

The identification of new and emerging markets in the telecommunications sector: A first multi- criteria proposal for regulatory bodies applied to the VDSL case

Draft

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Abstract

In February 2003, the European Commission published the regulatory directive 2003/331/EC on a common regulatory framework for electronic communication networks and services, according to which “new and emerging markets, in which market power may be found to exist because of ‘first mover’ advantages, should in principle not be subject to ex-ante regulation.”

While there is an ongoing debate among scholars about the appropriate regulatory regime for the access regulation of new telecommunication infrastructure in general and “Very High Data Rate Digital Subscriber Line” (VDSL) broadband network in Germany in particular as a new and emerging market (Baake et al. 2005), a systematic and economic grounded derivation of market (process) criteria for the definition and identification of new and emerging markets has rather been neglected. Against that background we introduce a first multi-criteria-framework in order to analyse and detect new and emerging market structures.

Strictly following a fact based approach, we apply our new market concept to the case VDSL network and its (possible) downstream services.

Overall, this paper provides a (first) global framework for capturing and tracking emerging market processes. If one takes a constructed market phase matrix as the basis, with particular consideration of the specifics of the telecommunication sector, characteristic features of the VDSL case can be classified as an ideal-typical emerging new market at an early development stage.

Keywords:

Market definition, new and emerging markets, dynamic markets, product market regulation, performance competition, market process theory and VDSL

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1. Introduction

„Needless to say identifying a genuinely new market is a lot harder than it sounds ...”
(Geroski 1998)

In February 2003, the European Commission published the regulatory directive 2003/331/EC on a common regulatory framework for electronic communication networks and services, according to which “new and emerging markets, in which market power may be found to exist because of ‘first mover’ advantages, should in principle not be subject to ex-ante regulation.”

The directive and in particular both the introduction of the dynamic concept of ‘first mover advantages’ and the ‘emerging markets’ concept reflect a development towards a more dynamic perspective on competition processes within the European regulatory bodies. However, the definition of new and emerging markets still remains imprecise.

While there is an ongoing debate among scholars about the appropriate regulatory regime for the access regulation of new telecommunication infrastructure in general and “Very High Data Rate Digital Subscriber Line” (VDSL) broadband network in Germany in particular as a new and emerging market (Baake et al. 2005), a systematic and economic grounded derivation of market (process) criteria for the definition and identification of new and emerging markets has rather been neglected.

The commentators Vrijmoet and Rosensto (2005) put the basic problems of formulating a workable definition in a nutshell: “An emerging market is any relatively new market in which there is insufficient information (for example, in terms of demand, pricing, price elasticity and entry behaviour) to carry out the necessary market definition procedures and/or tests as to whether the market is susceptible to ex ante regulation.”

Against this background, we developed a conceptional framework in order to analyse, discuss and identify new and emerging product markets from a “market process” perspective by introducing a multi-criteria approach. The target is to identify meaningful (early) criteria combinations, which not only point to a market emergence and development process in a specific case, but which can also claim a certain general validity, as well as facilitate a fact-based inter-subjective comparability for sector specific regulatory authorities. Our concept of market demarcation and identification of new markets is not based however on a purely static definition of a new market, rather for practical purposes the gradual character of the market emergence process is gone into, in order on the one hand to be able to take the emerging character adequately into account as an early indication, and on the other hand to be able to draw a clear demarcation line between old and new markets (Kirzner 1997; Ikeda 1990).

Within our framework, new and emerging markets will be regarded as a special case of dynamic markets (Teece, Coleman 1998). Markets do not simply appear out of the

blue, as it is assumed in static neoclassical market approaches, they rather develop along complex feedback processes among the relevant market dimensions over time (Ikeda 1990; Soberman, Gatignon 2005; Sterman 2000). Accordingly, we derived and discussed a set of market process and performance criteria and their characteristics along the market components "Supply", "Demand" and "Product" taking "Technology" as a further aspect separately into account by an assessment of various innovation, market and competition process theories, empirical contributions and market concepts (Bauer 1989; Malerba 2006; Teece, Coleman 1998). In order to structure and frame the relevant market dimensions and dynamics for regulation purposes, we applied the heuristic model of innovation system (Carlsson et al. 2002; Hekkert et al. 2006). Finally, we integrated the criteria into a market-innovation phase model (Schmidt, Rittaler 1987). Strictly following a fact based approach, we apply our new market framework to the case VDSL network and its (possible) downstream services in Germany, which is based on qualitative information available in June 2007.

The paper is structured as follows. After this introduction, two key-concepts to our market approach will be introduced. In Chapter 4 the conceptional framework will be characterised in summary. Before the VDSL-Assessment will be carried out, the market-process-criteria system will be introduced and evaluated. As the basic approach was developed with a view to identifying relevant criteria to define emerging markets in a general, technology- and market-independent form, before the analysis of the VDSL case, possible key implications and problems of the idiosyncrasies of the telecommunications sector for the criteria system, are briefly expounded. The relevant criteria pertaining to the VDSL case are discussed and evaluated in Chapter 7. This chapter ends with a preliminary assessment of the VDSL case. Based on the derived theoretical approach and the criteria or indicators deduced therefrom, a first summarised statement/opinion on the evaluation of the VDSL case as "new market" is put forward. The paper ends with a first critical assessment of the proposed method based on its implementation in the VDSL case, which also leads to a list of further challenges or questions deserving further research (Chapter 8).

2. Market Delimitation in Dynamic Industries and New Markets

2.1 Introduction

The definition of a given market is subject to differing accentuations depending on the discipline, aim and field of economic research.

Accordingly, no universally valid conventions exist for the delimitation of product market boundaries. The market is no natural phenomenon but rather a social construct for the appropriate detection of structures and exchange processes (Bauer 1989; Engel 2003).

Market definition conceptions vary by the intended use, the underlying competition theory, delimitation objects as well as delimitation criteria and methodology. Furthermore the delimitation of the relevant market appropriately occurs in an objective, spatial and, to a limited degree, in a temporal respect. Bauer classifies market objects by the market-constituting dimensions supply, demand, product and (technology)⁴ that can be derived from a functional market definition and further specified by means of criteria. Relevant delimitation methods encompass theoretical and statistical approaches that place individual criteria in a meaningful context and that allow for the operationalisation of criteria. According to Bauer (1989), a summarizing and universally valid but rather unspecific functional understanding of markets can be summarized as follows: “Supply and demand interact and exchange services, embedded in a competition process”

Standard market conception like the SSNIP-test or the “Bedarfsmarktkonzept” applied in competition law to detect market power and market abuse, proceed from an existing product market with its allocation function in a neo-classical sense. Competition takes the form of price or output competition within a specific geographical area, related to a given product or bundle of products.

Emerging markets, however, exhibit various development dynamics along the three (four) market dimensions and the time axis before a market in a neo-classical static sense could be spoken of, in an ideal-typical case (Ikeda 1990; Teece, Coleman 1998).

While several dynamic economic theories and parallel partial concepts exist to record competition dynamics in dynamic contexts, only few integrated concepts exist which connect the insights of dynamic approaches for a competition law analysis, in particular with a view to the analysis of new markets (Audretsch et al. 2001; Gilbert, Sunshine

⁴ Bauer (1989) reduces the relevant dimensions to the objects of product, business (supply), and demand. However, adding the object of “technology” to the dimension is as plausible. In our approach, we appropriately assume the presence of four market dimensions.

1995; Hartman et al. 1993; Teece, Coleman 1998; WIK 2003; European Economics 2003). The market approach introduced here is set out to take these deficits into account. The approach is essentially built on three conceptual pillars:

- (1) The concept of the innovation system as heuristic to structure the relevant criteria forms the basis, as a framework condition linking product market regulation to the relevant market dynamics (Carlsson et al. 2002; Hekkert et al. 2006).
- (2) The concept is based on the performance-vector-approach according to Teece and Coleman (1998) to demarcate the relevant market. The vector approach acts as the analytical starting point to register significantly altered product attributes, which are of fundamental importance as a "kind of shock" for the market emergence process, or at least of temporary system instability, in the sense of the market as a system (Ikeda 1990; Kirzner 1997). Secondly, the approach serves to functionally demarcate the relevant market from other markets in a dynamic market environment. Thirdly, the method to differentiate between "new" and "old" markets will be measured in a performance-based substitution approach to record so-called substitution gaps⁵ between old and new product (markets).
- (3) As Markets as a rule do not simply appear out of the blue, but rather develop over a certain time period by means of complex feedback processes, the concept to generate relevant criteria to describe dynamics along the four market dimensions – namely supply, demand, technology and product – in the market emergence process is based on various market and competition process theories, empirical contributions and concepts (Geroski, Mata 2001; Ikeda 1990; Malerba 2006; Soberman, Gatignon 2005; Sterman 2000). The criteria selection and thus the economic market process foundation is based on an interdisciplinary selection approach suggested by market process theorists (Malerba 2006; Soberman, Gatignon 2005).

⁵ Substitution gaps according to Robinson (Robinson 1933) are viewed as a chain(elements) that exhibit more or less strong substitution connections among each other. Where the substitution gaps are comparatively large, or, in other words, where the chains are disrupted, the relevant markets are to be delimited from each other. Substitution concepts are appropriately classified according to demand-specific and supply-specific substitution conceptions: According to the demand-specific substitution concept, all those products and/or services constitute a relevant product market, that are considered to be exchangeable or substitutable from the demand perspective in view of the product characteristics, the price or the intended use.

The underlying idea is that a “new market” represents a special case of a dynamic market. In other words, the technological performance competition constitutes an essential characteristic of “new” and emerging markets, where innovations hold a certain significance that could be causal for the development of new markets.

In the following section, two specific gateways to the delimitation and identification of dynamic and new markets respectively are introduced that constitute an essential part of the theoretical-conceptual foundation of our market approach: the performance-based product-market substitution concept according to Teece and Coleman (1998) and a market process theoretical foundation for the derivation of criteria for the detection of market formation processes.

2.2 Performance-Based Market Delimitation Approach

Contrary to the static standard delimitation of product market boundaries, Teece and Coleman (1998) focus on changes in product attributes for the delimitation of the relevant product market boundaries. They view technology and product properties as a variable and, in contrast to standard product market definition concepts, not as a given measure. Because particularly in dynamic markets and rapidly changing markets respectively, in which performance competition constitutes an essential characteristic of the competition process, relevant product attributes are subject to ongoing and incremental changes and adjustment processes.⁶

Competition gains significance through performance-upgrading of individual product or technology-performance-vector parameters as a specific case of quality competition vis-à-vis price strategies in dynamic markets and should, consequently, be taken into consideration for the delimitation of product market boundaries. In the end, the evaluation of the improvements of individual product attributes occurs from the demand-side perspective. Thus, essentially improved or novel product attributes can lead to a comparatively improved or novel functional fulfillment of specific needs from the demand perspective and, therefore, significantly influence the delimitation of the relevant market from the demand perspective.

Consequently Teece and Coleman (1998) propose modified product market substitution conceptions for the delimitation of relevant product markets boundaries. According to this approach price as a central competition and delimitation measure is to be substituted by performance measures.

6 See also Pleatsikas, Teece (Pleatsikas, Teece 2001), Hartman et al. (Hartman et al. 1993) and Schmalensee (Schmalensee 2000).

For changing product market substitution constellations, Teece and Coleman (1998) speak of a performance upgrading of critical product attributes of at least 25%. “A sample of participants could be asked whether a 25% change in the performance of any one attribute would lead to product substitution. While surveys are less exact than market data regarding past substitutions, they are forward- rather than backward looking. In innovative industries, that tradeoff may be well worth making” (Teece, Coleman 1998, p. 856).

From the conception’s perspective of new markets detection, the performance approach comprises three main functions:

- Firstly, as measured by substitution gaps, the approach offers an analytical starting point for the definition of the relevant product market in a factual respect from a dynamic perspective.
- Secondly, the conception establishes access for the delimitation of the relevant product market boundaries in a temporal respect.
- Thirdly, the market concept indicates the necessity of product innovations with a rather certain significance that might lead to noval product market substitution constellations.⁷

While the performance-vector-approach according to Teece and Coleman (1998) can first and foremost strictly speaking describe “noval markets” as a kind of innovation outcome in terms of changing product market-substitution-constellations that is to be captured by substitution gaps between products or technologies in an intertemporal respect, the evaluation of process-theoretical approaches allows for the description of market dynamics as a distinctive feature of emerging markets.⁸

7 In order to delimit “new” from “old” the conceptual approach results in the necessity for a comparatively rapid or radical performance change coupled with comparatively significant product innovations that can lead to a significant shift in the satisfaction of needs from the consumer perspective coupled with substitution gaps between “old” and “new” products.

8 The underlying reference for the delimitation of “new” in an objective-intertemporal respect is an essential aspect for the delimitation of relevant markets. According to this idea, “new” will be delimited from something existing in some form of “content” over time. So-called product market substitution concepts constitute a gateway to the delimitation of new markets in an objective-intertemporal respect. The relevant market, as seen from the perspective of the customer, is delimited as measured by the evaluation of specific substitution properties of individual products in view of the coverage of a basic societal demand.

2.3 Process-Theoretical Approaches and Market Delimitation

Although process-theoretical approaches do not constitute a concrete product market definition concept, supporting market delimitation criteria can be derived or traced back to these approaches.

While static standard product market concepts grounded in neoclassic market theory start from a given supply, demand, technology and product structure, contributions of (market) process-research (Ikeda 1990; Soberman and Gatignon 2003; Geroski, Mata 2001), which we consider as process-theoretical approaches, always deal with the development of the market dimensions explicitly or implicitly along a market emergence, development and innovation process.

Important development characteristics arise from multiple feedback-processes (Arthur 1999; Soberman, Gatignon 2005; Sterman 2000) among the four market dimensions starting from an initial innovation process, which has to have a certain underlying significance.⁹ Competition takes the form of competition for the market (Schumpeter 1950) and can be basically characterized by a kind of search and discovery process (Hayek 1968).

One of the key concepts explicitly dealing with market process definition can be traced back to Hayek's line of thoughts of competition as a search and discovery procedure (Hayek 1968) and the Modern Austrian School approach of market definition (Ikeda 1990; Kirzner 1997; Littlechild 1990).

The second line of thoughts can be traced back to the evolutionary economic theory (Nelson, Winter 2002), which is based upon the theory of economic development of J.A. Schumpeter (Schumpeter 1950; Schumpeter 1934).

Starting from cited paradigms and following an interdisciplinary economic founded approach suggested by (market) process theorists (Malerba 2006; Soberman, Gatignon 2005), detailed economic grounded insights into market evolution characteristics can be derived by an assessment of market research of different economic disciplines, such as customer research (Adner 2002; Carpenter, Nakamoto 1989; Rosa et al. 1999; Saam 2005), economic research on technology and product life-cycles (Klepper 1996) and/or organizational research on innovation and market outcome (Pleschak, Sabisch 1996), etc. Even though these concepts are partly theoretically compatible with each

⁹ The studies of Arthur (1999), Sterman (2000) and Soberman and Gatignon (2005) explicitly point out the significance of interdependencies of so-called feedback loops among the market dimensions in a market emergence process.

other – heterogeneous in their explanatory approaches and their explanatory breadth – stylistic facts and criteria that are of importance for the description and identification of market formation processes can still and will be derived and discussed (Geroski, Mata 2001; Geroski, Mazzucato 2001; Chapter 5).

3. Classification of New Markets over Time

In summary, following both the performance based approach according to Teece and Coleman (1998) and process-theoretical conceptions (Mazzucato 2000), “new” and emerging markets will be defined in a temporal respect as follows:

- (1.) If “Markets” exhibits features of an “emerging market” we will speak of emerging (new) markets. Globally speaking, the emerging market ideally describes a development from a state of high instability towards a state of at least temporary high stability (Mazzucato 2000; Ikeda 1990; Kirzner 1997). To account for this aspect, the analysis of the indication of emerging markets is based on findings of (market) process-theoretical approaches.
- (2.) “New products or product innovation” (new products as measured by rapid shifts or upgrades of the underlying product attributes applying a performance vector-approach) substitute “products already in the market” (original product market as a reference measure). “New” and “old” products are not considered so-called close substitutes and are, therefore, not simply interdependently exchangeable from a demand side perspective (Teece, Coleman 1998; Vogel-sang 2006).
- (3.) “New product market” and “old product market” coexist: The substitution gaps between old and new products are sufficiently large in terms of new product or significantly improved product functions addressing new demand segments or fulfilling novel functions from the customer perspective. “New” and “old” products are not seen as close substitutes from the consumer perspective because they cover different societal needs (Teece, Coleman 1998; Vogelsang 2006).

4. Characteristics of the selected Approach for the Designation of New and Emerging Markets

Our market concept of definable emerging (new) product markets is set out to serve as a basis for the justifiable detection and evaluation of innovations worthy of protection and is obtained by applying a market formation process approach. The operational goal is the early indication of new and emerging market dynamics applying a multi-dimensional criteria framework. From a market process-theoretical viewpoint, specific fundamental characteristics of a “new market” result from the justification of a market process, which are to be detected using the principle of collecting indicators or criteria in the sense of a kind of “trial” based on circumstantial evidence along the four market-justifying dimensions (supply, technology, product and demand) that make up a market. The performance approach according to Teece and Coleman (1998) constitutes the starting point, according to which markets, in a dynamic market environment, are not determined by price and output with the strict assumption of one given set of supply, demand, technology and product as it is common for standard market definition conceptions, but rather by changes of the underlying performance vector of a product or/and technology. While Teece and Coleman (1998) draw on the performance vector as a delimitation measure for the characterization of dynamic markets, a rapid shift of performance vectors— conform to market process research (Ikeda 1990) - is also seen as a starting point in form of a “shock” to the market system. From there on market structure dynamics describe a development of novel markets along all four market dimensions via multi-dimensional feedback processes. For the detection of relevant market dynamics along the four dimensions connected to the relevant product market regulation dimensions, the innovation system is drawn on as heuristic (Carlsson et al. 2002; Hekkert et al. 2006). According to our conception, new product markets can be roughly defined in a temporal respect as summarized in chapter 3.

Special features for early market formation indication result from the fact that various market characteristics relevant for the identification of emerging new markets are not fully developed in an early market phase (Ikeda 1990). Prognosis procedures, expert interviews and estimation methods should deliver first data.

From the theoretical-conceptual viewpoint all four market-justifying dimensions should be sufficiently developed, captured by market process criteria. The necessity of the consideration of various criteria along the four market dimensions results from the fact that although individual criteria can mostly exhibit an essential significance for the indication of emerging new markets, they do not constitute sufficiently robust conditions for the identification of new markets by themselves, since they merely illustrate a part of the underlying market construct.

Secondly, the individual criteria exhibit a complementary character in their function for the detection of emerging new markets. To account for these facts, an integrated evaluation of the criteria is to follow.

For the selection and the analysis of the relevant criteria, various (market) process-theoretical or process-theoretically founded approaches in the context of innovation systems are discussed such as diffusion market theory (Rogers 2003) and standardization economics (Tassey 2000). The results of the analysis are being transferred into a criteria grid system.¹⁰

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- 10 We set aside a basic discussion on the evolution of the regulation of developing new markets. Since our ultimate concern is the early indication, we included existing product market regulation of established markets in our analysis, when it is appropriate for the criteria interpretation and (the indicator development). Moreover, the influences of ex ante product market regulation on the criteria progression is hypothetically borne in mind. However we do not explicitly addressed the question of regulatory assessment en detail. In particular the innovation system approach can serve as an analytical construct to analyse the various impact dimensions of product market regulation on market processes in detail. However, we want to highlight that regulation from a market process perspective should be carried out in a co-evolutionary fashion (Hekkert et al. 2006).
- 12 Product market substitution gaps – as a market output of innovation - are particularly strongly developed in the late market development stage due to the emerging characteristics of a supply and demand structure.

5. Criteria and Indicators for the Designation of New Markets

5.1 Introduction

The fundamental criteria framework is based on the different classical components that make up a market. Besides supply and demand, we also differentiate between product and technology. This differentiation is due to the fact that the identical functionality of products can rest upon completely different technologies. Moreover, the term product also encompasses services, which are themselves dependent on technical infrastructure, especially in the network industries. Lastly, we can observe an increasing convergence of technologies in diverse sectors which, in turn, can constitute the basis for completely new combinations of products or services. In turn, these can be the impetus for the development of new markets. Altogether, the differentiation between technologies and products allows for a differentiated inspection regarding the criteria and indicators for the designation of new markets boundaries.

For the selection of the criteria, the standard of only taking those criteria and indicators into account whose specifications exhibit a comparatively universally valid character for the justification of emerging new markets, allow for a plausible justification of the market dimensions as regarding content as well as inhering a certain empirical significance. As a matter of principle, the criteria or the indicators derived from them have to allow for the delimitation of emerging new markets from old markets as a reference market in an intertemporal respect. Narrowly linked to it is the requirement that the criteria have to exhibit a certain dynamic of the corresponding market dimension over time that can be represented by corresponding criteria. According to this temporal dimension that is especially significant for the designation and interpretation of early indicators, the criteria have to also allow for a factual or functional delimitation of certain new product markets from other markets on a horizontal level, at least when the criteria interact. In order to draw conclusions regarding the novelty degree of a certain product market, the criteria or indicators have to at least provide structurally or qualitatively corresponding information. In the end, it is necessary to check for all criteria, to what extent they are possibly being distorted by existing regulatory condition. On this basis of the selected components and the methodologically justified requirements, the individual criteria assigned to the market components are being subsequently introduced, discussed and evaluated in summary.

5.2 Summary and Evaluation

We selected 19 market process criteria. Although there is no sufficient overall market criterion that might indicate an emerging market process - due to the complexity of the market and competition process in dynamic market environments -, we derived different sets of criteria, that can be linked to the emerging market process along the market dimensions supply, technology, product and demand. Consequently, we have to consider particular sets of criteria for a reasonable interpretation of new and emerging markets. Regarding the degree of new markets indication, we provide an assessment of relevant market criteria-sets. The selected criteria in view to their market function and ideal-typical development (and origin) are summarized in Tab. 1. For the definition of Innovation, we follow common OECD standards (OECD/EUROSTAT 2005).

Table 1: Selected market process criteria in respect to their market function and ideal-typical development in an early market stage of an emerging market

<i>Criteria</i>	<i>Characteristics</i>
Supply side criteria	
Innovations activities	Innovation activities (e.g. R&D expenditures) are essential input measures of most market process theories related to significant product innovation (Pleschak, Sabisch 1996). Emerging markets are marked by "competition for the market," where particularly rather rapid product innovations related to significant investments in R&D justify significant novelties from the consumer's perspective and act as a kind of shock to the <i>given market structure</i> (Ikeda 1990).
Innovation types	Product innovations have other implications for the creation of new markets than process, marketing or organizational innovations (Pleschak, Sabisch 1996). Particularly significant product innovations are assigned significant influence on the market development as external shocks to the market system, while process innovations are ideally observed in a later market phase due to increased price competition (Geroski 2003; Ikeda 1990; Klepper 1996).

<p>Market structure volatility</p>	<p>Market structure volatility captures the development from originally high market structure instabilities marked by high market entry-(exit) rates and fragmented heterogeneous market structures at the time of market portion by an ideal-typical shift all the way to stable and concentrated market structures along the market formation phase due to ideal profit and arbitrage possibilities for small and flexible companies in the early market phase. Stabilization of market structures occurs through diverse feedback processes between supplier and consumer, realization of large scale economies, learning effects, etc. in the pioneering phase.</p> <p>This argument probes the supply-oriented development of the relevant market structures and is drawn on different market theories and empirical investigations dealing with the evolution of the supply side market structure. The criteria selection mainly relies on theory assessments and assessments of empirics and simulations carried out by Mazzucato (Mazzucato 2000).</p>
<p>Differentiation of company specific value chain systems</p>	<p>This argument aims for the vertical differentiation of the supply and production structures of emerging markets and draws on insights of new institutional economics into the development of market transactions (Kranton 1995; Kranton 1996; Williamson 1990), research related to the evolution of value chain systems (Porter 1990) and innovation research of business science (Gerpott 2005).</p> <p>The progression of emergence and development of complementary value added structures depends on the degree of the supply and delivery-specific uncertainties regarding the market potential of the respective product, the necessary production techniques and the adjustment costs connected to switching the production design or investing in new production methods.</p> <p>According to this criterion, the early market phase can be ideally marked by high internalization activities of various value added stages in the companies with a low number of specialized suppliers, due to high switching costs of production and market coordination failure related to high uncertainties about market results in late market stage.</p>

Increase of turnover	<p>This argument probes the development of company-specific growth-risk measures as results of investment in product innovations on a supply-side micro level, first applied by Hartman et al. (1993).</p> <p>This criterion typically necessitates time series analysis. "High-Risk-Turnover-Expectations" due to investment in new products, e.g. by analysis of structural interruptions of specific stocks, might serve as a weak indicator in an early market stage.* Over time along the market formation process, market share growth due to significant product innovation can be analyzed by time series analysis.</p>
Change in - competition parameters & - competition structure	The development of new supply and demand structures is associated with a changing use of competition parameter, changing competition intensities and changing competition structures. "Competition for the market" can justify novel competition constellations (Schmidt, Rittaler 1987; Soberman, Gatignon 2005).
Technology-oriented criteria	
Performance	This argument probes the output dimension of innovations on a technology-dimension and their potential in view of the market creation, which is based on Teece and Coleman's performance vector substitution approach (Teece, Coleman 1998).
Technical standards	Insight from standardisation process research indicates that standards have the potential to structure emerging market processes. This argument draws on (applied) network economics and (applied) standardisation economics (Blind 2004; Tassej 2000). Increasing standardisation activities are to be observed along the market formation process.
Convergence of different Technologies	Through integration, technological convergence can enable various services of varying technologies, the formation of services with novel and/or improved utility functions through a re-combination of various technological attributes (Adner 2002).

Product-oriented criteria	
Infrastructure	<p>Infrastructure investments basically inhere certain enabler-functions for the development of services on the downstream market-segment. This dimension accommodates the specific interdependencies between downstream and upstream market segments in the market formation process (Tasseey 2000). The development of new products and particularly of services on a downstream value-added stage depends on the technological performance capability of the underlying infrastructures. Significant time-lags on the downstream sector after infrastructure investment has to be taken separately into account.</p>
Performance	<p>This argument probes the output dimension of innovations and their potential in view of the market creation on a product-dimension, which is based on Teece and Colemans` performance vector substitution approach as an important output dimension of product innovation/market input dimension (Teece, Coleman 1998).</p> <p>According to this argument, new and “emerging markets” are justified by an emergence of products with significantly new types of product functions or improved product functions to be captured through an assessment of technology-specific product attributes.</p> <p>A significant and rapid performance-upgrading of critical vector-parameters of the underlying product - 25%-upgrading according to Teece and Coleman (1998) – may serve as robust input-measure to the development of new markets. First expert assessment and customer-surveys for the assessment of a significant improved satisfaction of customer needs can provide first insights into new emerging performance based product market substitutions relations.</p>

Variety of the product design	<p>Besides the observation of individual new products with their new functionalities, the total structure of the new products that describe a potential new market can also be drawn on as a criterion. In the evolution of markets, according to this argument it is created to observe a great diversity of competing new product designs particularly in the early market phase (due to profit opportunities in early market phases). Related Literature covers empirical contribution on market evolution, evolutionary economics and empirical contribution of the "Research about the Genesis of Technology" (Weyer et al. 1997; Foray 1997).</p>
Product bundling	<p>Bundling of products and services can lead to the emergence of new product designs through the realization of synergies.</p>
Price volatility	<p>This criterion's dimension analyses price fluctuations as a result of unstable market conditions along the emerging market process (WIK 2003).</p> <p>As a result of unstable market conditions, relatively high price fluctuations may occur in an early market phase compared to price developments in consolidated markets.</p> <p>Evaluation of the criterion: Necessity for the consideration of other influencing factors in view of the price movement such as exchange rate fluctuations or externally justified demand shifts at the time of introduction of a new product (WIK 2003).</p>
Price correlation	<p>This criterion's dimension analyses the price development as an essential market delimitation measure in its function as an allocation parameter of standard market definition concepts.</p> <p>According to this argument, changing price correlations (decoupling of prices) over time indicate disconnecting product market substitution relations.</p> <p>Evaluation of the criterion: Necessity for the consideration of other influencing factors in view of the price movement such as exchange rate fluctuations or externally justified demand shifts at the time of introduction of a new product (WIK 2003).</p>

Demand side criteria	
Shift in patterns of demand	<p>The argument of the demand structure probes the emergence of the structural composition of the demand that defines the market in classical terms as an essential delimitation measure.</p> <p>Movements in the composition of the demand structures - starting from a close substitute at the time of introduction of a new product - reflect a changed consumer-specific satisfaction of needs through new product functionalities or designs. Movement of the demand structure can also be exogenously justified by a shift in income, preferences, etc. A Shift in the pattern of demand can also lead to the allocation of another existing market. From a process-theoretical perspective, demand structure is only entirely detectable in a mature market phase.</p>
Preferences	<p>The structure of preferences is an essential precondition for the explanation of the demand-side innovation diffusion and development of switching attitudes along the market emergence process (Adner 2004; Carpenter, Nakamoto 1989; Saam 2005).</p> <p>The introduction and adoption of significantly novel products/technologies influences consumer-specific preference structures through time. This is related to significant demand side uncertainties about the utility and function of new products at the introductory market stage. Consumer-specific preferences develop along the market formation process due to e.g. learning and reputation-effects.</p>
Diffusion of innovations	<p>The analysis of the diffusion of product/technology innovations is used in the analysis of the development and evaluation of the demand structures that make up a market. For the analysis of the development of the demand side market structure we draw on various empirical and theoretical research done on product and technology diffusion (Geroski 2000; Rogers 2003). In summary, the emergence of demand side market structure follows a rather "S-shaped adoption curve".</p>

Switching behaviour	The criterion of switching behavior serves as a basis for the designation of demand side product market substitution boundaries based on product performance vectors. As with the preference and diffusion structure, inclinations to change are to be particularly observed at a mature market stage (Klempere 1995; Teece, Coleman 1998).
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The selected criteria can be roughly divided into three criteria classes in respect to their temporal development. The criteria of the first class, which we labeled as input criteria, are first and foremost causal for the development of new markets. This includes the criteria innovation activities, innovation types, infrastructure, convergence of different technologies and performance and product bundling. The second criteria class encompasses those criteria that exhibit more of a procedural character such as demand side diffusion of innovations or market structure volatility criteria. The third class of criteria covers product market substitution relations, which are not fully detectable until a mature market stage is reached (Teece, Coleman 1998).¹²

While input criteria are to be captured as an observation measure particularly in the early market phase, the second criteria class depicts the evolutionary character of the market formation process along the time axis.

For the concluding evaluation of the 19 criteria selected for the identification and delimitation of new markets we assessed the criteria by

- explanatory power and robustness
- suitability as early indicators
- ability to be operational
- (product market) regulation influences

in order to enable a first prioritization of the criteria in view of their significance for the delimitation of new and emerging markets on this basis.

We divided the criteria sets into necessary and supporting classes in respect to their robustness and degree of emerging market indication.

Necessary criteria are criteria that are comparatively empirically robust and constitute an essential prerequisite for the existence or development of emerging new markets. Specifications of supporting criteria are comparatively less robust phenomena of the underlying market formation process. Accordingly, they are assigned a character that is

rather supportive in an explanatory way. The results of our analysis can be summarized as follows.

According to our evaluation and criteria-selection, the supply-side market components as presented in Table 1 encompass

- the market input criteria innovation activities and innovation types (OECD/EUROSTAT 2005),
- a market structure volatility criterion (Mazzucato 2000), which is to account for the market constituting development of the supply-side market structure on a macro level,
- a turnover-risk measure as a company-specific criterion (Hartman et al. 1993) that accounts for the development of the added value structure in the market formation process on a micro-level,
- the evolution of competitors interaction structure and changes in competition parameter use (Schmidt, Rittaler 1987) and
- the evolution of the company and market specific value chain structures.

Under the “supply” category the input indicators of “innovation activities” (e.g. R&D expenditure) and their classification by different “innovation types” constitute an essential prerequisite for the formation and designation of new markets. They are considered to have an activating character and, therefore, form a necessary condition for the justification of the development of new markets. They can be operationally used in the early market phase as early indicators and are basically only subject to a medium or even low direct regulation influence but, in certain circumstances, a high indirect regulation influence through respective constraints with the realization of expected profits.

Therefore, both of these criteria have to be taken into consideration at any time when checking emerging new markets. The remaining criteria in that category can be assigned importance in the supply-sided description of emerging new markets over time, but, relatively speaking, they have less explanatory power in view to the indication of new markets in the early market formation process. They can therefore only be used as early indicators in a limited way, entailing operationalisation problems and they are partly subject to strong regulative and therefore distorting influences. However, these criteria offer essential clues for the supply-sided development of market structures along the market formation phase (Mazzucato 2000). For this reason, these criteria inhere a supportive function in the description of the market formation process.

The *market dimension of technology* encompasses the criteria of technological performance and convergence as specific input criteria (Gual 2003; Teece, Coleman 1998) as well as the market-justifying criterion of standards (Tassey 2000).

The technological performance is of high importance in the technological dimension, especially since the entire approach essentially builds on that dimension. Furthermore, this criterion is well suited as an early indicator, relatively easily operational and usually not subject to regulatory influences.¹³ Emerging technological standards can - but do not have to - be a necessary criterion for new markets, because they can also develop from existing standards or represent a further development from those.

However, this indicator has a high potential to be used as an early indicator, because it is easily operational and only subject to regulative distortions in a limited way. For this reason, these two criteria are absolutely to be drawn on when analyzing the development of new markets. In contrast, the technological convergence has medium explanatory contribution and above all entails problems with the operationalisation (Adner 2002).

Under *the market dimension of product*, rapid changes of product performance and their evaluation from the demand side perspective at a mature market stage are seen as an essential prerequisite for the justification and development of novel market structures (Teece, Coleman 1998). Moreover, besides the input indicator of product bundling, the development of infrastructure is seen as complementary to the development of services and products in the downstream market segment (Tassey 2000) as well as the emergence and the development of product varieties as complementary to the supply structure in the market formation process (Mazzucato 2000) and the change or development of the price structure as a central competition and exchange parameter (WIK 2003) for the delimitation of product markets under the market dimension of product.

In analogue to the technology market dimension, technological infrastructure is of high importance as a basis for the development of services on a downstream market segment.

This criterion has a comparatively high potential to be used as an early indicator, because it is easily operational, but has to be evaluated with the regulative framework conditions in mind. For the performance of product properties, an evaluation similar to

13 This evaluation particularly relates to the technology-performance-vector as a proxy for the justification of new market structures. A qualitative evaluation of quantitative measures from the consumer or expert viewpoints is usually comparatively more complex to conduct.

the technological performance can occur, but it has to be kept in mind that the evaluation of the product properties can only take place at a later time, when de facto products can be used and evaluated by consumers, at least in the pilot stage.

The further, mostly price-related, criteria have high explanatory power in a theoretical respect but can be subject to strong regulatory influences. Moreover, various influence measures have to be checked with respect to the price progression for the evaluation of the criteria based on price so that they are only considered for the designation of new markets in a limited way or in a supporting role.

On *the demand side*, the demand-justifying market criteria of development of the demand structure, market diffusion (Geroski 2000) and switching behavior (Teece, Coleman 1998; Klemperer 1995) as well as the micro-indicator of preference-structure (Adner 2004; Carpenter, Nakamoto 1989; Saam 2005) are subsumed. While endogenously motivated demand and preference structures change rather comparatively slowly and are, therefore, less significant for the development of new markets as an initiating factor, particularly diffusion progressions (Geroski 2000) and switching behavior (Klemperer 1995) takes a central function for the demand-sided identification and delimitation of new and emerging markets. However, their suitability as early indicators is limited because information pertaining to it is only generated over the course of the formation process. By contrast, demand side insecurity about the value and the utility about significant new product functions at an early market stage, is an essential characteristic of new market emergence. To a certain extent, market research offers access to compensation.

After each of the criteria has been processed by itself, it is essential to highlight that single criteria cannot provide meaningful interpretation patterns if they are isolated from each other, in particular because the interpretation strengths differ in view of the explanatory power, market dimension and temporal and factual market delimitation among the individual criteria. Hence, in closing, the evaluation of the criteria has to occur in an integrated fashion, particularly taking into account the interrelations among product innovation, performance, the degree of demand- and supply-side insecurity about future market characteristics and market dynamics along the market dimensions.¹⁴

Finally, individual criteria can be transferred into a market phase diagram. We integrated single criteria into a stylised market phase framework analogous to previous

¹⁴ Moreover, the development of influencing factors such as product market regulation has to be considered when applying the criteria-system on specific cases.

market phase (Schmidt, Rittaler 1987) and innovation phase (Pleschak, Sabisch 1996) models of innovations research (Schmoch, Koschatzky 1996), product- and technology-life-cycle research (Klepper 1996).

In Table 2 the development of individual criteria is ideal-typically summarized in a linear market phase diagram.¹⁵ The “search phase or innovating phase” in the top row on the left describes roughly the research and development stages, under which research results are introduced to the market. Furthermore, the market formation process was divided into a “product market introduction phase” and, following the diffusion theory, into a market “penetration phase”, where the market relevant supply and demand structures emerge. The illustration clarifies that individual criteria can exhibit different specifications over time. Moreover, one can differentiate between continuous developments over time and non-recurring events. For the designation of new markets in dependency on a particular market phase, the criteria inhere a different explanatory content. The specific specification pattern offers clues for the localization of the individual case in the market formation process. Surveys and prognosis tools can provide supporting clues for the identification of new markets in an early market phase.

The observation measures of the individual criteria in the various market phases are marked in gray. In the early search phase, particularly high innovation activities, the construction or upgrades of infrastructure, certain performance attributes of a technology and performance attributes of products based on that can be observed that constitute an essential prerequisite for the development of emerging new markets. In the market penetration phase, the process-theoretically market-justifying criteria of product, supply and demand dimensions can be observed, such as the diffusion pattern or the development of the supply structures. Finally, at the end, product market substitution structures between “old” and “new” products are comparatively strongly pronounced. A decreasing degree of uncertainty about the development of new markets over time arises from the process perspective because the relevant observation measures of the individual criteria can fully develop over time. Supply and demand-specific uncertainties about the market evolvment potential are strongly pronounced in the early market phase compared to the technology criteria. Before the VDSL case is introduced, special characteristics of the telecommunications sector and their effect on the specification of individual criteria are to be examined in the following section.

15 The criteria of “convergence” and “product bundling” were not taken into account.

Table 2: Diagram of early market phases: simplified stylised ideal-typical development of market criteria over time

Criteria	Early discovery stage	Late discovery stage	Introduction to the market	Market penetration
Supply				
Innovation activities (product innovations; R&D-expenditure, patents, etc.)	High innovation activities, IPR ¹⁶ -registration		Ideal typical decreasing investment rates in R&D, but increasing investments in complementary products and services possible	
Market structure volatility (shift in market shares and entry-exit-ratios)	Increasing market entries possible		Assessment of increasing market structure volatility over time	
Differentiation of the company specific value chain systems	High internalisation ratios; high supply side uncertainty about reaching the relevant break even points		Differentiation of the company specific value chain systems over time, shift in price-production performance-structures within the companies	
Increase of turnover (with new products)	Financial market volatilities (first structural interruptions as turnover-risk measure)		Assessment of company specific growth over time	
Change in competition parameters	First indications (high innovation activities)		Change in the relevancy and intensity among different strategic action parameter options over time (e.g. advertising strategies, pricing strategies, performance competition)	

16 Intellectual Property Rights.

Change in the structure of the competitive interaction among different competitors	First indications (e.g. change in interrelationships among competitors via patent races)		Supply side emergence of product market substitution relations between old and new products over time
Technology			
Performance (of the technology attributes)	Significant change and/or upgrade of the relevant performance attributes of new technologies		emergence of product market substitution relations between old and new technologies over time
Technical Standards (publication of new standards)	Increasing standardisation activities over time		Publication of basic standards Diffusion of existing standards and development of complementary standards over time
Product			
Infrastructure (construction of new infrastructure)	Infrastructure assembly	Observing the relevant impact of infrastructure investment on the downstream market segment over time, heavy time-lags in view of the development of the relevant upstream services	
Performance (of product attributes)	Significant upgrading or radical change of the relevant performance parameters		Emergence of product market substitution relations between old and new products over time
Varieties of product designs (evolution of different product designs along the emerging market process)	Emergence of product varieties possible depending on the relevant type, source and degree of the underlying innovation (IPR-registration highly correlated to market entries)		Assessment of the relevant development over time; selection of dominant product designs

Price correlation (between products of the old and new market) and price volatility		Time series analysis, analysis of first structural interruptions
Demand		
Shift in the pattern of demand	First weak estimations	Observable over time corresponding to the demand side diffusion of new products
Preferences (change in preferences, degree of uncertainty about the utility of products with new or significantly improved product attributes)	High demand side uncertainty about the utility of the underlying product	Development of product specific preferences
Diffusion of innovation	First estimation of diffusion patterns	Patterns of diffusion and adoption rates are observable over time
Switching behaviour	First elaboration of attitudes towards switching between new and older product designs	Switching behaviour is observable, demand side emergence of product substitution between old and new products over time

6. Idiosyncrasies of the Telecommunications Sector in view to New Market Assessment

We started off with an examination of the telecommunication sector's specific characteristics applied to the derived general industry- and technology-independent set of criteria before applying the criteria-set to the VDSL case (Laffont, Tirole 2000; Shy 2001).

If the influences of the seven identified special features of the telecommunication sector are systematically applied to the criteria, a total of 133 test combinations can be differentiated. Discussing all 133 test combinations would go beyond the scope of this analysis and is also not absolutely goal-oriented. Therefore the most important findings are summarized in the following which are relevant for the interpretation of market demarcation criteria in the telecommunication sector, with a view to identifying emerging new markets and which should be considered in the evaluation of specific cases. This interim step should make clear in an exemplary fashion that in every case analysis the specifics of the telecommunication sector, which in turn are very context-specific, must be taken into account when dealing with criteria.

The most relevant aspects for the criteria system are network externalities (Shapiro, Varian 1999) and characteristics that arise from infrastructure characteristics of telecommunication networks such as the subadditivity of the cost function, bottleneck characteristics (Laffont, Tirole 2000) as well as specific interrelationships between downstream-services and networks-infrastructure (Tassej 2000).

One of the main findings is that the derived criteria system is broadly applicable for the telecommunications industry and robust. However, when interpreting specific criteria, sector specific contexts have to be taken into account. Thus, for example, due to collective switching cost related to network externalities and coordination necessities, diffusion of innovations might follow a steeper S-curve, respectively a more disruptive demand side switching behaviour from old to new product design at a comparatively late market stage (Shy 2001).

From a dynamic perspective, the infrastructure can be regarded as a technological basis, on whose characteristics product attributes and service offers in the downstream segments are based. Complementarities exist between infrastructure and services. The infrastructure – in this case the telecommunication network – is often assigned the properties of public goods, as it is a crucial pre-condition for production in an industry and various suppliers and manufacturers depend on it (Tassej 1997, Chapter 8 and 9).

Efficient networks (infrastructure) create the necessary pre-conditions for the development of complementary services, contents/ substance and products in the downstream market segment (infrastructure as enabling technology). Complementary products and services on the one hand can develop simultaneously with the formation of the network, primarily however the infrastructure represents a necessary pre-condition for innovations in the downstream market segment (Mazzucato 2000; Tassej 2000). In particular when significant technological innovations are concerned, the probability of utterly novel developments increases in the downstream segment in the course of time. If the enabling character of novel infrastructures is given special emphasis, one must assume at the same time that the new services in the downstream segment will only be completely determined in the course of time (Mazzucato 2000; Tassej 2000). They are not entirely laid down at the moment the technical infrastructure is formed and they dispose of features of emerging new markets, i.e. high entry rates, emergence of a product variety or also innovation activities in the downstream segment.

To take specific interactions between downstream and upstream sector into account, which arise from specific infrastructure and service interrelations, we follow a market system approach, considering downstream and upstream sectors as an integrative part of value-chain system, similar to the hardware-software-paradigm (Shapiro, Varian 1999).

Practically, infrastructure innovations are regarded as potential "enabling technologies" (Tassej 2000). In order to make the "degree of innovation/ novelty" of the upstream market segment tangible, the evaluation of new markets to record technological progress from the user perspective in the sense of the performance vector approach as the analytical starting point will be made dependent of the development of innovative services in the downstream segment. The assessment of the performance of single services ultimately occurs from a user perspective.

Secondly, the end user utilises not only an infrastructure or a specific service, rather the whole "system" influences the benefits for the end user and his decision for or against acquiring access to network and services, due to speed of infrastructure or its enabler function for new services. From a supply's perspective, the infrastructure can be interpreted as an essential part of the value added system. For the evaluation a functional interpretation of single criteria results with a view to the characteristics of the infrastructure and complementary services or contents. The consideration of both partial modules of the system is important, as both segments according to the sub-chapters 'Infrastructure' stand in a special complementary relation to one another, respectively are highly dependent on each other and thus can be classified (as belonging) to a service-infrastructure system. Thus, challenges for market analysis arises

from differentiating old (e.g. ADSL) and new infrastructures (e.g. VDSL) related to new services, which has to be taken separately into account (Chapter 7).

Closely related to the aspect of increasing dynamic into market is the aspect of convergence. Standard market definition concepts appear too narrow in dynamic telecommunication environments. Assuming advancing convergence of services and networks in the telecommunication sector – which corresponds to an advancing convergence of attributes of capability characteristics of single performance vectors from the perspective of the performance-vector-approach according to Teece – competition for the relevant clients for future services in the form of an inter-modal competition might already taking place in a dynamic respect.¹⁷

Accordingly, the analysis of new markets should not only refer to the infrastructures in the telecommunication sector, but should include platform competition as well. Further implications result here in particular in the form of relevant demarcation of emerging markets. However, a specific discussion of the assessment of the relevant market should however not take place in this context on an abstract plane. The linkages of specific networks and services with a view to new markets offer a practical orientation framework to demarcate the relevant search area for the evaluation of individual criteria. Consequently, convergence for example of cable and traditional telecommunication networks in regard to new services will be taken only into account if reasonable, but our contribution does not build on it.

17 Cf. Büllingen and Stamm (2001), Pohler et al. (2006). From a theoretical perspective Adner (2004) provides insight into the demand behaviour of buyers in technological convergence. Adner describes scenarios in which competition for buyer groups of different converging technologies displays over time a disruptive rather than gradual character. Specific preference structure developments and technology-related transition costs distort the competitive and thus the market relation of converging technologies from a customer's viewpoint, before a disruption in the sense of drastic change behaviour takes place. Traditional market demarcation concepts rooted in price theory and thus very short-term oriented assuming converging technologies limit the market too narrowly as a rule. Cf. also Christensen (1997).

7. Application of the Criteria to the VDSL case

7.1 Introduction

In this section the developed and discussed criteria for the assessment of new markets will be applied to the introduction of VDSL and (with its possible downstream services) in Germany based on an assessment of qualitative information available in June 2007. Altogether 18 single criteria were chosen for this exercise, taking into account the prioritisation in chapter 5 and the special relevance of certain criteria for the case at hand.

VDSL (Very high-speed Digital Subscriber Line) is a standard for high-speed transmission of digital data over telecommunication networks that is expected to replace ADSL (Asymmetrical Digital Subscriber Line) in the long run. Whereas the VDSL1-standard has hardly been used around the world, the follow-up standard VDSL2 is currently being rolled-out by several telecommunication companies and as such is gaining more and more importance. VDSL2 was adopted by the International Telecommunications Union (ITU) in May 2005 as a standard to enable triple play services (telephony, broadband-Internet access and digital TV) over telecommunication networks. Whenever we use the term VDSL here, it actually refers to the standard VDSL2 (ITU-T G.993.2). Via VDSL, up to 100 Mbit/s can be transmitted in both directions (downstream and upstream). One of the advantages of VDSL is its higher upstream speed, meaning the transmission of data from the end-user to the provider which can be used to upload photos, videos, software applications and the like. In contrast to ADSL, where the "A" stands for asymmetrical upload and download speeds, VDSL is generally capable of splitting available bandwidth half and half. However, VDSL can be implemented with different technical profiles and operators are able to scale up- and downstreams according to the need of their services.

From a technical point of view, VDSL is a further development of the ADSL standard. Yet looking at the requirements for the actual network build-up and the spectrum of new and emerging services, VDSL networks with their huge transmission capabilities might constitute the basis for a new era of high-speed Internet development.

Currently Deutsche Telekom is the only provider of VDSL in Germany. Competitors like Arcor or Versatel announced to invest in their own network build-up activities under the condition that the regulator ensures access to the new network of Deutsche Telekom.

On an international scale, many big telecom operators are building up ultra-high-speed infrastructures, using ADSL2+, VDSL or Fiber to the Home (FTTH). Examples are Swisscom Fixnet (Switzerland), TeliaSonera (Sweden and Finland), Belgacom (Bel-

gium), France Telecom, SBC (USA), Verizon (USA). These companies also offer IPTV services via their new infrastructures. Although these companies act in different regulatory and market settings, they have to a large extent the same problems in their home countries as Deutsche Telekom has in Germany. As such, the VDSL case in Germany can be used as an example for telecom operators in their need to offer new ultra-high bandwidth services to their customers by building up a new and expensive yet highly regulated network.

Currently, German telecom incumbent Deutsche Telekom AG is building up or plans to build up VDSL-networks in 50 German cities estimating the overall costs to 3 billion (Mrd.) Euros. Until 2008, the company plans to have more than 7 Mio. homes passed. The upgrade of the network requires extensive earth-moving to lay out fibre optical cables into the vicinity of the end-user's premises (FTTC, Fibre To The Curb) as well as reconfiguring the network architecture. In Mid 2007, approx. 5 Mio. households could be reached over the new network.

Deutsche Telekom offers two service packages with its VDSL connection: "T-Home Complete Basic" for a subscription fee of 70 Euro and "T-Home Complete Plus" for 85 Euro per month. Both packages include Voice over IP telephony, high-speed Internet access, video on demand (VOD) and a set of TV channels, some of them in HDTV quality. The "Complete Plus" package includes an additional Pay-TV subscription which comprises the channels of German Pay-TV provider Premiere and also the Bundesliga football channel. Subscribers for either package need an IPTV decoder box, a device which connects to the TV set and which costs about 100 Euro.

During the introduction phase, Deutsche Telekom does not use the whole bandwidth potential of VDSL but limits the single connections to 25 Mbit/s for the downstream and 5 Mbit/s for the upstream. The company claims that transmission speeds can be increased as soon as demand arises without having to reconfigure the network.

In March 2007, the incumbent decided to open its video on demand service to its existing DSL customers in an attempt to broaden the technical spectrum respectively the customer base for this service. By offering the VOD service also to households connected via ADSL and ADSL2+-upgraded networks which provide between 6 and 16 Mbit/s downstream speeds, the market potential for the entertainment service could be increased by three times at once. By the end of 2007, approx. 17 Mio. households will be able to subscribe to the service due to this new approach.

The double tracked strategy of Deutsche Telekom - to urge the VDSL network build-up in big cities and to provide other selected areas with ADSL2+ upgrades - leads to a situation, where VDSL to a certain extent loses exclusivity concerning services. Apart

from the extremely high bandwidth for Internet-access, the German VDSL network today provides only two services exclusively: live streaming TV programmes and programmes broadcasted in high-definition (HDTV). These services require more bandwidth than ADSL and ADSL2+ are able to provide.

In order to develop new and exclusive services which use the whole bandwidth capacity of the VDSL network, Deutsche Telekom initiated a city competition in 2006 in which over 50 medium-sized German cities took part and sent in their suggestions of how they would use the new infrastructure. In February 2007, the city of Friedrichshafen was awarded the price of the "T-City" which includes the build-up of a complete VDSL network as well as an HSDPA-upgrade of the mobile network and financial means to develop the suggested series of new high bandwidth applications. Altogether Deutsche Telekom will invest about 35 Mio. Euros for the network upgrades in Friedrichshafen. Another 80 Mio. Euros will be invested by Alcatel Lucent, the European Union, the German state and Deutsche Telekom to realise the suggested T-City projects within the next five years. The projected applications range from new teleworking environments over E-learning applications in cooperation with the Zeppelin. Against this background 18 criteria, developed in the preceding sections will now be applied to the VDSL infrastructure and its possible downstream services.

For the VDSL case, a broad market interpretation or a functional market system interpretation is taken as basis, in order to take the development of new markets in the downstream segment stemming from significant infrastructure innovations in the upstream market segment into account. ADSL and cable TV network will be considered as infrastructure market reference (Chapter 6).

7.2 Supply side criteria

7.2.1 Innovation activities

Based on common OECD definitions, the investments connected to the build-up of the VDSL network can be considered as innovation activities. Apart from expensive earth-moving activities the build-up of the optical fiber-based VDSL network comprises R&D expenditures for tests, adaptations and the development of devices. In addition, the new technological possibilities of an ultra-fast network triggers innovation activities from other companies, especially ones that are developing broadcasting and interactive services, but also software and Internet-application developing companies. The shift of service development activities from the telecommunication network provider to outside parties already started with ADSL. ADSL for the first time provided a platform for

independent companies and even individuals to develop services of their own and implement them on the Internet protocol (IP) based platform.

As a consequence, this led to a principal change of service development activities in the telecom sector, opening up the area for new players. A current study on the future of the telecommunications sector called this development the “Internetisation of telecommunications”, meaning the opening-up of telecommunication networks, which once were closed shops, for independent service developers based on the introduction of the Internet protocol (IP) and an all-IP strategy (Pohler et al. 2005). VDSL-networks are expected to lead this development to a new stage because of its enormous bandwidth capacities.

7.2.2 Innovation types

Possible innovation types are product innovation, process innovation and organisational innovation. Concerning the VDSL case, “product innovation” seems to be the predominant innovation type, especially when considering the whole system which not only consists of the network itself and its technical components but also of the possible new applications and services. The new network functions as an enabler for a whole series of new services and contents and as such creates new markets in adjacent and downstream market segments.

Concerning the effect of enabling new services not yet known at the time of the infrastructure build-up, it can be referred to other Science & Technology Studies which found the same effect looking at the early phases of the development of the radio, the Personal Computer or the Internet (see for example Friedewald 2000; Friedewald 2003). All these developments have in common that at the time of their introduction it was not foreseeable what users would make of the innovation and for what purposes the technical capabilities will finally be used for. Very often, users or service providers re-invented the new technology or used the network in other ways than was originally intended. The principal unknowability of future use and services also applies to the VDSL case, especially because the new network provides bandwidth capacities for services not yet invented today. However, the company investing large sums in the build-up of the network embraces concrete expectations concerning product innovations because of the need to refinance the investment. One of these services today is video on demand and Pay-TV (IPTV) which in the future will also include interactive programmes and service elements.

A characteristic of product innovations is that they are not easily substitutable with existing products. Concerning the VDSL case this is only the case if again the whole system is considered and if the new services not yet known today were included as

“wild cards” or possibilities of the future. This is because simple VOD or pay-TV services can very well be substituted by the cable TV network or even by direct satellite broadcasting. The criterion of low substitution, which in fact means originality of services to be realised only over the new VDSL network points to the future, when new combinations of broadcasting services with interactive services will be realised and when new applications relying on high upstream capacity will be implemented. In this context, it is in the interest of the operator of the VDSL network to develop such services or to let others develop respective services.

7.2.3 Market structure volatility

The development of new markets – in particular at an early development stage - can normally be characterised by a large number of market entries (and exits) combined with fundamental changes in market shares. Such a market is commonly called unstable or volatile. Concerning the VDSL case, a change in market shares would only be possible if alternative infrastructures like cable TV networks, pure fibre-optic networks or wireless networks like WiMAX or UMTS lost or gained relevant market shares compared to VDSL. Within the fixed telecommunication network, however, changes in market shares are not to be expected as long as regulation does not force the incumbent to open the network for competing network providers.

In addition to conceptual difficulties discussed in the preceding chapter, the volatility criterion is difficult to apply to the telecommunications market because it is a regulated market. How regulation influences market developments can be shown at the example of small alternative network providers like city carriers. Their entry into the market of infrastructure providing based on own fiber optic networks is only possible because the incumbent can currently claim relatively high prices for the lease of the last mile. Only because of this, the buildup of competitors' own infrastructures are profitable. Using their own network they can then offer cheaper services or services with better (bandwidth-) quality than the incumbent. The networks of competitors are paradoxically only profitable as long as the lease of the last mile – a price set by the regulatory body - is relatively expensive. In this case, high prices are advancing innovation activities although it is in the general interest of the regulator to lower access prices.

7.2.4 Differentiation of the company specific value chain system

The fact that a company extends its value chain as it enters new markets seems to be trivial at first sight. From the perspective of the company it might indeed be a new market, also because of new service and cost structures connected with the new product. Yet from a general market perspective this company is just a new competitor which was not active in this segment before. For Deutsche Telekom, the build-up of the VDSL

network involved the entry into the market segment of video on demand service delivery and the delivery of pay-TV services and TV broadcasting in general. However, as the strategy of opening up TV services for ADSL and ADSL2+ customers shows, this activity is not exclusively connected to the VDSL network build-up.

A positive evaluation of the criterion “value chain differentiation” arises from the fact that VDSL is more than just IPTV. Again we have to consider the whole VDSL system and also have to take into account the potential for new services not (completely) known today. Thus, the expected changes the VDSL development will induce refer not only to value chain extensions within the company but contain conceivable changes in the market, the development of services, the technical service and development of the end-user devices.

7.2.5 Increase of turnover

Generating a significant increase of turnover in a certain segment might be a sign for the development of a new market as it also triggers activities by other companies which strive to generate similar products or which try to offer complimentary products. Their activities in turn further the development of a new market. One important aspect in this line of argument is the ability of the innovating company to generate a willingness to spend money for new products or new services. Applied to the VDSL case, this is a central but still unanswered question: Will people actually be willing to spend more money for an even faster Internet access or for standard pay-TV services delivered over the telecom network?

Especially concerning additional TV services it was noted that Germany is an extremely difficult market with over 50 free-to-air programmes and a lively and competing commercial and publicly funded TV landscape (Arthur D.Little 2005). In 2007, German pay-TV services like Premiere or Kabel Digital Plus were able to convince only 4 Mio. subscribers altogether. Germany has a history of failed attempts to introduce pay-TV services, of which the Kirch bankruptcy is the most prominent.

To generate additional revenues, on the other hand, is a central task for Deutsche Telekom as well as other incumbent operators, given the fact that the most profitable source of revenue – fixed network telephony – is in the course of losing its meaning rapidly. In addition, in the mobile sector as well as in the high-speed Internet access market, strong competition has led to falling revenues over the last years. Thus, new services need to be developed and put on the market in order to make up for the loss in traditional telephony. In this context, a change of market shares within telecom companies as well as between sectors can in fact be observed and will become even more relevant in the future.

7.2.6 Change in competition parameters and competition structure

This criterion has two aspects. The first concerns strategies to create demand for the new product termed “demand-side oriented upgrade of performance vectors” in the preceding chapter, and the second aspect deals with the competitors’ strategies to encounter the new product.

The first aspect applied to the VDSL case points to the subsidising of end-user devices in order to promote the actual service. This can be observed in other markets as well, for example in the mobile phone market where devices are relatively cheap while service fees are relatively high. This strategy only succeeds when all operators follow the same strategy. Although it has aggravating effects on the market structure, the subsidizing of mobile phones was a central element for the success and speed of the introduction of mobile phones in Germany. Concerning VDSL, a similar strategy is being followed by Deutsche Telekom: The IPTV decoder box is being offered for less than 100 Euro, a price way under its regular production costs. Also, Deutsche Telekom subsidises some HD-ready flat screen TVs in order to advertise the HDTV-channels of its “T-Home Complete” VOD services.

The second aspect of the competition parameters criterion concerns competitors’ reactions to the VDSL service. In fact it can be said that current and potential competitors like city carriers with own fiber-based networks like NetCologne, Hansenet or Wilhelm.tel and especially cable TV operators like Kabel Deutschland, Kabel BW or Unity Media have been forcing their own triple play services in an attempt to counter Deutsche Telekom’s move into the broadcasting business.

Cable TV operators in Germany are still in the course of upgrading their networks in order to be able to offer interactive services, especially high-speed Internet access which was for a long time reserved to telecom operators. In areas with upgraded networks, cable TV operators as well as city carriers can now offer basically the same products as Deutsche Telekom with its “T-Home complete” service. Cable TV operators explicitly referred to the telecom operator’s triple play strategy when setting up their own high-speed Internet strategies (Beckert et al. 2005; Pohler et al. 2007) Although cable TV operators have ambitious plans for introducing triple play services, it has to be said that high-speed Internet over the cable TV network is still a niche market in Germany with only 0,5 Mio. subscribers at the end of 2006 which is 3,4 % of all broadband households (see Bundesnetzagentur 2007, p. 62).

7.3 Technology-oriented criteria

7.3.1 Performance

The technical characteristics and the special performance of VDSL as described in section 7.1 have to be seen in perspective with the development of analogue modems, ISDN-cards and ADSL. Based on new technical features a line of new products was developed, each enabling a new market: From the analogue modem with its lengthy dial-up procedure and a maximum of 56 kBit/s to ISDN-cards with a faster dial-up procedure and a maximum of 120 kBit/s (bunveled ISDN) to ADSL with always-on and a downstream data rate of up to 6 Mbit/s – each new technology enabled new usages and applications thus creating new markets.

VDSL with its ultra-high-speed transmission rates in downstream as well as in upstream direction of up to 100 Mbit/s will also constitute a new market as it will change the way people use and perceive the Internet and other media applications. To date it can be said that increasing data transmission rates was rendering the use of the Internet more convenient while supporting the development of the Internet to become more “TV-like”. Considering VDSL as the next step of technical development, fundamental changes of the way the Internet and other media applications are being used can be expected.

The increased upstream rate constitutes a technical speciality of VDSL and may become a central requirement for future Internet and media applications. New Web-services currently discussed under the name “user-generated content” or “Web 2.0” can only unfold their full potential with high upstream speeds that enable users to upload large files.

In addition, because of the increased data rates, video on demand and live television broadcasting can be blended in with interactive services and existing Web applications. The technical features of the VDSL network will probably lead to the Internet becoming even more TV-like. On the other hand, the potential for digital convergence and the possibilities for entirely new services developed and implemented on the VDSL platform should not be underestimated. In principle, these new services can be novel combinations of TV and Internet, push and pull media, narrowcast news and entertainment services, etc. (Beckert, Kubicek 2000; Boyd 2004; Heil 2004; Ridder 2005; Beckert et al. 2005). But also applications in areas as diverse as telemedicine, e-government or e-learning can be foreseen.

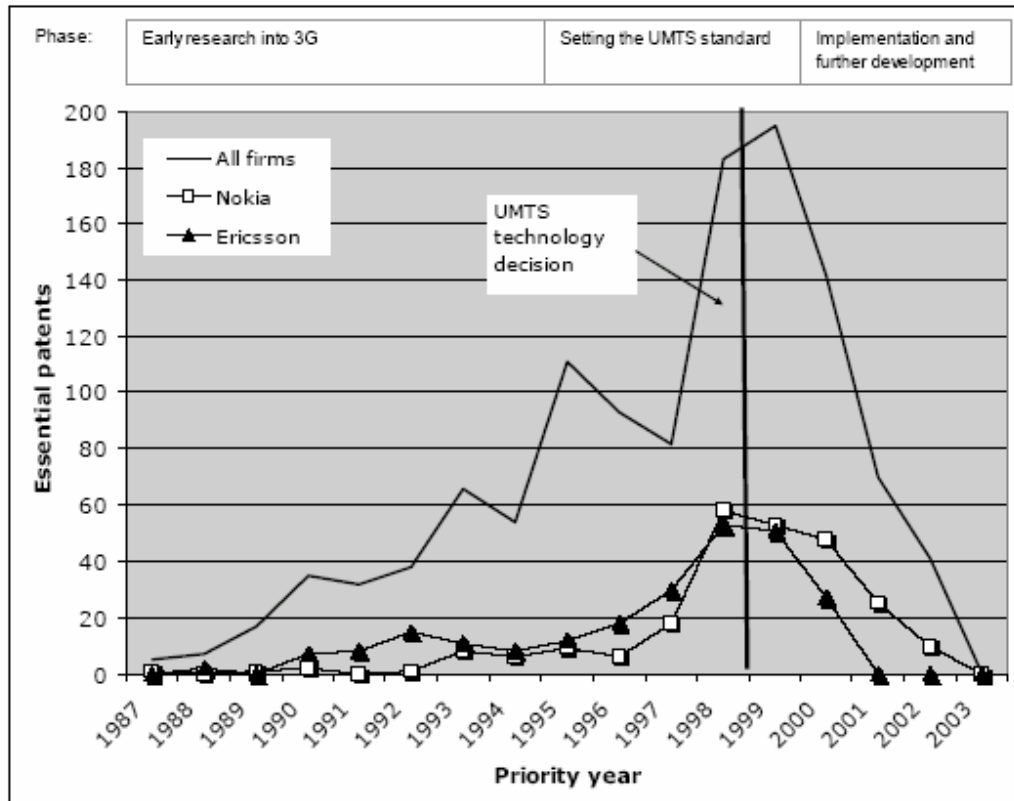
Whereas the current strategy of Deutsche Telekom to open standard applications like pay-TV and video on demand to the mass market also means to give up exclusive ap-

plications for its VDSL network, it becomes clear that the search for exclusive VDSL applications is not a search for the one and only killer application. Instead a whole series of new, target-group specific applications in many different fields needs to be generated.

7.3.2 Technical standards

Similar to the amount of R&D expenses (see section 7.2.1), the number of patent applications can be used as a technology-oriented indicator for technology-oriented new market indication/assessment. Here, the example of UMTS standardisation can be used to illustrate the process (see figure 1) The first phase was characterised by increasing numbers of patent applications signalling the involved enterprises starting to consider UMTS not only as new but also as relevant for their future business. The second phase shows a jump in patent applications due to the announcement of the UMTS standard setting process. R&D activities in the involved enterprises soared as they intended to include their own developments and proprietary standards into the official standard. The expectation that UMTS would in fact constitute a new market became widely accepted. The technical standardisation then closes the process and marks the start of the third phase in which R&D activities for new patents sharply decrease. In this phase, the development of the whole technical system as well as the creation of new applications based on the now available standard are now in the focus of enterprises' activities.

Figure 1: Development of UMTS related patents before and after setting of the UMTS standard



Source: Bekkers and West 2006

Transferring this pattern to VDSL, it is not so much the development of patent applications that is of interest but the fact that at some point in time, rather vague ideas of future technical possibilities turn into concrete expectations of the availability of new technology. In the case of UMTS, the event responsible for the shift in expectations was the announcement of an official standardisation process. In the case of VDSL it is the announcement of Deutsche Telekom to invest large sums into the build-up of the new network. Both events create a certain commitment to a new technology which causes a series of downstream activities within companies and involved sectors. Today, with VDSL, we seem to be at the beginning of the second phase in which activities and innovations are about to increase steeply.

7.4 Product-oriented criteria

7.4.1 Infrastructure

The infrastructure element of the VDSL case is obvious. The development towards all-IP (data as well as voice, audio and video transmitted via IP) has triggered a series of infrastructure innovations over the last years. The bandwidth increase could only be realised by continuous re-shaping and re-scaling of networks as well as developing new infrastructures and technical components. This not only applies to the fixed network but also to wireless networks, be they portable (WLAN, WiMAX) or mobile (UMTS, 4G).

One important consequence of the all-IP strategy is a de-coupling of networks and services: All kinds of services, like voice or video telephony, video on demand, live IPTV or other Web services can be developed and provided by independent companies. They are not any longer restricted to the telecom company and its supplys. Thus, non-telecommunication companies like software developers or media enterprises can programme and implement new applications and services independently and “distribute” them via the telecom network. However, this “Internetisation of telecommunications” (see section 7.2.1) does not mean that innovations can only occur in the service development area. The factual explosion of IP-services since the introduction of ADSL was only possible on the basis of the deployment of modern IP-based so called Next Generation Networks and remains depeent on future infrastructure innovations. Even in a “decoupled” telecom world, innovations are still required and possible on all levels of the value chain even though coordination mechanisms have changed and open standards enjoy central prominence.

To emphasise this point is important because the influential concept of “technologically neutral regulation” wrongly presupposes that new developments below the service level do not play a role anymore. What is true for other “service-enabling” technologies like video compression algorithms or application programming interfaces (API) also applies for the network itself: Without innovations at network components or the overall network design, no new services will be possible.

7.4.2 Performance

The technical performance of VDSL with possible transmission speeds of up to 100 Mbit/s in both directions is principally many times over the transmission speed of current top-speed ADSL offers, which are up to 6 and in some areas in Germany up to 16 MBit/s. The top-speed ADSL services come with upstream speeds of 0,6 Mbit/s and 1 Mbit/s respectively. However, most of the total 15 Mio. DSL connections in Germany

(36 % of all German households) have between 1 and 2 Mbit/s downstream at their disposal - which translates to 0,1 and 0,2 Mbit/s upstream respectively (see Bitkom 2007 and www.point-topic.com).

The VDSL service which Deutsche Telekom offers in selected German cities is 12 times (downstream) and 25 times faster (upstream) respectively than the most common DSL connection types in Germany. Based on the criterion of a 25 percent increase in technical performance as Teece and Coleman (1998) suggest, the “newness” of VDSL compared to ADSL would already be given because of its ultra-high transmission speeds.

However, if user-related performance increases are the basis for the evaluation, the result is not as obvious as it is in technical terms: How could the additional value of a VDSL connection for a specific customer be measured? To answer this question, the applications and services not yet developed would need to be included. Because this is not possible, the criterion “performance” is rated neutral to positive in respect to the identification of new markets.

7.4.3 Variety of the product design

In Science Technology Studies the “dominant design”-idea denotes the observation that the final use of a new technology is being determined in the course of its diffusion. While there are many possible uses in the beginning, the process of implementation supports typical uses and forecloses others. This finally leads to the “closing” of the spectrum of potential uses. Bijker et al. (Bijker et al. 1987) have illustrated this process using as an example the development of the dominant design of the bicycle. Concerning the development of the Internet and network-based new applications, the contrary of a “closing” process can be observed. In fact what we have observed within the last years is an explosion of new services and applications (see also section 7.4.1). Currently, the fact that Internet applications can easily be developed and implemented, which in turn starts a complex selection process, is best characterised by the “Long tail” approach (Anderson 2004; Fallows 2006).

While concepts like the “Long tail” concept contribute to a better understanding of the development mechanisms of new services in an all-IP world, they do not contribute to a clear cut assessment of the criterium at hand. This is because the VDSL network can either be used in order to deliver largely traditional services like high-speed-Internet (only faster) or IP television (only on-demand and possibly interactive) or it can be used to deliver uncharted new services (examples are services with user-generated content, e-learning applications or telemedicine applications) or both in different mixtures.

7.4.4 Product bundling

The bundling of different services in the sense of “triple play” (fixed network telephony, Internet, TV) or “quadruple play” (fixed network telephony, mobile phone, Internet, TV) has certain parallels to the supply side criterion “differentiation of the company specific value chain system” as described in section 7.2.4: What is a new economic activity for the supply may just be an additional service within an existing line of products or services for the customer.

However, applied to the VDSL case, the current bundling of traditional telecom fixed network services (telephony and Internet access) with new ones like pay-TV seems not sufficient to define a new market. Especially when taking into account that cable TV operators already offer triple play services in certain areas. Again, the fact that potential applications over VDSL are not yet known impede a throughout positive evaluation of this criterion.

7.4.5 Price volatility

Persistent and hefty changes in prices within short time periods and especially falling prices over time can be used as a sign of the development of new and emerging markets. These fluctuations reflect uncertainties of the enterprises and of customers towards the new technology. However, the telecommunications market is a strongly regulated market in Germany and the formation of prices always is influenced by the regulatory body. As such, the criterion of price volatility can not be held responsible for the assessment of VDSL as a new market.

7.4.6 Price correlation

A future decoupling of prices from the old reference market ADSL is very likely. One of the reasons for this is that the price spans in the pay-TV market are different from the ones in the Internet-access market. However, concerning the new services which are not yet fully known today, it can be expected that at their center there is “connectivity” and not “content” as we understand it today. “Connectivity” means all kinds of user-generated content, video-telephony, video-e-mail, etc. Today, it is difficult to assess, in which way the prices for these services will relate to existing price schemes.

7.5 Demand side criteria

7.5.1 Shift in patterns of demand

One important sign for a new market is a shift in patterns of demand compared to the demand structure of the reference market (ADSL-Markets). More general the change of

influencing factors on consumer behaviour like income or age and rather more important the introduction of new products into the market. Since it is unclear which new services will be realised on the VDSL infrastructure it is difficult to come to a clear cut evaluation of this criterion. For example, it can be expected that new telemedicine applications will be realized and because of the demographic development in Germany new markets will evolve in this context. However, this development constitutes a long-winded causality which does not match with the notion of a fast developing lead market. Direct demand side effects in this sense, caused by the build up of the VDSL network, can currently not be identified.

7.5.2 Preferences

In general, user preferences and product characteristics need to be aligned in order to generate a successful market introduction. Concerning VDSL it is too early to judge whether customer expectations actually meet product characteristics. Also, the expected wide range of new applications and services may make a final judgement difficult as many target groups with different expectations will be served. From today's point of view, this criterion is a prospective criterion which should be checked in the future when the network and new services had been available for some time.

7.5.3 Diffusion of innovations

In the conceptual discussion, the early-adopter-phenomenon and the threshold to a critical mass was described (Theoretical Derivation and Indication is central and also Review). Concerning the s-shaped curves in diffusion research, the question always is how steep the curve will be in the special case. This also determines when the new technology will reach an audience big enough to lead the development to the next stage and to open up a profitable market.

The early-adopter-phenomenon is central for the assessment of a new market in the area of electronic media as well as in other areas. Early-adopter effects occurred in the past with the personal computer, the mobile phone, the Internet as well as with consumer electronics products (see section 7.2.2). It can be expected that similar effects will show with the development of broadband and ultra high-speed Internet. In the first phase of their diffusion, a small group of techno-enthusiasts tests the new technology and experiments with its possibilities. Due to the fact that these technologies are not made for one specific purpose but have the potential for many different purposes and uses, the process of creating new applications as well as narrowing the spectrum of possible uses in a later phase is of special importance. In this phase, the originally intended use is often changed by the early adopters who frequently discover surprising

new ways to make use of a new technology or network. The concept of re-invention broadens the simple dichotomy of adoption vs. rejection of diffusion research. Innovation in this concept is not a linear process anymore but a dynamic, constantly evolving process with adopters molding and shaping the innovation as it diffuses, as Hays (1996, p. 631) puts it. Factors supporting the re-invention of a new technology or network are, according to Rogers 2003, among others: High complexity and a broad spectrum of technical functions and features (see Rogers 2003, p. 186f).

Concerning information and communication technologies it can be observed that re-invention processes have become more and more important. One example are user-generated programs, applications and contents developing under the notion Web 2.0. And re-invention processes will also play a role at the transition from ADSL to VDSL. Users will - not only as consumers of new services but also as active innovators and contributors to the development - shape the transition to a new phase of Internet use. Of course this does not only apply to VDSL but to all ultra high-speed Internet Internet access platforms like fiber optical networks or upgraded cable TV networks. But because DSL has a market share of over 80 percent, the telecom network will be the most important infrastructure for this development in Germany.

Applied to the concrete case under investigation, the question is which of the described developments are likely to occur. First of all, the new network will be used by techno-enthusiasts as a creative play test area. Software will be written, new applications will be developed and tried out. In a second phase, a series of new applications will turn out to be of interest for a larger user group. This group will not need to have the technical understanding of the techno-enthusiasts. In this sense, the new applications will become more user-friendly. Concerning the IPTV project which is currently being rolled out under the brand name "T-Home Complete", things look different. Here, user involvement and co-operative product development will not play a major role because the service has already been designed and tested and is as such to a large extent fixed in its use.

Today, for a final evaluation of the criterion "diffusion of innovations", relevant experiences and data are still missing. Here, user studies and further market analysis will be needed. The expected course of diffusion of VDSL strongly indicates the development of a new market, however a clear cut positive assessment seems not feasible today.

7.5.4 Switching behaviour

The number of customers switching from the old to the new service is an important indicator for a new market product . In the case of VDSL switching means switching from ADSL to VDSL services as well as switching from other networks like cable TV,

city carriers or even wireless broadband networks to VDSL. In which ways and under which conditions, if at all, customers will actually switch to VDSL is currently unknown. The customer base of VDSL is still very small and amounts to only 50.000 subscribers (of a technical potential of 5,5 Mio homes) in mid 2007.

In principle, switching to the new service increases when the new service has exclusive features or contents or offers better customer satisfaction. But in fact, VDSL will be placed and priced according to the strategy of Deutsche Telekom which tries to avoid cannibalisation of its ADSL services. Also, the company will use VDSL as an instrument to increase customer loyalty. As a consequence, the incumbent will try to set up low switching costs for new customers and high switching costs for existing customers who intent to change the provider. This can be achieved for example by subsidising end-user devices or taking over wiring costs of the customer which “log in” the customer to a certain network or technology. Whereas this already happens with VDSL, competitors are also trying to convince customers of their services which offer very similar applications, at least in the area of TV broadcasting.

For a final evaluation of the switching behaviour, the whole range of new applications exclusively offered via the VDSL network would have to be known. Today, we can only speculate about these potential services, which is why the criterion “switching behaviour” is considered “not relevant” today.

7.6 Summary

The application of the 18 criteria to the VDSL case has shown that 3 criteria can be evaluated positively, 6 are (rather) positive to neutral, and 6 are not relevant meaning that they are not applicable in the present context (see table 3).

Unfortunately the two most interesting criteria with the potential to render the “newness” of the market obvious, e.g. the “diffusion of innovations” and “switching behaviour” can not be finally assessed as of today. Here, the development of VDSL has not generated enough data and experiences for a reasonable evaluation of its impact. It will become necessary to reassess the elaborations for these criteria in the future. Today, we are restricted to analogies from former technology introductions or speculations about the future of the Internet and its delivery platforms. The characterisation of the last two criteria as “not relevant” might very well mean “not yet relevant” as they could be of great importance in the near future.

Table 3: Summary of the criteria discussed in the VDSL case and their evaluation

<i>Criteria</i>	<i>Main points</i>	Evaluation
Supply side criteria		
Innovation activities	High costs for infrastructure build-up and technical implementation. New technological possibilities trigger investments of service providers.	(rather) positive
Innovation types	VDSL as a product innovation enabling new services and applications which are not yet fully known today. However, substitution is partly possible.	neutral to positive
Market structure volatility	Many market entries and fundamental changes in market shares can not be expected from the introduction of VDSL so far. Impacts of telecom regulation need to be considered.	not relevant
Differentiation of the company specific value chain system	Entry into the TV market means a differentiation of the value chain of Deutsche Telekom but not for the whole market. Positive if whole VDSL system and future services are considered.	neutral to positive
Increase of turnover	Generating additional turnover with standard pay-TV services seems difficult in Germany. However, due to the waning of the fixed network for telephony, telecom companies need to find alternative sources of revenue.	not relevant
Change in competition parameters	Subsidising end-user devices in order to promote the service affects competition.	neutral to positive

	Introduction of VDSL is part of the motivation for cable TV providers to force their own triple play services.	
Technology-oriented criteria		
Performance	New technical characteristics and improved technical performance of VDSL enables a wide range of new services and media applications which in turn constitute new markets just like modems, ISDN-cards and ADSL did.	(rather) positive
Technical standards	New infrastructure-based technologies (like UMTS) show patterns of R&D activities which may also hold true for VDSL. The investment of Deutsche Telekom to build up the VDSL network creates a bindingness which will cause many market activities.	neutral to positive
Product-oriented criteria		
Infrastructure	The infrastructure element in VDSL is obvious. Decoupling of network and services which is typical for Next Generation Networks (NGN) requires significant infrastructure-based innovations.	(rather) positive
Performance	Technical performance is 12 times (downstream) and 25 times faster (upstream) respectively than the most common DSL connection types in Germany. Problem: additional value for users can only be determined in the future.	neutral to positive
Variety of the product design	VDSL network can either be used in order to deliver largely traditional services or totally new services not yet known today.	neutral

	No clear cut assessment possible as of today.	
Product bundling	Triple play not sufficient for a throughout positive evaluation because of competing offers by cable TV providers. Future VDSL-bundling activities not yet known.	neutral to positive
Price volatility	Regulation of prices impedes free formation of prices.	not relevant
Price correlation	Decoupling of prices from the old reference market ADSL is very likely. However, pricing for all new services is not yet known.	not relevant
Demand side criteria		
Shift in patterns of demand	Long-term changes do not match the notion of a fast developing VDSL lead market.	neutral
Preferences	Expectations and product characteristics need to be aligned. VDSL has not had enough time in the market to make an assessment of this synchronisation process.	neutral
Diffusion of innovations	Early adopter effects and user involvement developing new applications can be expected. VDSL will become a platform for re-inventing the Internet. However, there is not enough data for a final assessment as of today.	not relevant
Switching behaviour	New services apart from pay-TV are not yet fully known today. This makes it difficult to assess the future switching behaviour to VDSL. Deutsche Telekom will keep switching costs down and create incentives to change to its new service. Subsidising devices and services will be a strategy in the	not relevant

	early phase.	
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8. Conclusion and Further Research

If our qualitative estimates of the development of individual criteria are integrated into a specific market phase matrix (Table 3) with particular consideration of the specifics of the telecommunication sector (Shy 2001; Laffont, Tirole 2000), then the individual evaluations of the criteria innovation activities, infrastructure, technological standards or also product and technology performance indicate that the VDSL with its (possible) downstream services has the potential of a new market.

However, a reliable statement about the important demand-side criteria and downstream services can only be made in future. Consequently, continuous up-dating, checking and possibly re-evaluation of the criteria are necessary in future.

The market identification respectively demarcation approach introduced here should take the potential of emerging (new) markets into account. In this context, it is not of primary importance that a new market emerges. It is much more important to put framework conditions in place which make the emergence of a new market possible (Hekkert et al. 2006). Process theoreticians such as Hayek or members of the Austrian School in particular emphasise the property of uncertainty in an early innovation and market phase as an essential characteristic of innovations and market formation processes, since relevant information will be generated through the market evolution process (Hayek 1968; Ikeda 1990; Kirzner 1997).

From a market process perspective product market regulation in such an environment is therefore basically to be undertaken cautiously, as the uncertain direction of the development of innovations and markets could be artificially distorted by regulatory interventions *ex ante*, or even prevented due to the lack of knowledge about future market characteristics (Hayek 1968; Ikeda 1990; Kirzner 1997).¹⁸

As the introduced concept here is not specified for special sectors, markets or even technologies, prior to conducting the specific individual market analyses, as in the investigated VDSL case, in an intermediary step the idiosyncrasies of the branch, here the telecommunication sector, should be determined and the most important implications for the criteria table and its assessment be highlighted. It appears that sector-specific particularities must definitely be taken into account in evaluating single criteria.

¹⁸ It is not important that a new market actually develops. Much more important is that a new market could develop. As innovations are fraught with uncertainties *a priori*, when the relevant criteria are met in an early market phase, for example a long-lasting existence as a niche market is also absolutely conceivable. That means that the market in this case would *de facto* not develop completely.

The criteria table as a whole is however absolutely compatible with branch-specific idiosyncrasies. Ultimately, the individual criteria or indicators of the criteria system are to be determined in the context of a very specific market, possibly against the background of a certain technology.

On the basis of the case-specific and chronological context the criteria analysis and discussion make clear that the application of the conceptual approach in a very early market phase with as yet very few users, a not widely differentiated and developed product portfolio and rather unclear competition structures or actor constellations is based very strongly on supply-side and technology-specific criteria and indicators. As in such early market phases little actual demand behaviour is observable, relevant information must be collected by means of various market research approaches.

Besides the challenge of collecting valid information about the demand behaviour in the sense of acceptance for new products and the willingness to change in this specific VDSL case and thus also to gather indications from the side of demand- and product-related criteria, research is faced with further fundamental challenges. The general conception of the approach indeed requires that the criteria be assessed as a whole. A systematic analysis of the criteria combinations can however surely contribute to identifying promising patterns and ultimately even to further pointers for a more specific evaluation.

In order to be in a position to finally determine not only the interplay of the criteria but also their relative significance, historical analysis of new emerging markets is necessary. Thus on the one hand the completeness of the criteria list can be checked, on the other hand the significance of criteria constellations in various market phases can be examined and finally the change in criteria significance observed. For a justiciable application in single current cases the criteria respectively indicator system should be further operationalised. Building on these findings, specific analysis or process steps can finally be developed in order to undertake a practical, realisable and sound record of emerging new markets in an objective and chronological dimension, not only from the perspective of enterprises, but also of regulators. It is important to note, that the analysis conducted here, based on a first qualitative assessment. Concrete indicators in view to benchmark analysis should be integrated in a sufficient guideline for in-depth judgements. Overall, this paper provides a (first) global framework for capturing and tracking emerging market processes. Contrary to so-called forward-looking market definition concepts (Europe Economics 2003), ex post product market substitution approaches and performance based market substitution approaches (Teece, Coleman 1998), we call for a "market tracking approach". In view to observable market characteristics, product market regulation should be co-evolutionary adjusted in later market

stages (Hekkert et al. 2006). Our results shall provide a platform for the discussion of a fact based approach, which relies on distinctive criteria sets.

9. Reference

- Adner, R. (2002): When are technologies disruptive? A demand-based view of the emergence of competition. In: *Strategic Management Journal*, 23 (8), pp. 667-688.
- Adner, R. (2004): A demand-based perspective on technology life cycles. In: *Business Strategy Over the Industry Life Cycle*, 21, pp. 25-43.
- Anderson, C. (2004): The Long Tail. In: *Wired*, Issue 12.10 - October 2004.
- Arthur D. Little (2005): The Arthur D. Little Global Broadband Report Update 2005 "Growth Fuels Disruption".
- Arthur, W.B. (1999): Positive Feedbacks in the Economy. In: *Scientific American*, 262 (February), pp. 92-99.
- Audretsch, D.; Baumol, W.J.; Burke, A.E. (2001): Competition policy in dynamic markets. In: *International Journal of Industrial Organization*, 19 (5), pp. 613-634.
- Baake, P.; Kamecke, U.; Wey, C. (2005): A Regulatory Framework for New and Emerging Markets. In: *COMMUNICATIONS & STRATEGIES*, 58 (2nd Quarter), pp. 1-16.
- Bauer, H.H. (1989): *Marktabgrenzung*, Berlin: Duncker & Humboldt GmbH.
- Beckert, B.; Kubicek, H. (2000): *Narrowcast: Die TV- und Online-Erweiterung. Anbieterstrategien und Erfolgsfaktoren für neue digitale Fernsehdienste und breitbandige Online-Angebote*, Bremen.
- Beckert, B.; Schulz, W.; Zoche, P.; Dreier, H. (2005): *Die Zukunft des deutschen Kabelfernsehnetzes. Sechs Schritte zur Digitalisierung*. Heidelberg: Physica (ed.).
- Bekkers, R.; West, J. (2006): The effect of strategic patenting on cumulative innovation in UMTS standardization. In: In Coenen et al (eds), *EURAS proceedings of the Workshop on Standardization on 8-9 June, Hamburg.Aachen, Germany: Wissenschaftsverlag Mainz*, pp. 17-39.
- Bijker, Wiebe E.; Hughes, Thomas P.; Pinch, Trevor J. (1987): *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*. Cambridge, Massachusetts and London, England: MIT Press.
- Bitkom (2007): *Daten zur Informationsgesellschaft. Status quo und Perspektiven Deutschlands im internationalen Vergleich. Edition 2007*. Berlin: Bundesverband Informationswirtschaft, Telekommunikation und neue Medien (Bitkom). Online: www.bitkom.org.
- Blind, K. (2004): *The Economics of Standards: Theory, Evidence, Policy*: Edward Elgar Publishing, Inc.
- Boyd, K. (2004): T-Online Vision - Ein hybrides Konzept. Vortrag auf dem 13. Symposium der Deutschen TV-Plattform am 22. April 2004 in Düsseldorf.
- Büllingen, F.; Stamm, P. (2001): *Entwicklungstrends im Telekommunikationssektor bis 2010, Studie des Wissenschaftliches Institut für Kommunikationsdienste (WIK)*

im Auftrag des Bundesministeriums für Wirtschaft und Technologie,
<http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/br-entwicklungstrends-intelekkommunikationstor,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf>.

- Bundesnetzagentur (2006): Anhörung der Bundesnetzagentur vom 22. Februar 2006 zur Identifizierung „neuer Märkte“ im Bereich Telekommunikation sowie zu deren regulatorischer Behandlung,
<http://www.bundesnetzagentur.de/media/archive/5105.pdf>.
- Bundesnetzagentur (2007): Jahresbericht 2006. Bonn, Februar, Online: www.bundesnetzagentur.de.
- Carlsson, B. et al. (2002): Innovation systems: analytical and methodological issues. *Research Policy* 31: pp. 233-245,.
- Carpenter, G.S.; Nakamoto, K. (1989): Consumer Preference Formation and Pioneering Advantage. In: *Journal of Marketing Research*, 26 (3), pp. 285-298.
- Christensen, C.M. (1997): *The Innovator's Dilemma When New Technologies Cause Great Firms to Fail*, Cambridge, Massachusetts.: Harvard Business School Press.
- Engel, C. (2003): Marktabgrenzung als soziale Konstruktion. In: Preprints of the Max Planck Institute for Research on Collective Goods, Bonn.
- European Commission (2003): Commission Recommendation of 11 February 2003 on relevant product and service markets (Directive 2003/311/EC). In: *Official Journal of the European Union*, pp. -L 114-45.
- Fallows, J. (2006): Homo Connexus. Ein Veteran des Technologie-Journalismus hat zwei Wochen lang alles ausprobiert, was das Web 2.0 zu bieten hat. In: *Technology Review*, September, pp. 49-52.
- Foray, D. (1997): The dynamic implications of increasing returns: Technological change and path dependent inefficiency. In: *International Journal of Industrial Organization*, 15 (6), pp. 733-752.
- Friedewald, Michael (2000): Vom Experimentierfeld zum Massenmedium: Gestaltende Kräfte in der Entwicklung des Internet. *Technikgeschichte*, 67(4): pp. 331-361.
- Friedewald, Michael (2003): Die fortwährende Konstruktion des Computernutzers und Leitbilder in der Geschichte der Mensch-Computer-Interaktion. In: *Technikgeschichte* 70(4): pp. 255-276, Dezember.
- Geroski, P.A. (1998): Thinking creatively about markets. In: *Industrial Organization*, 16, pp. 677-695.
- Geroski, P.A. (2000): Models of technology diffusion. In: *Research Policy*, 29, pp. 603-625.
- Geroski, P.A. (2003): *The Evolution of New Markets*, Oxford: Oxford Press.
- Geroski, P.A.; Mata, J. (2001): The evolution of markets. In: *International Journal of Industrial Organisation*, 19 (7), pp. 999-1002.

- Geroski, P.A.; Mazzucato, M. (2001): Modelling the dynamics of industry populations. In: *International Journal of Industrial Organization*, 19 (7), pp. 1003-1022.
- Gerpott, T.J. (2005): *Strategisches Technologie- und Innovationsmanagement*, 2. Aufl., Stuttgart: Schäfer-Pöschel.
- Gilbert, R.J.; Sunshine, S. (1995): Incorporating Dynamic Efficiency Concerns in Merger Analysis: The Use of Innovation Markets. In: *Antitrust Law Journal*, 63, no. 2, pp. 569-602.
- Gual, J. (2003): *Market Definition in the Telecoms Industry: Centre for Economic Policy Research, Discussion Paper Series No. 3988.*
- Hartman, R.; Teece, D.; Mitchel, W.; Jorde, T. (1993): Assessing Market Power in Regimes of Rapid Technological Change. In: *Industrial and Corporate Change*, 2 (3), pp. 317-350.
- Hayek, F.A.v. (1968): Competition as a Discovery Procedure. In: Friedrich August von Hayek (1978, ed.), *New Studies in Philosophy, Politics, Economics and the History of Ideas*, Chicago, pp.179-190; first published in German: *Der Wettbewerb als Entdeckungsverfahren*. Kieler Vorträge, Neue Folge 56, Kiel 1968.
- Hays, S.P. (1996): Influences on Reinvention During the Diffusion of Innovations. In: *Political Research Quarterly*, 43, pp. 631-650.
- Heil, B. (2004): Digitales Fernsehen. Mehr Nutzen für den Zuschauer, Herausforderung für die Sender, pp. 142-145.
- Ikeda, S. (1990): Market-Process Theory and Dynamic Theories of the Market. In: *Southern Economic Journal*, 57 (1), pp. 75-92.
- Kirzner, I.M. (1997): Entrepreneurial discovery and the competitive market process: An Austrian approach. In: *Journal of Economic Literature*, 35 (1), pp. 60-85.
- Klemperer, P.D. (1995): Competition when Consumers have Switching Costs. In: *Review of Economic Studies*, 62, pp. 515-539.
- Klepper, S. (1996): Entry, exit, growth, and innovation over the product life cycle. In: *American Economic Review*, 86 (3), pp. 562-583.
- Kranton, R.E. (1995): The Formation of Cooperative Relationships. In: *Journal of Law, Economics, and Organization*, 12 (214), p. 233.
- Kranton, R.E. (1996): Reciprocal Exchange: A Self-Sustaining System. In: *American Economic Review*, 86 (830), p. 851.
- Laffont, J.J.; Tirole, J. (2000): *Competition in Telecommunications*, Cambridge, London: The MIT Press.
- Littlechild, S.Ed. (1990): *Austrian Economics*, Aldershot 1990.
- Malerba, F. (2006): Innovation and the evolution of industries. In: *Journal of Evolutionary Economics*, 16 (1), pp. 3-23.

- Mazzucato, M. (2000): *Firm Size, Innovation and Market Structure: The Evolution of Industry Concentration and Instability*: Edward Elgar Cheltenham, UK, MA, USA.
- Nelson, R.R.; Winter, S.G. (2002): Evolutionary theorizing in economics. In: *Journal of Economic Perspectives*, 16 (2), pp. 23-46.
- Pleatsikas, C.; Teece, D. (2001): The analysis of market definition and market power in the context of rapid innovation. In: *International Journal of Industrial Organization*, 19 (5), pp. 665-693.
- Pleschak, F.; Sabisch, H. (1996): *Innovationsmanagement*, Stuttgart: Schäffer-Poeschel Verlag.
- Pohler, M.; Beckert, B.; Schefczyk, M. (2006): *Technologische und ökonomische Langfristperspektiven der Telekommunikation: Entwurf des Schlussberichts an das Bundesministerium für Wirtschaft und Technologie, Projekt-Nr. 23/05*, Dresden, Karlsruhe.
- Porter, M. (1990) *The Competitive Advantage of Nations*, New York.
- Ridder, M. (2005): *Surfen für den Erfolg im Kabel*, p. 26.
- Robinson, J. (1933): *The Economics of Imperfect Competition*, London, New York.
- Rogers, E.M. (2003): *Diffusion of Innovations*, 5, New York: Free Press.
- Rosa, J.A.; Porac, J.F.; Runser-Spanjol, J.; Saxon, M.S. (1999): Sociocognitive dynamics in a product market. In: *Journal of Marketing*, 63, pp. 64-77.
- Saam, N.J. (2005): The role of consumers in innovation processes in markets. In: *Rationality and Society*, 17 (3), pp. 343-380.
- Schmalensee, R. (2000): Antitrust issues in Schumpeterian industries. In: *American Economic Review*, 90 (2), pp. 192-196.
- Schmidt, I.; Rittaler, J.B. (1987): Marktphasen und Wettbewerb. In: *WiSt*, 16, pp. 597-602.
- Schmoch, U.; Koschatzky, K. (1996): *Freie Erfindungen erfolgreich verwerten*, Grupp, H. (ed.), *Schriftenreihe Zukunft der Technik*, Köln: Verlag TÜV Rheinland.
- Schumpeter, J. (1950): *Capitalism, Socialism and Democracy*, 3rd ed., New York, Harper.
- Schumpeter, J.A. (1934): *The Theory of Economic Development*, 8th printing, Cambridge/Mass: Harvard University Press.
- Shapiro, C.; Varian, H.R. (1999): *Information Rules. A Strategic Guide to the Network Economy*, Boston, Mass.: Harvard Business School Press.
- Shy, O. (2001): *The Economics of Network Industries*: Cambridge University Press.
- Soberman, D.; Gatignon, H. (2005): Research issues at the boundary of competitive dynamics and market evolution. In: *Marketing Science*, 24 (1), pp. 165-174.

- Sterman, J.D. (2000): *Business dynamics : systems thinking and modeling for a complex world*, Boston [u.a.]: Irwin/McGraw-Hill.
- Tasse, G. (1997): *The Economics of R&D Policy*, Westport,CT.: Quorum Books.
- Tasse, G. (2000): Standardization in technology-based markets. In: *Research Policy*, 29 (4-5), pp. 587-602.
- Teece, D.J.; Coleman, M. (1998): The Meaning of Monopoly: Antitrust Analysis in High-Technology Industries. In: *The Antitrust Bulletin*, 43, Heft 3-4.
- Vogelsang, I. (2006): *Die regulatorische Behandlung neuer Märkte im Bereich der Telekommunikation*; Boston University Gutachten für den Bundesverband Breitbandkommunikation e.V. (ed.).
- Vrijmoet, D.; Rosenstok, J. (2005): How to regulate new markets? Innovation and competition in the EU electronic communications framework: Agenda, *Advancing economics in business Oxera*, pp. 1-4.
- Weyer, J.; Kirchner, U.; Riedl, L.; Schmidt, J.F.K. (Hrsg.) (1997): *Technik, die Gesellschaft schafft. Soziale Netzwerke als Ort der Technikgenese*, Berlin: Edition Sigma.
- WIK (2003): *Methodologies for market definition and market analysis*, http://www.icp.pt/streaming/WIK.pdf?categoryId=79055&contentId=128770&fileId=ATTACHED_FILE.
- Williamson, O.E. (1990): *Die ökonomischen Institutionen des Kapitalismus*: J.C.B., Mohr, Tübingen.