an analytical framework for analysing successful business strategies for Internet Service Providers. This paper focused on the impacts of production characteristics on costs and opportunities for product differentiation. A conceptual and qualitative approach was presented which allows for analysis of impacts of business strategies on competitiveness of ISPs.

There are many features of business strategies of ISPs which are relevant for the competitive position of an ISP and also there are more types of ISPs than presented here. Furthermore, the model-based analysis as presented is mostly *qualitative*. Further specification of such scenarios, analysing the interaction dynamics inherent in these scenarios and developing an instrument to support strategy development and testing is certainly one of the issues for further research. For a quantitative analysis the model should be extended and reliable data should be made available. Despite these limitations, the analysis gives a basis for identifying successful ISP strategies.

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